Aggregate Effects of Public Health Insurance Expansion: The Role of Delayed Medical Care

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US Health Insurance Coverage Jumps Discretely at Age 65

Source: NHIS data from 2002 to 2012
Does Delayed Care Offset Costs of Public Insurance Expansion?

Two key novel channels related to delayed care:

1. Early care is more cost-effective ⇒ lower total medical expenses
2. Early care saves lives ⇒ higher aggregate medical expenses

In this paper: Aggregate effects of expanding Medicaid

Main Result: Expansion is half as costly as previous estimates suggest

- $40 billion per year vs CBO $80 billion per year
- CE Welfare -0.4% vs Jung and Tran (2016) -0.7%
Model Ingredients

- OLG model with heterogeneous agents and ABH incomplete markets
- Two dynamic state variables: wealth and health
- Rich insurance market w/ endogenous premiums
- Endogenous health investment $\rightarrow$ Endogenous mortality
- Use micro estimates to discipline model:
  1. DiD: 2014 ACA expansion led to **decline** in mortality (Miller, Johnson, and Wherry, 2021)
  2. RDD: **increase** in healthcare consumption at age 65 (Card, Dobkin, Maestas, 2008)
Summary of Quantitative Results

- Substantial impact of delayed care:
  - For every $100 spent on Medicaid expansion, Medicare costs decrease by $49
  - Life expectancy increases by 0.4 years
  - New insurance recipients gain 6% of consumption
  - Others lose 1% of consumption due to higher healthcare prices and taxes
    - Losses twice as large with delayed care channel
Model
A Macroeconomic Model of Health Expenditure

- \( N \) measure of heterogeneous individuals indexed by
  - \( b \): Assets (risk-free)
  - \( h \): Health
  - \( a \): Age
  - \( z_p \): Permanent Productivity
  - \( z_a \): Temporary Productivity
Individual Preferences

- Individual optimization problem:

  \[
  \max \sum_{j=17}^{a-1} \prod_{j} (1 - \pi(h_j, j)) \beta^a (\bar{u} + u(c_a, l_m, a, l_c, a))
  \]

  \[s.t. \ c_t + b_{t+1} + p_t \chi(i_t, x_t) + P_p = R_t b_t + T(z(z_p, z_s, t, a) (w_{m, t} l_{m, t} + w_{c, t} l_{c, t}))\]

  \[b_{t+1} \geq 0\]

- \(\bar{u}\): the additional utility from being alive each period

  - Generates preferences over consumption, labor, and mortality
Death is Determined Endogenously

- At end of each period, die with probability $\pi(h, a)$
  - For simplicity $\pi(h, 100) = 1$; maximum age of 100
  - (Exogenous) Measure $n$ of new individuals born each period
    - No population growth
    - No demographic concerns in public finance
Spending on Medical Care

- Individuals gain health by spending on medical care $i$

- Law of motion for health $h$ is given by

$$h_{t+1} = (1 - (\delta_a + 1 \{x > 0\} \delta_x)) h_t + \phi_a t^\omega$$

- $\phi_a$ is decreasing in age $\Rightarrow$ earlier care is more effective
Emergency Shocks

- Individuals face risk of health emergency each period
- Probability of emergency is $\pi_x(h, a)$
- When hit by emergency, face stochastic medical expenditure $x$

\[
\ln x \sim N(\mu(h, a), \sigma(h, a))
\]
Individuals can purchase insurance to reduce health risk

- Five types of insurance plans
  - 1. Employer-based Coverage
     - Availability follows Markov process with matrix $M$
  - 2. Marketplace Coverage
     - Universally available
  - 3. Uninsurance
     - Universally available
  - 4. Medicaid
     - Available to individuals below productivity threshold $\bar{z}$
  - 5. Medicare
     - Available to individuals 65 or older
To pay for \( i \) and \( x \), HH with plan \( p \) pays \( \chi_p(i, x) \)

\[
\chi_p(i, x) = v_p i + \left[ \rho_p \max(x - d_p, 0) + \min(x, d_p) \right] + P_p
\]

- \( v_p \): Copay rate (e.g. for GP visits, prescriptions drugs, etc.)
- \( d_p \): Deductible
- \( \rho_p \): Coinsurance rate (e.g. for hospital stays, ER visits, etc.)
- \( P_p \): Per-period insurance premium
Insurance Companies Operate at Zero Profits

- Insurance firms collect premiums and administer insurance subject to loading factor $\kappa$
- For plan $p$, zero profits implies:

  $$(\text{Premiums Collected}) = (1 - s_p)\kappa(\text{Cost of Covered Care})$$

- $s_p$: government subsidy rate
Individual Productivity Process

- Household period productivity given by

\[ z(z_p, z_s, a) = \exp(g(a) + z_p + z_s) \]

- Life-cycle component of productivity: \( g(a) \)

- Permanent productivity: \( z_{p,t+1} = z_{p,t} \)

- Temporary productivity: \( z_{s,t+1} = \rho z_{s,t} + \varepsilon_t \)
Supply Side

- Consumption and Medical sector labor are imperfect substitutes
  \[ l = \nu \left( (1 - \alpha_m) l_m^{\xi+1} + \alpha_m l_c^{\xi+1} \right)^{\frac{\xi}{\xi+1}} \]

- Yields constant elasticity relative labor supply curve
  \[ \frac{l_m^*}{l_c^*} = \left( \frac{1 - \alpha_m}{\alpha_m} \right)^\xi \left( \frac{w_m}{w_c} \right)^\xi \]

- Representative firms use Cobb-Douglas technology and operate in perfect competition
  - \( Y_m = A_m K_m^\alpha L_m^{1-\alpha} \)
  - \( Y_c = A_c K_c^\alpha L_c^{1-\alpha} \)
State Variables

- **Individual level:**
  1. Assets $b$
  2. Health $h$
  3. Age $a$
  4. Permanent productivity $z^p$
  5. Temporary productivity $z^s$
  6. Insurance plan $p$
  7. Access to employer-provided insurance $e$
  8. Information status $\lambda$

- **Aggregate level:**
  1. Cross-sectional distribution of (1) - (8) $\Omega$
Bellman Equation

\[
V(b, h, a, z^p, z^s, p, e; \Omega) = \max \bar{u} + u(c, l) + \\
+ \beta(1 - \pi(h, a)) \mathbb{E}[V(b', h', a + 1, z^p, z^{s'}, p', e'; \Omega')]
\]

\[
c + b' + p_h \chi_p(i, m) = (1 + r(\Omega)) b + T((w_m(\Omega)l_m + w_c(\Omega)l_c)z(z^p, z^s, a)) \quad \text{if } a < 65
\]
\[
c + b' + p_h \chi_{MCR}(i, m) = (1 + r(\Omega)) b + y_{a \geq 65}(z^p, \Omega) \quad \text{if } a \geq 65
\]
\[
h' = (1 - \delta_a - \delta_x)h + \phi_i \psi
\]
\[
l = \nu \left( (1 - \alpha_m) l_m^{\xi + 1 \over \xi} + \alpha_m l_c^{\xi + 1 \over \xi} \right)^{\xi \over \xi + 1}
\]
Quantification
Data From Medical Expenditure Panel Survey

- Medical Expenditure Panel Survey (MEPS) provides data on:
  - Detailed individual health status
  - Health insurance coverage
  - Healthcare expenditure paid OOP and **paid** by insurance
    - ⋆ Collected from medical provider component
    - ⋆ ⇒ **Actual**, not “guessed”, expenditure and coverage
  - Panel structure ⇒ Observe outcomes (e.g. hospitalization, mortality)

- Separate spending into emergency and non-emergency
How to Measure Health?

- Following Hosseini et al. (2021), use frailty index
- Have battery of varied health questions
  - Diagnoses: “Have you ever been diagnosed with diabetes?”
  - Self-reported: “Do you have difficulty lifting 10 pounds?”
  - Activities of Daily Living: “Do you need help using the telephone?”
  - Objective measures: BMI, K6 score
- Intuition: sum up number of “Yes”’s and normalize so that $f_i \in (0, 1)$
- Health index $h_i = 1 - f_i$
  - $h_i = 1$: Maximally healthy, no health deficits
  - $h_i = 0$: Minimally healthy
Distribution of Measured Health

![Distribution of Measured Health](image-url)
Model Estimation

- Parameters fall broadly into 3 categories
  1. Health parameters estimated using SMM
  2. Directly estimated health parameters
  3. Standard macro parameters
Two Key Parameters for Delayed Care

- Returns to scale parameter for health investment $\psi$
  - Governs intertemporal substitution of healthcare

- Productivity of health investment $\phi_a = \phi_0 + \phi_1 a$
  - Level parameter $\phi_0$ determines overall importance of health spending

- Discipline using two quasi-experiments from health economics literature
Card, Dobkin, and Maestas (2008)

- Estimate jumps in various healthcare outcomes at age 65 using RDD framework
- Use hospital admin data to estimate increase in utilization of various procedures
- 54% increase in average utilization
- Observed jump disciplines returns to scale
Use state-level Diff-in-Diff to estimate impact of Medicaid expansion on mortality of low income adults ages 55-64

Mortality measured using Social Security admin data

9.4% decline in mortality

Decline disciplines productivity of health spending $\phi_0$
Replicating MJW (2021) in Model

1. Calculate pre-expansion steady-state with eligibility cutoff $\bar{z}_{\text{PRE}}$

2. Select sample of adults age 55-64 with productivity less than $\bar{z}_{\text{POST}}$
   - Sample is measure 0

3. Simulate outcomes in (a) world where cutoff remains $\bar{z}_{\text{PRE}}$ and (b) changes to $\bar{z}_{\text{POST}}$

4. The model DiD estimator can be calculated as (b) - (a)

   - Choose $\bar{z}_{\text{PRE}}$ and $\bar{z}_{\text{POST}}$ to match
     - estimated change in eligibility
     - post-expansion income cutoff of 138% of FPL
Decline in Morality due to Expansion: Model and Data

- Medicaid Eligibility (pp)
- Years since Treatment
- Mortality (%)

Model vs Data comparison over years since treatment, showing declines in mortality and Medicaid eligibility.

- Medicaid Eligibility (pp) graph:
  - Y-axis: Δ Medicaid Eligibility (pp)
  - X-axis: Years since Treatment
  - Graph includes model and data lines.

- Mortality (%) graph:
  - Y-axis: Δ Mortality (%)
  - X-axis: Years since Treatment
  - Graph includes model and data lines.
Estimating Other Health Parameters

- Market-based insurance plan parameters from data
- Government-provided insurance plan parameters from administrative numbers
- Mortality risk $\pi(h, a)$ estimated using logit regression
- Emergency risk $\pi_x(h, a)$ and expenditure mean $\mu(h, a)/\text{variance } \sigma(h, a)$ directly from data
## Standard Macro Parameters

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Effective) Discount Factor</td>
<td>$\beta \pi(a, h)$</td>
<td>0.96</td>
</tr>
<tr>
<td>CRRA</td>
<td>$\sigma$</td>
<td>2</td>
</tr>
<tr>
<td>Frisch Elasticity of Labor</td>
<td>$\nu$</td>
<td>1</td>
</tr>
<tr>
<td>Disutility of Labor</td>
<td>$\kappa$</td>
<td>0.15</td>
</tr>
<tr>
<td>Income Persistence</td>
<td>$\rho$</td>
<td>.91</td>
</tr>
<tr>
<td>Income SD</td>
<td>$\sigma$</td>
<td>.04</td>
</tr>
<tr>
<td>Life-cycle Income</td>
<td>$g(a)$</td>
<td>Lagakos et al. (2018)</td>
</tr>
<tr>
<td>Labor Share</td>
<td>$\alpha$</td>
<td>0.66</td>
</tr>
<tr>
<td>Tax Function</td>
<td>$T(y)$</td>
<td>$\lambda \tau y^{1-\tau}$</td>
</tr>
<tr>
<td>Tax Progressivity</td>
<td>$\tau$</td>
<td>0.181</td>
</tr>
<tr>
<td>Tax Level</td>
<td>$\lambda \tau$</td>
<td>0.73</td>
</tr>
<tr>
<td>Social Security Function</td>
<td>$y_{a \geq 65}(z_p)$</td>
<td>Statutory</td>
</tr>
<tr>
<td>Moment</td>
<td>Model</td>
<td>Data</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>Avg. VSL of Medicaid Recipient</td>
<td>$2 million</td>
<td>$2.25 million</td>
</tr>
<tr>
<td>Jump in Medical Exp. at 65</td>
<td></td>
<td>Discussed Previously</td>
</tr>
<tr>
<td>Mortality Response to Medicaid</td>
<td></td>
<td>Discussed Previously</td>
</tr>
<tr>
<td>Mean of Health Spending</td>
<td>$6,220</td>
<td>$6,086</td>
</tr>
<tr>
<td>SD of Health Spending</td>
<td>$4,359</td>
<td>$10,047</td>
</tr>
<tr>
<td>Avg. Health</td>
<td>0.886</td>
<td>0.877</td>
</tr>
<tr>
<td>cov(Health, Age)</td>
<td>-1.11</td>
<td>-1.21</td>
</tr>
<tr>
<td>Emerg. vs Non-Emerg Health</td>
<td>-0.045</td>
<td>-0.090</td>
</tr>
</tbody>
</table>
Model Validation: Distribution of Health in Data and Model

![Graph showing the distribution of health index for Model and Data.](image-url)
Quantitative Results
Main Quantitative Experiment: Medicaid Expansion

- Increase Medicaid eligibility cutoff from $\tilde{z}_{\text{PRE}}$ to $\tilde{z}_{\text{POST}}$
  - Same $\tilde{z}_{\text{PRE}}$ and $\tilde{z}_{\text{POST}}$ as Miller et al. Diff-in-Diff
  - Effectively simulating Medicaid expansion portion of ACA

- Expansion funded by adjusting tax level $\lambda_{\tau,t}$ each period
log(Healthcare Expenditure) by Age in Model

![Graph showing log(Average Health Spending 2018$) by age with estimated jumps.]

- **pre-Expansion**
  - Estimated Jump: 0.46

- **post-Expansion**
  - Estimated Jump: 0.28
Expansion Successfully Reduces Delayed Care

- RDD-estimated jump in health expenditure at age 65 shrinks from 46% to 28%
- Spending for younger-than-65 increases
  - +2.9% for individuals between 18 and 60
  - +13.0% for individuals between 60 and 64
- Spending for older-than-65 decreases by 2.7%
Expansion Successfully Reduces Mortality

Data
Pre-Expansion
Post-Expansion

Mortality vs Age
For every $100 spent on expansion, Medicare costs fall by $49.63

- Expansion increase Medicaid outlays by 1.37% of GDP
- Reduces Medicare outlays by 0.68% of GDP
- Taxes increase by 0.40% of GDP
## Contribution of the Two Channels

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1) Post-Expansion</th>
<th>(2) Exo. $\pi$</th>
<th>(3) Exo. $i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid Coverage (% Population)</td>
<td>+15.7%</td>
<td>+12.3%</td>
<td>+15.7%</td>
</tr>
<tr>
<td>Medicare Savings per $100 Spent</td>
<td>$49.63</td>
<td>$56.93</td>
<td>$0</td>
</tr>
<tr>
<td>Total Medicaid Spending (% of GDP)</td>
<td>+1.37%</td>
<td>+1.37%</td>
<td>+1.29%</td>
</tr>
<tr>
<td>Total Medicare Spending (% of GDP)</td>
<td>−0.68%</td>
<td>−0.78%</td>
<td>−0.00%</td>
</tr>
<tr>
<td>Total Tax Receipts (% of GDP)</td>
<td>+0.40%</td>
<td>+1.04%</td>
<td>+1.13%</td>
</tr>
</tbody>
</table>

- **Early care channel:** $56.93 savings for every $100 spent
- **Mortality channel:** $7.30 increase in costs for every $100 spent
CE Welfare Gain as a Function of Permanent Income

- Baseline Model (1)
- Model with Exogenous Health (3)

Avg Welfare Gain: -0.5%
Popularity: 10.7%
Avg Gain (Exogenous Health): -1.4%

- Losses twice as large without delayed care channels
CE Welfare Gains as a Function of Ex-Post Age 40 Health

[Graph showing CE welfare gains as a function of health index for 'Employer-Base Insurance' and 'Uninsured' categories.]
Conclusion

- Delayed care represents large potential cost savings

- Public health insurance expansion can reduce delayed care and save money
  - For every $100 spent on Medicaid expansion, Medicare costs fall by $49

- Substantial impact on welfare
  - Those who lose would lose twice as much without delayed care channels