Workshop objectives

1. To understand differences in DD models and outputs
2. To assess contribution of women to harnessing the DD
3. To understand issues with implementing DD-related development strategies at the country level
4. To gain knowledge on strategies for communicating research on the DD to non-technical audiences
“Field guide” to available DD models

J.M. Ian Salas
Jan. 25, 2016

A CENTURY OF SAVING LIVES
MILLIONS AT A TIME

JOHNS HOPKINS
BLOOMBERG SCHOOL
OF PUBLIC HEALTH
Preface

• In ICFP program, there is a session on “Modeling the DD”

1. NTA labor-consumption age profiles
2. DemDiv simulation tool
3. CKW macro-simulation model

• This presentation aims to situate the approaches against each other
Different DD-related approaches

1. NTA labor-consumption age profiles

2. DemDiv simulation tool

3. CKW macro-simulation model

* Nigeria example
Economic Lifecycle

• The economic lifecycle refers to the variation over our lifetime of our needs and our abilities
• Expresses itself in age variation in what we consume and what we produce
• In all contemporary societies we have extended periods at the beginning and the end of our lives, when we are consuming far more than we are producing.
Economic Lifecycle

- Labor income
  - Wages & salaries
  - Self-employment income
- Profiles based on household surveys of wages and income
- Adjusted to match National Income and Product Accounts
- Reflects age variation in productivity, hours worked, unemployment, and labor force participation.

- Consumption
  - Public and private
  - Education, health, and other
- Profiles based on surveys and administrative records
- Adjusted to match National Income and Product Accounts
- Reflects age variation in expenditures
Important features of the economic lifecycle

• In all contemporary societies there are large per capita lifecycle deficits at both the young and old ages.
• The per capita child deficit is rising as fertility declines, more is invested in human capital, and entry into the labor force is delayed.
• The per capita old age deficit is rising as age at retirement has declined and spending on health care has increased.
• The aggregate economic lifecycle is dominated by changes in age structure.
Per capita age profiles

Consumption & Labor income, 1999

Pesos

Labor income

Consumption
Aggregate age profiles

Consumption & Labor income, 1999

Philippine NTA

Billion Pesos

Total consumption

Total labor income
Source: Tung (2011)
Age Reallocation System

- Age reallocation system is the counterpart of the economic lifecycle
- Economic system that shifts resources from one age group to another.
- Accounting: Fills the gap between consumption and labor income (flow constraint).
- All reallocations fall in two broad classes
  - Transfers
    - Public transfers (cash and in-kind)
    - Private transfers (familial including intra-household)
  - Asset-based reallocations
    - Asset income
    - Saving
The NTA Flow Account Identity

- **Inflows**
  - Labor Income
  - Asset Income
  - Transfer Inflows

- **Outflows**
  - Consumption
  - Saving
  - Transfer Outflows

\[
Y^l(x) + Y^a(x) + \tau^+(x) = C(x) + S(x) + \tau^-(x)
\]

where \( x \) is age.
Funding the Child Deficit

Components of Lifecycle Deficit, US 2003

Net public transfers – public schools, value of public goods allocated to children.

Net private transfers – intra-household transfers to children; largest in all countries studied.

Asset-based flows – none for children, small for young adults (mostly credit).

Source: NTA
Funding the Old-age Deficit

Components of Lifecycle Deficit, US 2003

- Asset-based reallocations – asset income and dis-saving from owner-occupied housing, private pension funds, personal saving, etc.
- Net public transfers – social programs (public pensions, health care, etc.), benefits from general programs, less taxes paid.
- Net private transfers – inter- and intra-household transfers.

Source: NTA
Nigeria age profiles, 2004 and 2009

Source: NTA
Support ratio

• Support ratio = Working-age population (15-64) / Dependent population (<15 + 65+)

• Economic support ratio = No. of effective producers / No. of effective consumers
Comparing the two for Nigeria
Mechanical and behavioral sources of potential growth

Figure 1.3.
Support ratio for China and annual growth rate of support ratio in China, 1950-2050

Source: NTA manual
First and second dividend in Nigeria

DemDiv: Demographic sub-model

Source: DemDiv technical guide
DemDiv: Economic sub-model

Source: DemDiv technical guide
<table>
<thead>
<tr>
<th>Scenario Name</th>
<th>Value in:</th>
<th>Expect Years Female</th>
<th>Mean Years Female</th>
<th>Mean Years Male</th>
<th>Mean Years Both</th>
<th>CPR</th>
<th>PPI</th>
<th>Sterility</th>
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<td>5.44</td>
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<td>11</td>
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<td></td>
<td>2010</td>
<td>4.65</td>
<td>1.94</td>
<td>3.87</td>
<td>3.49</td>
<td>42.62</td>
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<td>4.65</td>
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<td>4.89</td>
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<td>4.90</td>
<td>4.71</td>
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<td>4.89</td>
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<td>4.71</td>
<td>29.83</td>
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</table>

Source: DemDiv
Family planning has the largest effect on fertility, lowering it to around two children per woman.

Source: DemDiv
DemDiv: Kenya example

The lower fertility rate in the combined scenario results in a smaller total population.

Source: DemDiv
DemDiv: Kenya example

With constant TFR, Kenya’s age structure remains very young and dominated by dependents.

The Econ+Ed+FP scenario produces the youth bulge, which is beginning to move into working-age years.

Source: DemDiv
DemDiv: Kenya and Uganda output

• Kenya

• Uganda Vision 2040

Gross Domestic Product (GDP) Per Capita

Source: DemDiv briefs
DemDiv: Nigeria reaches 70% mCPR in 2050
DemDiv: Nigeria reaches 70% mCPR in 2050

Gross Domestic Product per capita

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2050 Base Case</th>
<th>2050 Econ Only</th>
<th>2050 Econ+Ed</th>
<th>2050 Econ+Ed+FP</th>
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<tr>
<td>GDP per capita</td>
<td>$1,000</td>
<td>$1,050</td>
<td>$1,100</td>
<td>$1,150</td>
<td>$1,300</td>
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</table>
DemDiv

• intended for practical use with concrete policy levers and connections

• relationships “stylized” from cross-country regressions

• policy variables for econ, education, and FP distinct and separate, so no dynamic feedback loops incorporated
CKW: Full model of production

Source: CKW (2015)
# CKW: Micro-founded relationships

## Table 1: Parameter Calibration

<table>
<thead>
<tr>
<th>Parameter Symbol</th>
<th>Value</th>
<th>Description</th>
<th>Source(s)</th>
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<tbody>
<tr>
<td>$\pi$</td>
<td>0.02</td>
<td>Effect of fertility on female labor supply</td>
<td>Ashraf et al. (2013)</td>
</tr>
<tr>
<td>$\theta_{E}$</td>
<td>0.2</td>
<td>Effect of fertility on childhood education</td>
<td>Joshi &amp; Schultz (2007); Rosenzweig &amp; Wolpin (1980)</td>
</tr>
<tr>
<td>$\psi$</td>
<td>-0.15</td>
<td>Effect of women’s education on fertility</td>
<td>Osili &amp; Long (2008)</td>
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<tr>
<td>$\theta_{H}$</td>
<td>-0.00067</td>
<td>Effect of fertility on adult height</td>
<td>Giroux (2008); Joshi &amp; Schultz (2013); Kravdal &amp; Kodzi (2011); Stevens et al. (2012); Victora et al. (2008)</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.33</td>
<td>Capital share of output in modern sector</td>
<td>Hall &amp; Jones (1999)</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.167</td>
<td>Land share of output in traditional sector</td>
<td>Kawagoe et al. (1985); Williamson (1998, 2002)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.1</td>
<td>Economic returns to schooling</td>
<td>Banerjee &amp; Duflo (2005); Oyelere (2010); Psacharopoulos (1994); Psacharopoulos &amp; Patrinos (2004)</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>0.08</td>
<td>Effect of health on output</td>
<td>Schultz (2002, 2005)</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.07</td>
<td>Depreciation rate of capital</td>
<td>Schmitt-Grohe &amp; Uribe (2006)</td>
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<tr>
<td>$\phi_1$</td>
<td>0.758</td>
<td>Effect of lagged savings on current savings</td>
<td>Bloom et al. (2007)</td>
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<td>$\phi_2$</td>
<td>0.133</td>
<td>Effect of wage rate on savings rate</td>
<td>Bloom et al. (2007)</td>
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<td>$\phi_3$</td>
<td>-0.006</td>
<td>Effect of squared wage rate on savings rate</td>
<td>Bloom et al. (2007)</td>
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<td>$\phi_4$</td>
<td>-0.209</td>
<td>Effect of ratio of old to working age population on savings rate</td>
<td>Bloom et al. (2007)</td>
</tr>
</tbody>
</table>

Source: CKW (2015)
CKW: Nigeria TFR under alternative scenarios

Source: CKW (2015)
CKW: Nigeria population projected under alternative scenarios

Source: CKW (2015)
CKW: Simulated income per capita

Source: CKW (2015)
CKW: Female employment

Source: CKW (2015)
CKW: Which feature contributed the most?

Source: CKW (2015)
Summary

- NTA: support ratio a refinement of dependency ratio
- DemDiv: macro-based simulation model, policy-oriented
- CKW: micro-founded simulation model
- Schultz's take
  - micro experiments along the lines of Matlab
  - DD benefits course through changes in time allocation/economic activity of women
  - also health and productivity gains of women and their children
Summary (2)

• Complicated endeavor because of complexity involved

• Approaches highlight different features
  • NTA: economic lifecycle, support system; a bit static
  • CKW: structural model showing channels and mechanisms; with dynamic feedback loops
  • DemDiv: ease of use and relevance to policymakers
Questions/issues to be raised

• Need for system-level understanding of the economic and demographic forces that are at play
• Things change slowly, but compounding magnifies any initial change
• How does this modeling relate to the often-mentioned assertion that context-specific policies are needed to realize the DD?