The Macroeconomics of Health Savings Accounts

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Dysfunctional U.S. Health Care System

- **Low Coverage**: about 50 million uninsured in 2012 (17%)
- **High Cost**: 17% of GDP in 2012 and close to 20% by 2015

Comprehensive Health Care Reforms

- **Health care reforms:**
  1. Health Savings Accounts (HSAs) in 2003
  2. The Affordable Care Act in 2010
     (aka Obama Health Care Reform)
  3. Other proposals: public option, universal medical vouchers
- **Goals:**
  1. control total health expenditure
  2. increase the number of insured individuals

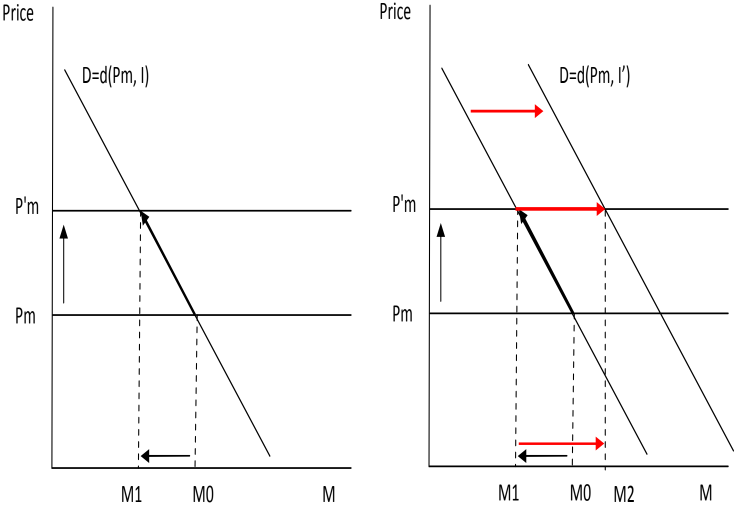
What are HSAs?

Medicare Prescription Drug, Improvement, and Modernization Act (2003)

1. HSAs are **tax free** trust accounts to save for medical expenses
2. Interest earnings are not taxable
3. Funds roll over into next period
4. Age < 65 with **high deductible** health insurance (at least $\$1,100$)
5. 10% penalty for non-medical expenses
6. Age > 65 funds can be withdrawn without penalty (income tax applies)
7. Annual contribution limit ($\$2,850$)

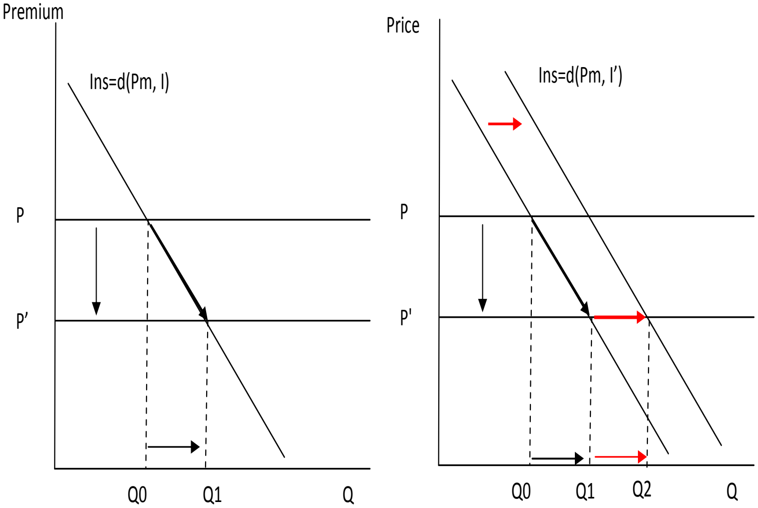
Intuitively, a twin reform: a capital income tax reform coupled with a health insurance reform

HSAs and Health Expenditures: Price and Income Effects



HSAs and Medical Consumption

HSAs and Health Insurance: Price and Income Effects



HSAs and Health Insurance

This Paper

- Conduct a general equilibrium analysis of HSAs

  1. Determine the success of HSAs

  2. Quantify tax revenue loss resulting from HSAs

Findings and Contribution

- Findings:
    1. HSAs increase health insurance coverage but fail to control health expenditure costs
    2. General equlibrium effects are quantitatively important
- Contribution:
    1. A macroeconomic model with health as a durable good
    2. Quantify macroeconomic effects of HSAs

Related Literature

- Quantitative macroeconomics: Hugget(1993), Aiyagari(1994), Imrohoroglu et al. (1995)
- Health micro/econometrics: Grossman(1972a,1972b), Grossman(2000)
- Health macroeconomics: Suen(2006), Jeske and Kitao (2010), Jung and Tran(2010)
- HSAs empirical: Buntin et al. (2011), Haviland et al. (2011, 2012)

The Model

- Standard overlapping generations framework
  1. Agents live at most J periods: J_1 periods as workers and $J - J_1$ periods as retirees
  2. Competitive production sector
  3. Government with social insurance programs
  4. Incomplete financial markets
- New ingredients
  1. Health as a durable good (consumption and production)
  2. Health shocks
  3. Health spending and financing
  4. Health savings accounts

Preferences and Technology

- Preferences:

$$u\left(c_j, h_j\right) = \frac{\left(c_j^{\eta_j} h_j^{1-\eta_j}\right)^{1-\sigma}}{1-\sigma}$$

- Health production:

$$h_j = \phi_j m_j^{\xi} + \left(1 - \delta\left(h_j\right)\right) h_{j-1} + \varepsilon_j$$

- Markov switching between health shocks:

$$P_j\left(\varepsilon_j, \varepsilon_{j-1}\right) = \Pr\left(\varepsilon_j | \varepsilon_{j-1}, j\right)$$

- Human capital:

$$e_j = \left(e^{\beta_0 + \beta_1 j + \beta_2 j^2}\right)^{\chi} \left(h_{j-1}^{\theta}\right)^{1-\chi} \text{ for } \; j = \{1, ..., J_1\},$$

where $\beta_0, \beta_2 < 0$, $\beta_1 > 0$, $\chi \in (0,1)$ and $\theta \in [0,1]$

Financing Health Expenditures

- Health insurance:
  - $in_j = 1$: low deductible health insurance
  - $in_j = 2$: high deductible health insurance
  - $in_j = 3$: no insurance
- Total health expenditure: $p_m m$
- Out of pocket expenditures

$$o\left(m_j\right) = \begin{cases} p_{m,noIns} m & \text{if } in_j = 3, \\ \min\left[p_{m,Ins} m_j, \gamma + \rho\left(p_{m,Ins} m_j - \gamma\right)\right] & \text{if } in_j = 1, 2 \end{cases}$$

Key Features of HSAs

- HSA only with high deductible insurance
- Save a_j^m tax-free in HSAs at the market interest rate
- $age < 65$: penalty tax τ^m applies if spent on 'non-health' items
- $age \geq 65$: no penalty, but income tax
- Maximum contribution $\bar{s}^m$ (e.g. $\$2,850$ for an individual or $\$5,650$ for a family per year)

Worker's Program

- Agent state $\mathrm{x}_j = \{a_{j-1}, a^m_{j-1}, h_{j-1}, in_{j-1}, \varepsilon_j\}$
- Agents receive income (wage, interest income, accidental bequests, profits, and social insurance)
- Pay taxes (payroll and progressive income tax)
- Agents simultaneously choose:
  1. Consumption c_j and asset holdings a_j
  2. Health expenditures m_j
  3. Insurance state for next period $in_j = \{1, 2, 3\}$
  4. If $in_j = 2$, saving a^m_j in HSA is possible
- If net investment into HSA $NI < 0 \rightarrow$ penalty τ^m

Worker's Dynamic Programming

$$V_j(x_j) = \max_{\{c_j, m_j, a_j, a_j^m, in_j\}} \left\{ u\left(c_j, h_j\right) + \beta \pi_j E_{\varepsilon}\left[V_{j+1}\left(x_{j+1}\right) | \varepsilon_j\right] \right\}$$

s.t.

$$\mathrm{c}_j + a_j + 1_{\{in_j=2\}} a_j^m + o^W\left(m_j\right) + 1_{\{in_j=1\}} p_j + 1_{\{in_j=2\}} p_j'$$

$$=_j + R\left(a_{j-1} + T^{Beq}\right) + R^m a_{j-1}^m + T^{Insprofit} + T_j^{SI} - Tax_j$$

$$\mathrm{h}_j = \phi_j m_j^{\xi} + \left(1 - \delta\left(h_j\right)\right) h_{j-1} + \varepsilon_j$$

$$\mathrm{e}_j = \left(e^{\beta_0 + \beta_1 j + \beta_2 j^2}\right)^{\chi} \left(h_{j-1}^{\theta}\right)^{1-\chi}$$

$$0 \leq a_j, a_j^m$$

Retiree's Program

- Agent state: $\mathrm{x}_j = \{a_{j-1}, a^m_{j-1}, h_{j-1}, in_{j-1}, \varepsilon_j\}$
- Agents receive income (pension, interest income, accidental bequests, profits, and social insurance)
- Pay taxes (progressive income tax)
- Forced into Medicare $\rightarrow$ pay p_j^{Med}

- Agents simultaneously choose:
  1. Consumption c_j and asset holdings a_j
  2. Health expenditures m_j
  3. Funds in HSA a_j^m

- If net investment into HSA $NI < 0 \rightarrow$ forgone income tax

Retiree's Dynamic Programming

$$V_j(x_j) = \max_{\{c_j, m_j, a_j, a_j^m\}} \{u(c_j, h_j) + \beta \pi_j E_\varepsilon [V_{j+1}(x_{j+1}) | \varepsilon_j]\}$$

s.t.

$$\begin{aligned} & c_j + a_j + a_j^m + o^R(m_j) + p_j^{Med} \\ = \; & R\left(a_{j-1} + T^{Beq}\right) + R^m a_{j-1}^m + T^{Insprofit} + T_j^{Soc} + T_j^{SI} - Tax_j \end{aligned}$$

$$\begin{aligned} h_j &= \phi_j m_j^\xi + (1 - \delta(h_j)) h_{j-1} + \varepsilon_j \\ NI_j &\leq 0 \\ 0 &\leq a_j, a_j^m \end{aligned}$$

Firms and Insurance Companies

- Firms:

$$\max_{\{K,L\}} \left\{AK^{\alpha_1}L^{\alpha_2} - qK - wL\right\}, \text{ given } (q, w)$$

- Insurance Companies:

$$
\begin{aligned}
& (1+\omega) \times \sum_{j=2}^{J_1+1} \mu_j \int \left[I_{\{in_j=1\}} (1-\gamma) \max(0, p_{m,Ins} m_j(x) - \rho) \right] d\Lambda_j(x) \\
= \quad & \sum_{j=1}^{J_1} \mu_j \int I_{\{in_j=1\}} p_j(x)\, d\Lambda_j(x)
\end{aligned}
$$

$$
\begin{aligned}
& (1+\omega) \times \sum_{j=2}^{J_1+1} \mu_j \int \left[I_{\{in_j=2\}} \left(1-\gamma'\right) \max\left(0, p_{m,Ins} m_j(x) - \rho'\right) \right] d\Lambda_j(x) \\
= \quad & \sum_{j=1}^{J_1} \mu_j \int I_{\{in_j=2\}} p'_j(x)\, d\Lambda_j(x)
\end{aligned}
$$

- Profits $T^{Insprofit}(\omega)$ are distributed back to households in a lump-sum payment.

Government I

- Bequests:

$$\sum_{j=1}^{J} \mu_j \int T_j^{Beq}(x)\, d\Lambda_j(x)$$
$$= \sum_{j=1}^{J} \nu_j \int a_j(x)\, d\Lambda_j(x) + \sum_{j=1}^{J} \nu_j \int a_j^m(x)\, d\Lambda_j(x)$$

- Social Security:

$$\sum_{j=J_1+1}^{J} \mu_j \int T_j^{Soc}(x)\, d\Lambda_j(x)$$
$$= \sum_{j=1}^{J_1} \mu_j \int \left[\begin{array}{c} 0.5\tau^{Soc} we_j(x) + 0.5\tau^{Soc} \\ \times \left(\tilde{w}_j(x) - 1_{\{in_j(x)=1\}} p_j - 1_{\{in_j(x)=2\}} p_j'\right) \end{array} \right] d\Lambda_j(x)$$

Government II

- Medicare:

$$\begin{aligned} & \sum_{j=J_1+1}^{J} \mu_j \int \left(1-\gamma^{Med}\right) \max\left(0, m_j(x) - \rho^{Med}\right) d\Lambda_j(x) \\ = \; & \sum_{j=1}^{J_1} \mu_j \int \left[\begin{array}{c} 0.5\tau^{Med} we_j(x) + 0.5\tau^{Med} \\ \times \left(\tilde{w}_j(x) - 1_{\{in_j(x)=1\}} p_j - 1_{\{in_j(x)=2\}} p_j'\right) \end{array} \right] d\Lambda_j(x) \\ & + \sum_{j=J_1+1}^{J} \mu_j \int p_j^{Med} d\Lambda_j(x) \end{aligned}$$

- Government budget is balanced:

$$G + \sum_{j=1}^{J} \mu_j \int T_j^{SI}(x)\, d\Lambda_j(x) = \sum_{j=1}^{J} \mu_j \int Tax_j(x)\, d\Lambda_j(x)$$

Calibration

- Preferences:

$$u\left(c_j, h_j\right) = \frac{\left(c_j^{\eta_j} h_j^{1-\eta_j}\right)^{1-\sigma}}{1-\sigma}$$

- Health production:

$$h_j = \phi_j m_j^{\xi} + \left(1 - \delta\left(h_j\right)\right) h_{j-1} + \varepsilon_j$$

- Markov switching between health shocks:

$$P_j\left(\varepsilon_j, \varepsilon_{j-1}\right) = \Pr\left(\varepsilon_j | \varepsilon_{j-1}, j\right)$$

- Human capital:

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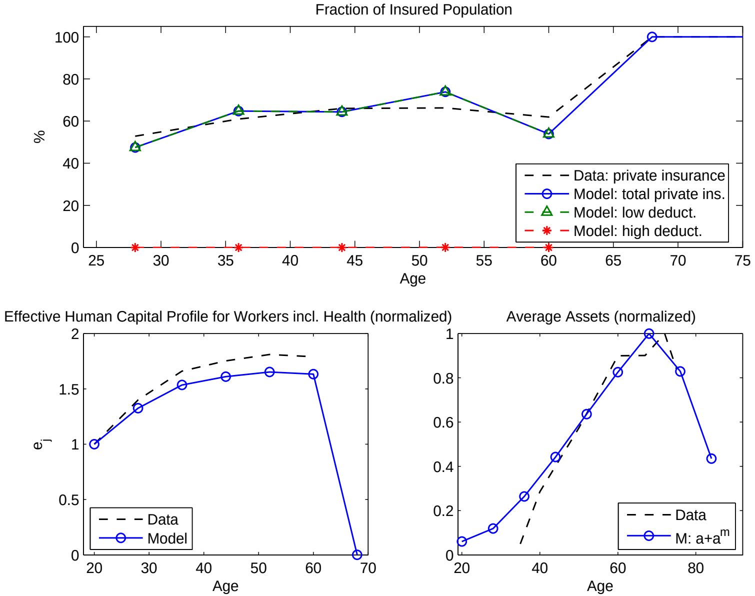
where $\beta_0, \beta_2 < 0$, $\beta_1 > 0$, $\chi \in (0, 1)$ and $\theta \in [0, 1]$

Calibration

Baseline Parameters		
$J_1 = 6$	Health Production:	Insurance:
$J_2 = 3$	$\phi_j = [.65, 0.9, 1, ..., 1]$	$\rho^{Med} = \$1,076$
	$\xi = 0.27$	$\gamma^{Med} = 0.25$
Preferences:	$\delta_h = [0.0001, ..., 0.08]$	$\rho = \$305$
$\sigma = 3.$		$\gamma = 0.25$
$\beta = .98$	Health Productivity:	$\rho' = \$2,330$
$\eta_j = 0.9$	$\theta = [0, 1]$	$\gamma' = 0.20$
Technology:		Exogenous
$\alpha = 0.33$		premium growth:
$\delta = 8.5\%$		1.5%

Model vs. Data: Insurance, Human Capital and Asset Holdings



Model vs. Data: Distribution of Medical Expenditures

	Data (in %)	Model (in %)
Percent of Total Population		
1%	22.000	17.940
5%	49.000	52.823
10%	64.000	74.950
50%	97.000	99.900

HSAs: General vs. Partial Equilibrium Effects

	Benchmark No HSA	HSA G.E.	HSA P.E.
Output: Y	100.000	100.980	
Capital stock: K	100.000	102.999	
Standard assets: a in %	100.000	43.700	75.004
Assets in HSAs: a^m in %	0.000	56.300	24.996
Consumption: C	100.000	107.512	102.738
Health Capital: H	100.000	100.349	100.157
Human capital: Hk	100.000	100.000	100.000
Interest rate: r in %	3.377	3.235	
Wages: w	100.000	100.860	
Medical spending: $p_m M$	100.000	107.474	102.572
Medical spending: $p_m M/Y$ in %	17.233	18.341	
Insured workers - low deduct. %	62.215	0.000	38.380
Insured workers - high deduct. %	0.000	99.168	36.917
Government spending: G/Y in %	18.663	13.115	
Welfare	-100.000	-85.251	-93.951

Table : Steady state results without human capital effect, $\theta = 0$

Mechanism: HSAs and Health Expenditures

- Partial Equilibrium Effects

  1. $\Uparrow$ effective price of health care services
  2. $\Downarrow$ demand for health care - "PE substitution effect"
  3. $\Uparrow$ household income due to tax deductible
  4. $\Uparrow$ demand for health care - "PE income effect"

- General Equilibrium Effects:

  1. the saving effect and the human capital effect result in changes in household income - 'GE income effect'
  2. $\Downarrow$ or $\Uparrow$ demand for health care depending on "GE income effect"

- The net effect determines health expenditures

Mechanism: HSAs and Number of Insured Individuals

- Partial Equilibrium Effect

  1. $\Downarrow$ price of high deductible insurance
  2. $\Uparrow$ demand for health insurance - "PE substitution effect"
  3. $\Uparrow$ household income due to tax deductible
  4. $\Uparrow$ demand for health insurance - "PE income effect"

- General Equilibrium Effect

  1. the saving effect and the human capital effect result in changes in household income - "GE income effect"
  2. if income $\Downarrow$, demand for health insurance $\Downarrow$
  3. and number of insured individuals $\Downarrow$
  4. if income $\Uparrow$, demand for health insurance $\Uparrow$

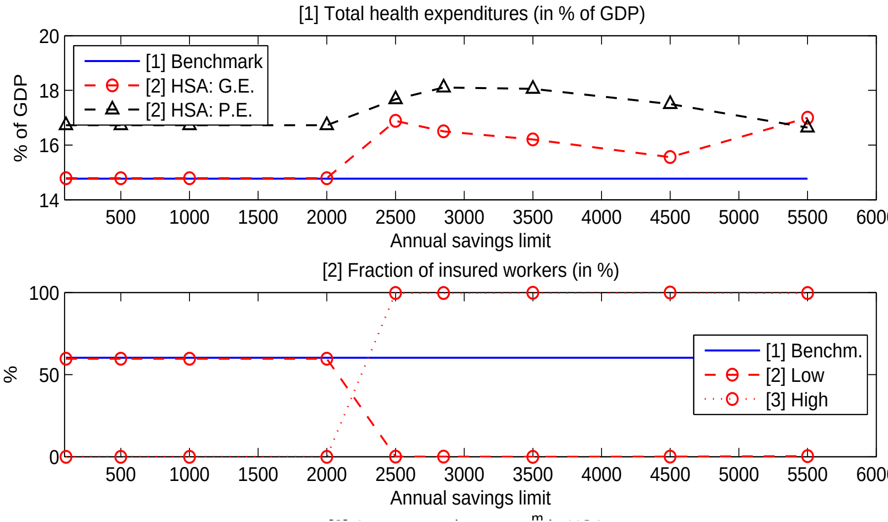
- The net effect determines the number of insured individuals

HSAs: General vs. Partial Equilibrium Effects 2

	Benchmark No HSA	HSA G.E.	HSA P.E.
Output: Y	100.000	100.876	
Capital stock: K	100.000	102.710	
Standard assets: a in %	100.000	48.521	51.603
Assets in HSAs: a^m in %	0.000	51.479	48.397
Consumption: C	100.000	105.556	102.095
Health Capital: H	100.000	100.144	100.120
Human capital: Hk	100.000	99.984	99.999
Interest rate: r in %	3.876	3.767	
Wages: w	100.000	100.678	
Medical spending: $p_m M$	100.000	112.684	108.228
Medical spending: $p_m M/Y$ in %	14.774	16.503	
Insured workers - low deduct. %	60.319	0.000	11.301
Insured workers - high deduct. %	0.002	99.762	85.575
Government spending: G/Y in %	19.794	14.471	
Welfare	-100.000	-87.442	-93.373

Table : Steady state results with human capital effect, $\theta = 1$

Contribution Limits and the Success of HSAs



Conclusion

- A macromodel with health capital i.e. a generalized version of the Grossman model
- Macroeconomic implications of health care reforms
- General equilibrium channels are quantitatively important in determining the sucess of HSAs