Theory and Practice of Fiscal Sustainability Analysis

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Question of Interest

- Is the financial structure of jurisdictions (federal, state, and local) sustainable?
- Definition of sustainability (Dictionary.com)
  - The ability to be sustained, supported, upheld, or confirmed
Essence of the Question

- Will the growth in a jurisdiction’s revenues be sufficient to sustain desired growth in expenditures?
- Formally

\[
\begin{align*}
\text{Fiscal Balance}_t & = \text{Revenue}_t - \text{Expenditures}_t \\
\text{Revenue}_t & = \mu\text{Revenue}_{t-1}dt + \sigma\text{Revenue}_{t-1}dW_{t-1} \\
\text{Expenditures}_t & = \nu\text{Expenditures}_{t-1}dt + \tau\text{Expenditures}_{t-1}dW_{t-1}
\end{align*}
\]
Issues

- **Stochastic process**
  - Must estimate trend and volatility

- **Breaks**
  - Abrupt change in trend
    - “Regime shifts”
  - Discrete level changes in *Revenue, Expenditure*
    - Infrastructure investment
    - Exogenous events

- No *a priori* sense of a “Breaking Point” in fiscal balance
Existing Work

- “Indicators”
  - Selected ratios
    • Brown’s Ten Point Test (1993)
    • Maher & Nollenberger (2009)
  - Usually measured at one or a few points in time
  - Trends
    • ICMA’s Financial Trend Monitoring System (Groves and Valente, 1986, 1994)

- Issues
  - Static
    • No measurement of trend or volatility
    • Exception is FTMS which at least attempts to capture trend
  - Not empirically verified
    • Exception is recent paper by Gorina, Maher, and Joffe (2018)
Our Approach

- Explicit modeling of stochastic process
  - Forecast development
    - Generates estimates of trend and volatility
    - Generates standard errors
  - Simulation of system to estimate risk of fiscal balance falling below specified levels
PROJECT 1: AFFORDABILITY OF SMALL COMMUNITY WATER SYSTEMS
Research Question & Data

- Question: Is it affordable (sustainable) for very small communities to make water infrastructure investments? (EPA contract)
- Unit of analysis is municipality
  - All municipal governments in EPA Region 7 states (Iowa, Kansas, Missouri, Nebraska)
- Data from US Census Bureau, American Community Survey
Definition of Affordability

- EPA Definition of Affordability
  - Average Drinking Water Bill $\leq 2.5\%$ of Median Household Income (MHI)
  - Average Wastewater Bill $\leq 2.0\%$ of MHI
Econometric and Simulation Model

\[ MHI_{it} = f(MHI_{it-1}, POP_{it}, PERCHS_{it}, PERCBACH_{it}, MANUSHARE_{it}) \]

\[ POPN_t = \omega_1(\beta_0 + \beta_1 time_t + \varepsilon) + \omega_2 \left( \frac{\sum_{n=1}^{3} POPN_{t-n}}{3} \right) \]
STUDY 2: FISCAL SUSTAINABILITY OF ILLINOIS MUNICIPALITIES
Research Question & Data

- Question: Are Illinois municipalities’ finances sustainable?
- Unit of analysis is municipality
  - Stratified sample of Illinois communities
Forecasting System

- Economic variable VAR
  \[ Y_t = c + \Pi_1 Y_{t-1} + \cdots + \Pi_p Y_{t-p} + e_t \]
  \[ Y = \begin{cases} 
  PCPI \\ 
  Wages \\ 
  Empl 
\end{cases} \]

- Financial variable VAR with exogenous variables
  \[ Y = \begin{cases} 
  PropVal \\ 
  Taxable \\ 
  IG Rev \\ 
  Other Rev \\ 
  TotExp 
\end{cases} \]
  \[ X = \begin{cases} 
  PCPI \\ 
  Wages \\ 
  Empl 
\end{cases} \]
Example

- City of Springfield, IL
- Randomly selected from “large” city group
- Economic data available from 2001-2017
- Financial data available from FY 2003-2018
  - Governmental Funds
Springfield Governmental Funds Revenue & Expenditures
Springfield Other Financing Sources
Economic VAR Results
Forecast Example - PCPI
Forecast Example – Total Property Valuation

![Graph showing forecast and 95 percent interval for property valuation over time.]
Results – Simulated 2019 Net Position
## Baseline Results

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<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>-3.58%</td>
<td>-20.96%</td>
<td>-40.42%</td>
<td>-62.58%</td>
<td>-86.69%</td>
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<tr>
<td><strong>Standard Deviation</strong></td>
<td>4.80%</td>
<td>7.01%</td>
<td>8.63%</td>
<td>10.07%</td>
<td>11.45%</td>
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<tr>
<td><strong>Prob. &lt; -10%</strong></td>
<td>9.45%</td>
<td>94.32%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>Prob. &lt; -20%</strong></td>
<td>0.06%</td>
<td>54.89%</td>
<td>99.32%</td>
<td>100.00%</td>
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# Results with 1% Sales Tax

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<tr>
<td><strong>Mean</strong></td>
<td>4.54%</td>
<td>-3.57%</td>
<td>-13.69%</td>
<td>-26.27%</td>
<td>-40.74%</td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td>4.30%</td>
<td>6.24%</td>
<td>7.64%</td>
<td>9.01%</td>
<td>10.12%</td>
</tr>
<tr>
<td><strong>Prob. &lt; -10%</strong></td>
<td>0.05%</td>
<td>15.30%</td>
<td>68.49%</td>
<td>96.52%</td>
<td>99.90%</td>
</tr>
<tr>
<td><strong>Prob. &lt; -20%</strong></td>
<td>0.00%</td>
<td>0.39%</td>
<td>20.32%</td>
<td>75.41%</td>
<td>98.19%</td>
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Summary

- We argue for a more explicit modeling of the financial
  - Similar to “pro forma” modeling in private sector businesses

- Benefits
  - Provides more information
  - More intellectually honest

- Drawbacks/Weaknesses
  - Requires some sense of “breaking point”
  - Can generate too much information
  - Illusion of specificity