EFFECT OF DEMOGRAPHIC CHANGES ON STATE FISCAL BALANCES IN THE U.S.

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Major Professor: Dr. MAN-KEUN KIM.
The share of population 65 or over keeps rising.

This share was estimated at 12% ten years ago.

U.S Census Bureau put the current estimate at 15%.

1 in every 5 resident will be retirement age.

By 2030 all baby boomers will be older than 65.

- U.S POPULATION WILL REACH 405 MILLION IN 2060.
- THE GROWTH RATE WILL BE 1.8 MILLION PEOPLE PER YEAR BETWEEN 2017-2060.
- THE GROWTH RATE WILL FALL TO 1.5 MILLION PEOPLE PER YEAR BETWEEN 2040-2060.
- NET MIGRATION WILL OVERTAKE NATURAL INCREASE BY 2030.
- BABY BOOMERS WILL AGE INTO RETIREMENT BY 2030.
65 and older population will double by 2060.

85 year and older will double by 2035.

85 year and older will triple by 2060.
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Population (million)</th>
<th>Change from 2016 to 2060</th>
<th>Number</th>
<th>percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>2016: 323.1</td>
<td>2020: 332.6</td>
<td>2030: 355.1</td>
<td>2040: 373.5</td>
</tr>
<tr>
<td>Under 18 years</td>
<td>2016: 73.6</td>
<td>2020: 74.0</td>
<td>2030: 75.7</td>
<td>2040: 77.1</td>
</tr>
<tr>
<td>18 to 64 years</td>
<td>2016: 200.2</td>
<td>2020: 202.6</td>
<td>2030: 206.3</td>
<td>2040: 215.6</td>
</tr>
<tr>
<td>65 years and over</td>
<td>2016: 49.2</td>
<td>2020: 56.1</td>
<td>2030: 73.1</td>
<td>2040: 80.8</td>
</tr>
</tbody>
</table>

Population Aging and Fiscal Balance

Modify Expenditure Such as:
• Pension
• Medical care
• Social Security
• Long term Care

Modify Revenue Such as:
• Sales Tax
• Personal Tax
• Income Tax
• Corporate income tax
Research Objective

• To Investigate Impact of Population Aging in the U.S on public expenditure and revenue in U.S States.

• Whether Population Aging Affect the Budget Balance.......
Demographics changes affect:
- taxes
  - Lee and Edwards (2001) - U.S.
- Fiscal balance of different layers of Govt.
- causes vertical imbalance across levels of Govt
- Savings rate and account balance
Demographic Change Affect:

- Per capita Growth: Prettner (1995)

Literature Review Continues:
Empirical Evidence on Fiscal Impact

Demographic changes Affect:

• **Transfer of income between generations**
  - Yashiro et al., (1997) – Japan

• **Aggregate expenditure**
  - Gruber and Wise (2001)

• **Payroll tax**
  - Auerbach and Kotlikoff (1985) – U.S

• **Tax base from labor income to capital asset**
  - Kurdal et al.,(2015) - Australia
Empirical Evidence (cont.)

Demographic changes Affect:

• **Health Expenditure**

• **Per capita Govt Health Expenditure**
  • Di Matteo & Di Matteo (1998) – Canada
DATA

Dependent variables
• Revenue
• Expenditure
• Fiscal balance

Explanatory variable
• dependency ratios:
  • Old age dependency ratio
  • Young age dep. Ratio
• Control variables:
  • Population density
  • Unemployment
  • Financial crises dummy
  • Trend
Table 2. Public Expenditure, Revenue and fiscal balances in U.S states.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue (billion dollars)</td>
<td>49.58</td>
<td>60.08</td>
<td>4.35</td>
<td>419.03</td>
</tr>
<tr>
<td>Expenditure (billion dollars)</td>
<td>49.17</td>
<td>49.17</td>
<td>4.16</td>
<td>412.79</td>
</tr>
<tr>
<td>Revenue per capita (dollars)</td>
<td>7,890</td>
<td>1,701</td>
<td>5,294</td>
<td>15,370</td>
</tr>
<tr>
<td>Expenditure per capita (dollars)</td>
<td>7,733</td>
<td>1,464</td>
<td>5,120</td>
<td>14,322</td>
</tr>
<tr>
<td>Fiscal balance (billion dollars)</td>
<td>0.418</td>
<td>3.292</td>
<td>-24.605</td>
<td>28.950</td>
</tr>
<tr>
<td>Fiscal balance per capita (dollars)</td>
<td>157</td>
<td>491</td>
<td>-793</td>
<td>3,725</td>
</tr>
</tbody>
</table>

Source: Revenue and expenditure data are compiled from Tax Policy Center; fiscal balance are authors’ calculation.
Figure 1: Fiscal balance and Dependency Ratios

Heterogeneity in data Due to:

- State size, population, Tax system.
- California deficit of 20 billion in (2008-2009)
- New York has surplus (30b)
- NY per cap Rev (2015) $14499
- NY PER cap Exp (2015) $13033
- Fiscal balance $14466/person

Source: Authors' calculation using public revenue and expenditure data from Tax Policy Center
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old-age dependency ratio (%)</td>
<td>21.59</td>
<td>2.99</td>
<td>13.60</td>
<td>32.30</td>
</tr>
<tr>
<td>Youth dependency ratio (%)</td>
<td>37.99</td>
<td>3.58</td>
<td>26.20</td>
<td>52.90</td>
</tr>
</tbody>
</table>

Source: authors’ calculation
Figure 2. Dependency Ratio (%).

- OLD AGE DEPENDENCY RATIO KEEPS ON INCREASING.
- HIGHEST: FL
- LOWEST: UT

- YOUNG AGE DEPENDENT RATIO SHOWS NEGATIVE TREND.
- LOWER FERTILITY
- HIGHEST RATE: UT
- LOWEST RATE: VT

Figure 2. Dependency Ratios in Percent
Source: US Census Bureau
Table 4: Other Explanatory Variables.

During 2008-2009 Great recession,

- Unemployment rate hit 10%
- GDP decreased by 5% (U.S. treasury Dept. 2012)

<table>
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<tr>
<th>Variable</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment rate (%)</td>
<td>6.21</td>
<td>2.13</td>
<td>2.59</td>
<td>13.61</td>
</tr>
<tr>
<td>Population density (persons/square mile)</td>
<td>214</td>
<td>559</td>
<td>5</td>
<td>12,121</td>
</tr>
<tr>
<td>Financial crisis</td>
<td>0.17</td>
<td>0.37</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Trend</td>
<td>6.50</td>
<td>3.46</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Unemployment rate: https://www.bls.gov; Population density is author's Calculations.
Figure 3: scatter Diagram.

Figure 3. Scatter Diagrams between Fiscal Balance and Dependency Ratios
Source: Tax Policy Center and US Census

No clear relationship between fiscal balance and dependency ratios
DYNAMIC PANEL MODEL.

• Fiscal balance is persistent.
• No changes in public Revenue and Expenditure in short term.
• Lagged dependent variable provides dynamic adjustment.
• Bond (2002) argue for consistent estimates with lagged dependent variable.

The general linear dynamic model takes this form:

\[ y_{i,t} = \mu + \gamma y_{i,t-1} + \beta x_{i,t} + \varepsilon_{i,t}, \]

Where \( i \) denotes state \((i=1, \ldots, 48)\) and \( t \) denotes time periods \((t=2004, 2015)\).

\( y_{i,t} \) represents dependent variable e.g. fiscal balance.

\( \beta \) is a vector of parameter of interest.

\( X_{i,t} \) represents vector of explanatory variables e.g. old age and Young age dependent ratio.

\( \varepsilon_{i,t} \) is the error term assumed to be i.i.D with mean zero and Constant variance.

\( \alpha_{i,t} \) represents unobserved individual specific time-invariant Effect which allows for heterogeneity across states.
Dynamic model (cont.)

- Equation 1 faces endogenous issue.
- $y_{i,t-1}$ is correlated with $\varepsilon_{i,t}$
- Panel data estimate is not consistent
- Issue is resolved by taking first difference.
- Individual specific effect parameter is eliminated.

The first differenced dynamic model looks like this:

$$y_{i,t} - y_{i,t-1} = \gamma(y_{i,t-1} - y_{i,t-2}) + \beta(x_{i,t} - x_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1})$$

$$\rightarrow \Delta y_{i,t} = \gamma \Delta y_{i,t-1} + \beta \Delta x_{i,t} + \Delta \varepsilon_{i,t}$$

$\Delta y_{i,y-2}$ is used as instrument for $\Delta y_{i,y-1}$.

Instruments will not correlate with $\Delta \varepsilon_{i,t}$ (A. and Hsiao, 1981)

Arellano and Bond (1991) proposed GMM procedure.

Blundell and Bond (1998) suggested a system GMM estimator.
Table 5. Fiscal Balance Estimation Results using System GMM

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1 Fiscal Balance in Billion Dollars</th>
<th>Model 2 Fiscal Balance Per Capita in Dollars</th>
<th>Model 3 Fiscal Balance in Percent of State Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged dependent variable</td>
<td>0.5269***</td>
<td>0.5157***</td>
<td>0.5428***</td>
</tr>
<tr>
<td></td>
<td>(0.003)***</td>
<td>(0.022)***</td>
<td>(0.003)***</td>
</tr>
<tr>
<td>Old-age dependency ratio</td>
<td>-0.4260***</td>
<td>-82.580***</td>
<td>-0.1099***</td>
</tr>
<tr>
<td></td>
<td>(0.020)***</td>
<td>(10.76)***</td>
<td>(0.014)***</td>
</tr>
<tr>
<td>Youth dependency ratio</td>
<td>-0.3808***</td>
<td>-59.458***</td>
<td>-0.1275***</td>
</tr>
<tr>
<td></td>
<td>(0.015)***</td>
<td>(6.11)***</td>
<td>(0.011)***</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>-0.4564***</td>
<td>-44.799***</td>
<td>-0.0776***</td>
</tr>
<tr>
<td></td>
<td>(0.008)***</td>
<td>(3.79)***</td>
<td>(0.005)***</td>
</tr>
<tr>
<td>Population density</td>
<td>0.0003***</td>
<td>0.038***</td>
<td>0.0001***</td>
</tr>
<tr>
<td></td>
<td>(0.0001)***</td>
<td>(0.001)***</td>
<td>(0.0001)***</td>
</tr>
<tr>
<td>Financial crisis dummy</td>
<td>-2.2458***</td>
<td>-238.340***</td>
<td>-0.6325***</td>
</tr>
<tr>
<td></td>
<td>(0.034)***</td>
<td>(11.08)***</td>
<td>(0.015)***</td>
</tr>
<tr>
<td>Trend</td>
<td>0.1831***</td>
<td>26.083***</td>
<td>0.0030***</td>
</tr>
<tr>
<td></td>
<td>(0.008)***</td>
<td>(5.09)***</td>
<td>(0.007)***</td>
</tr>
<tr>
<td>Constant</td>
<td>26.0010***</td>
<td>4289.348***</td>
<td>7.9687***</td>
</tr>
<tr>
<td></td>
<td>(0.879)***</td>
<td>(418.57)***</td>
<td>(0.647)***</td>
</tr>
</tbody>
</table>

N used                         | 528                                      | 528                                         | 528                                           |
Number of groups                | 48                                       | 48                                          | 48                                            |
Arellano-Bond test note         |                                          |                                             |                                               |
Order 1                         | -1.823 [0.068]                           | -3.001 [0.003]                             | -3.479 [0.001]                               |
Interpretation of Results

Old age dependency Ratio
The estimates are:
• -0.426 in model 1
• -82.580 in model 2
• -0.1099 in model 3

Youth dependency Ratio
• The estimates are:
  • -0.3808 in model 1
  • -59.458 in model 2
  • -0.1275 in model 3
Figure 4: Old Age Impact on Government Revenue

In panel A in figure 4:

- It is positive and statistically significant on property tax and corporate income tax.
- A % increase in OADR will increase the above taxes by $35/person.
- Negative effect on individual income tax, other tax, and all other revenue.
- A 1% increase in OADR will decrease the above taxes by $139/person.
- In all a 1% increase in OADR will decrease state revenue by $104/person.
Figure 4: Old Age Impact on Government Expenditure.

In panel B in figure 4:

- It is positive and statistically significant on public welfare, hospital expenditure and education & highway.
- A % increase in OADR will increase state expenditure by $64/person.
- Combining changes in Government revenue a 1% increase in OADR will lead to $172/person in state fiscal balance which is a bit larger than $83/person in model 2 table 4.
Summary and Concluding Remarks

- Demographic change causes aging population.
- U.S. population will rise to 404 million in 2060.
- 23% of U.S. population will be 65 years and over in 2060.
- OADR has a negative impact on fiscal balances.

- A 1% point increase in OADR will result in $0.426 billion worse in fiscal balance.
- About $83/person in model 2.
- 0.11% point more in model 3.
- All other explanatory variables are significant with expected signs.
Summary and conclusion
Remarks (cont.)

OADR increases spending on primary education, public welfare, health and highways & roads expenditure.

OADR increases property and corporate tax.

OADR decreases individual tax, other tax on motor vehicles etc.

All told 1% increase in OADR will decrease state revenue by $104/ person.
Policy makers should put up measures to increase Government revenue by:

- Increase labor force participation and employment.
- Expand tax base.
- Increase the eligible retirement age.
- Social intervention programs to encourage large family.
- Immigration policies for skilled migrant workers.
References


References (cont.)


Chen D.H. C(2004)“ Population Age structure and budget Deficit”.

The End

QUESTIONS AND COMMENTS.