

Health Insurance Reform and the (Re-)Distribution of Welfare: A Dynamic Structural Analysis of Heterogeneity in Willingness to Pay for the Affordable Care Act

Ahmed Khwaja¹ Matthew N. White²

¹University of Cambridge
a.khwaja@jbs.cam.ac.uk

²Econ-ARK
mnwhite@gmail.com

Background: ACA and Welfare

- Patient Protection and Affordable Care Act of 2010 (ACA) reformed non-group medical insurance market
- Policy goals:
 - Increase insured rate (among non-elderly population)
 - Make individual market insurance more affordable
 - Improve consumer protections in insurance markets
- Policy strategy:
 - Make non-group insurance market more like group market
 - Encourage participation with carrot and stick approach
- Who does this help? Who does this hurt? By how much?

Pre-ACA market

Research Question: Welfare Effects of the ACA

- Clear winners from ACA: previously excluded or priced out
- But life circumstances are dynamic:
 - The young (inevitably) become the old
 - Healthy people (sometimes) become unhealthy
 - The poor (hopefully) become the rich (and vice versa)
 - People (evidently) change jobs, change ESI access
- Who really benefits from ACA reforms? Who doesn't?
- By how much? Quantify distribution of welfare effect
- How are those welfare effects attained?

Research Strategy

- 1 Specify dynamic model of individual decisions about consumption, saving, medical care, & insurance
- 2 Estimate model parameters using MEPS and SCF data to match outcomes: wealth, medical spending, insurance
- 3 Use estimated model to counterfactually simulate effects of ACA reform policies, jointly and separately
- 4 Consider insured rate, premium structure, willingness-to-pay

Literature

Summary of Results

- The ACA progressively redistributed welfare, as intended
- Average WTP for the ACA of $\sim \$29k$ ($\$51k$ for ages 22-25)
- Gains were broad, but not universal: 78% have positive WTP
- But $\sim 50\%$ of college-educated with ESI have negative WTP
- Wide heterogeneity: 1st pctl WTP $-\$23k$; 99th pctl $\$160k$
- Welfare effects dominated by insurance subsidies (APTC)
- Subsidies drive IMI uptake for low- and mid-income workers
- Mandate induces IMI uptake for young and/or high income

MODEL

Model Ingredients

Necessary model components to (fully) address our questions:

- Lifecycle dynamics of health, income, and access to ESI
- Dynamic tradeoffs: saving, labor supply, health investment
- Risk aversion: willingness-to-pay for insurance
- Choice of quantity of medical care → moral hazard
- Choice of insurance contract → adverse selection
- Equilibrium pricing of insurance
- Oligopolistic competition among insurers (cost structure)
- Closed fiscal system: budget neutral policy
- Endogenous factor prices / labor contracts
- Household dynamics / bargaining / allocation

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Model Overview

- Agents represent workers (unitary HH agent), het. education
- Discrete time, one year periods
- Expected utility maximizers, discount utility geometrically
- Utility: two CRRA terms, different coefficients Utility function
- Decisions about consumption, medical care, saving, insurance
Control variables
- Subject to liquidity constraint, consumption floor Budget constraint
- Risk: permanent and transitory labor income shocks
Income process
- Risk: changes in access to ESI ESI process
- Risk: health (including mortality), medical need shocks
Health process Medical needs
- Equilibrium insurance pricing: nested solution method

Model Sequence

In period t , agent i with age j ...

- 1 Draws new health state & ESI status, receives income shocks
Shock variables
- 2 Observes own health, perm inc, market resources, ESI access
State variables
- 3 Chooses a health insurance contract, pays premium Contracts
- 4 Draws and observes a medical need shock Medical needs
- 5 Chooses levels of consumption and medical care, pays for them Control variables
- 6 Transitions to the next period, with possible mortality
Health process

Agent's Solution

- Fix calibrated and structural parameters and premiums
- Individual's problem can be solved by backward induction
- State space: 3 continuous, 2 discrete (plus age & education)
- Medical need shocks can be massive; careful w/ integration
- Beginning-of-period value function is upper envelope of insurance-conditional (expected) value functions
- Discrete choice & deductible \rightarrow non-concave value function
- First order conditions necessary, but not sufficient

Consumption function

Medical care function

Expected med function

Actuarial value function

Equilibrium Premiums

- But premiums *aren't* known ex ante— they're endogenous!
- Not modeling competition among insurers
- Actuarial constraint: premium revenue received equals expected benefits paid out *plus* actuarial load.
- ESI loading: 15% of benefits paid (mid-size firm average)
- IMI loading: 40% of benefits paid plus \$800
- Expected benefits depends on *who buys* each contract
- **One** insurance pool for all ESI enrollees
- **Many** insurance pools for IMI: ages 22-64 & binary health
- Medical tax rate τ also determined in equilibrium

Medical tax rate

DATA & ESTIMATION

Medical Expenditure Panel Survey

- Panel study focusing on medical spending and insurance
- Respondents selected at household level, measured individually
- Households in MEPS sample for two years (five rounds)
- About 18,000 respondents in each panel
- Restrict sample to men 25 years and older:
 - Working age sample: all men 25-64
 - Retired sample: all men 65-84
- Use 2007-2013 waves of MEPS
- 55,525 working age observations; 9,844 retired obs

Data used from MEPS

Other data sources

Estimation Overview: SMM

- Want to find structural parameters that best fit data moments
- Solve model given parameters, generate simulated data
- Calculate simulated moments, diff with empirical moments
- Compute weighted distance between model and data
- Weighting matrix: (inverse of) bootstrap covariance matrix

Identification overview

Moment Selection

- Mean wealth-to-income ratio by age (25 to 64)
- Mean of log (non-zero) total medical spending...
 - by age and health status (5 year blocks, 25 to 84)
 - by age and income quintile (5 year blocks, 25 to 64)
- Stdev of log (non-zero) total medical spending...
 - by age and health status (5 year blocks, 25 to 84)
- Mean out-of-pocket ESI premium by age (25 to 64)
- ESI insured rate by age (25 to 64), conditional on offer
- IMI insured rate by age (5 year blocks) & income quintile

Some Estimated Parameters

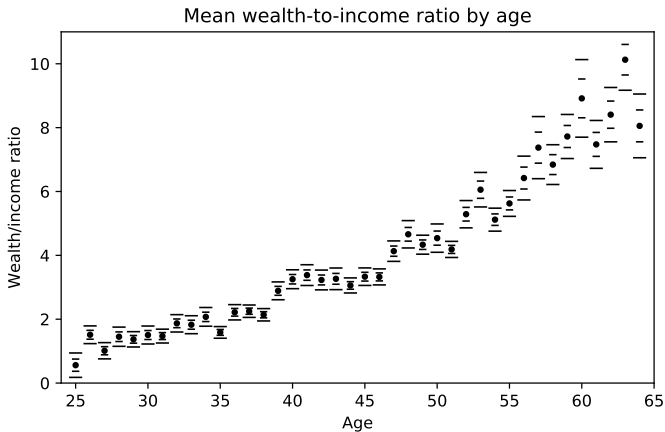
312 moments, 29 parameters, objective function value 779.47

	Est	Std Err	Description
β	0.944	(0.005)	Intertemporal discount factor
ρ	4.054	(0.067)	Coefficient of relative risk aversion for consumption
ν	23.80	(1.41)	Coefficient of relative risk aversion for medical care
\underline{c}	3828	(93)	Consumption floor (USD)
s_p	2264	(67)	Employer contribution to ESI (USD)

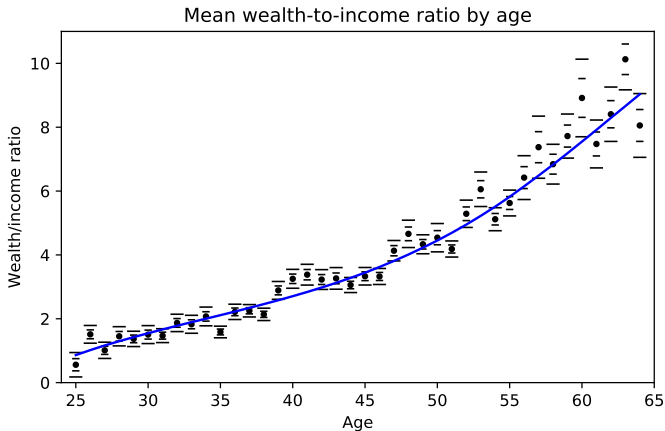
Mean medical need shock params

Stdev medical need shock params

Wealth Accumulation by Age



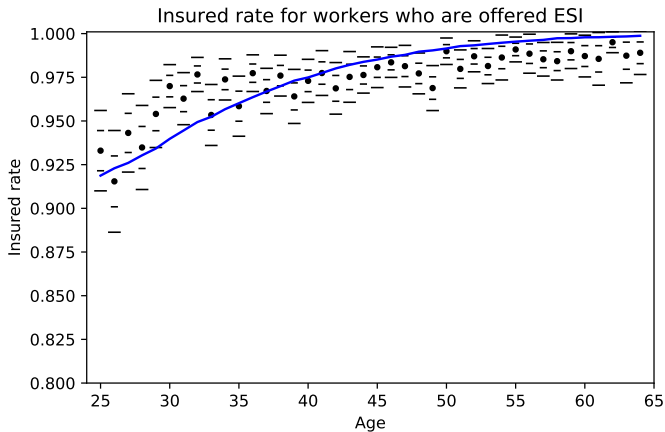
Wealth Accumulation by Age



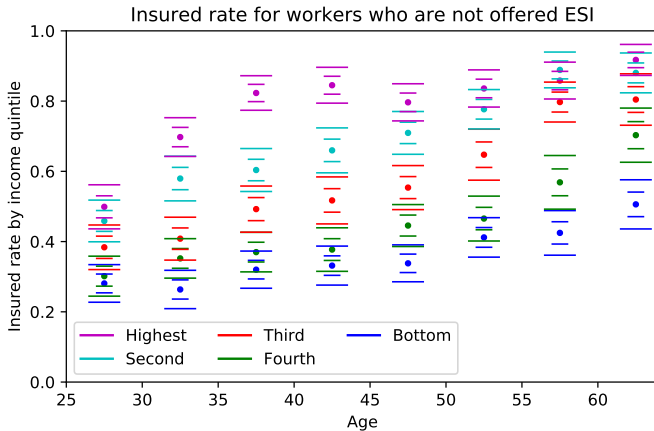
ESI Uptake Rate by Age



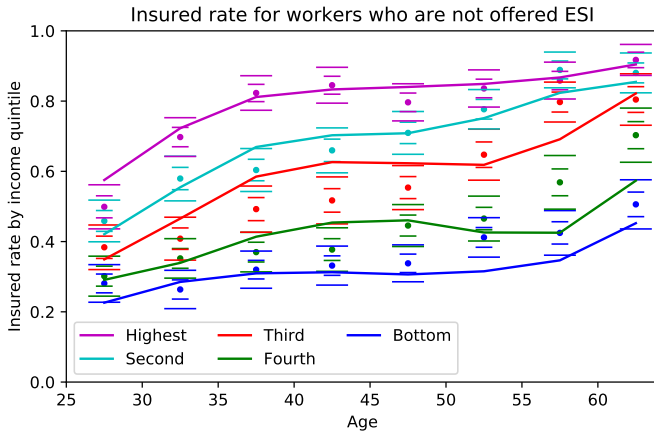
ESI Uptake Rate by Age



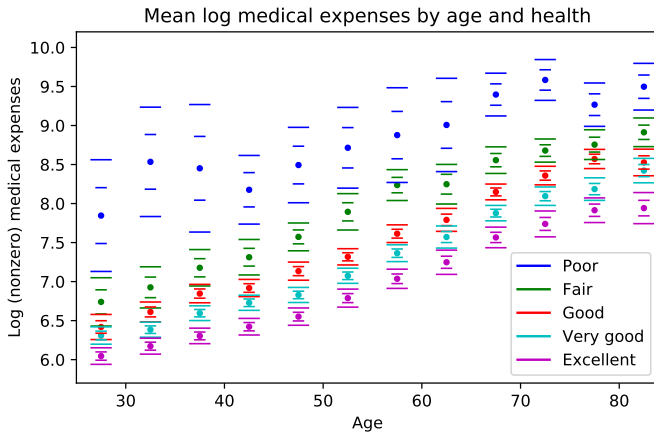
IMI Uptake Rate by Age & Income



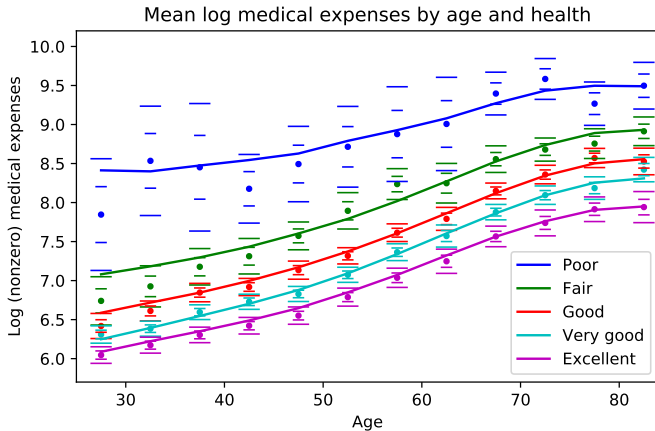
IMI Uptake Rate by Age & Income



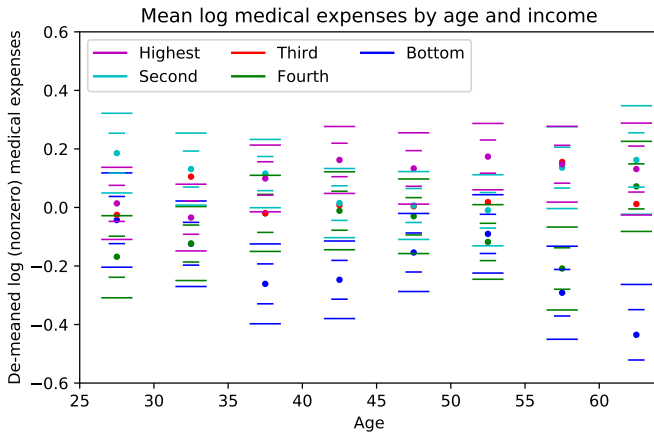
Medical Expenses by Age & Health



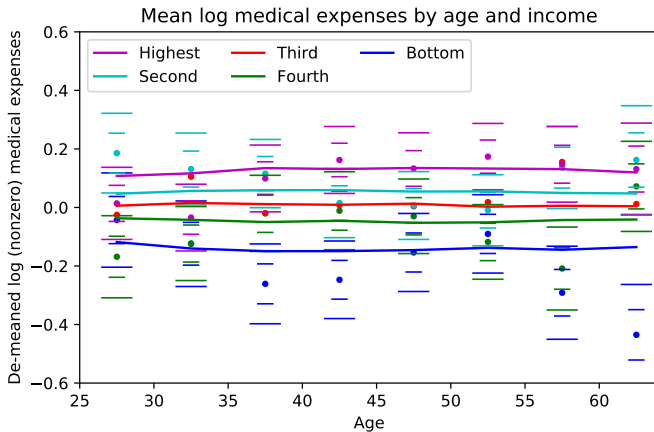
Mean Log Medical Expenses by Age & Health



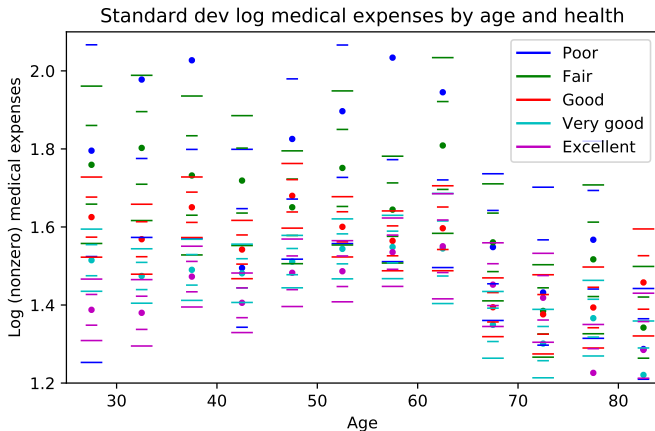
Mean Log Medical Expenses by Age & Income



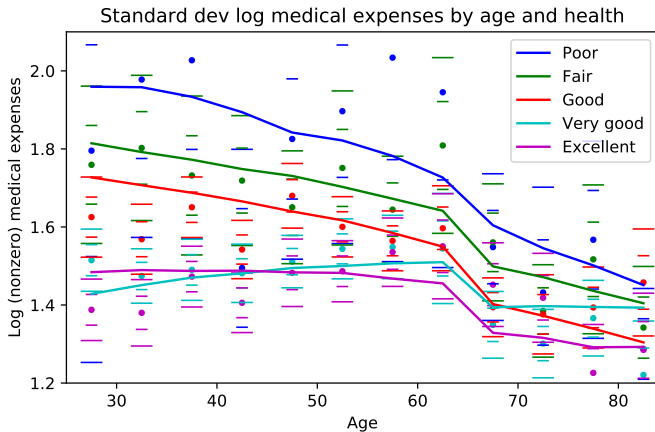
Mean Log Medical Expenses by Age & Income



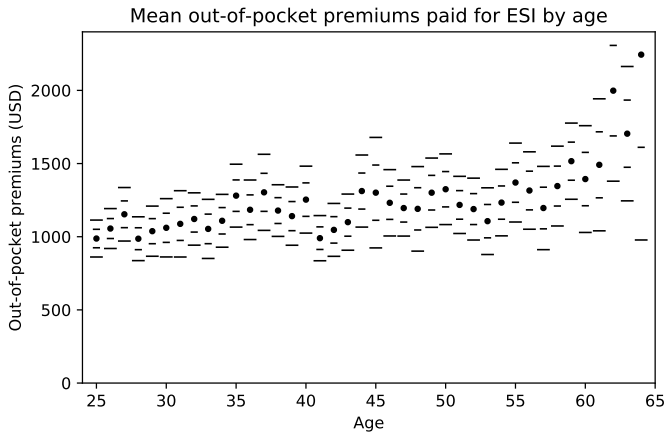
Standard Deviation of Medical Expenses by Age & Health



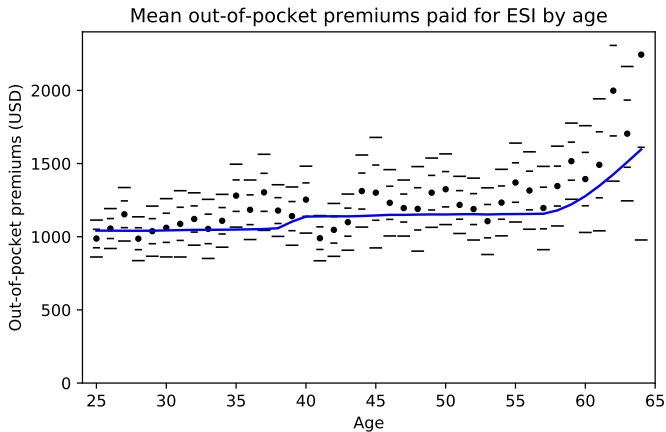
Standard Deviation of Medical Expenses by Age & Health



Out-of-Pocket ESI Premiums Age



Out-of-Pocket ESI Premiums Age



POLICY EXPERIMENTS

Counterfactual Goals

- Want to gauge welfare effects of modeled ACA reforms
- Who benefits from reform? By how much?
- Also consider other counterfactual outcomes
 - What happens to equilibrium premiums?
 - Who gains insurance coverage?
 - How does saving behavior change?
 - How much more medical care is purchased?

Counterfactual Procedure

For each counterfactual policy:

- 1 Solve baseline pre-reform market, store state distribution
- 2 Solve post-reform market (eqbm premiums & tax rate)
- 3 For each agent, find compensating variation w.r.t. permanent income
- 4 Calculate WTP as present value of change in lifetime income
- 5 Compute mean WTP by age, income, health, and ESI status

CV calculation

WTP calculation

Major ACA Individual Market Reforms

- Insurance exchanges: online marketplaces (by state)
- Insurance subsidies: 100% to 400% FPL, set to make benchmark plan cost a particular % of income
- Medicaid expansion: available for all up to 138% FPL
- Individual mandate: uninsured tax penalty of 2.5% income
- Community rating: can't price on sex, health, history
- Guaranteed issue: can't exclude on those either
- Limited age rating: 3:1 ratio of 64-to-24 y.o. premium
- Essential health benefits / actuarial standards for QHP
- 80% of premium revenue must be spent paying claims

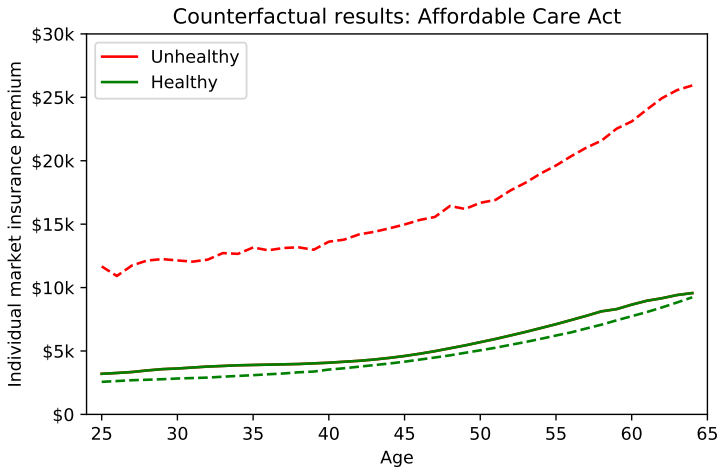
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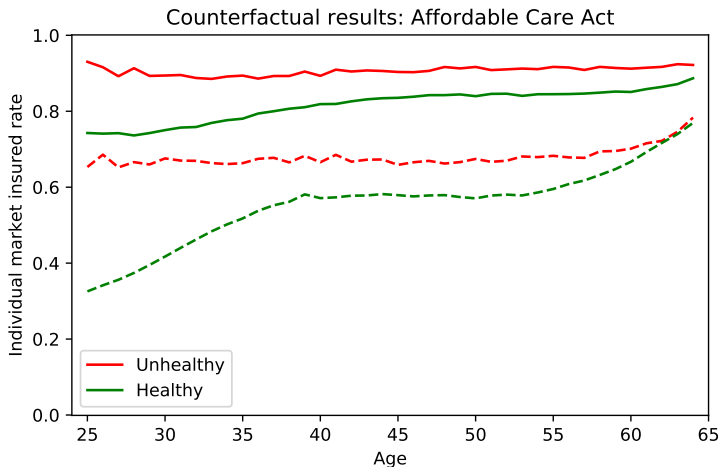
Implementing the ACA: Summary

- Counterfactual policy: four major components of the ACA
- Premiums slightly above pre-ACA levels for the healthy
- Mean WTP is \$21,881 (\$46,945 for ages 22-25)
- 78% of workers have positive WTP (98% for ages 22-25)
- WTP decreases over lifecycle as remaining periods to benefit dwindle **and** uncertainty is resolved

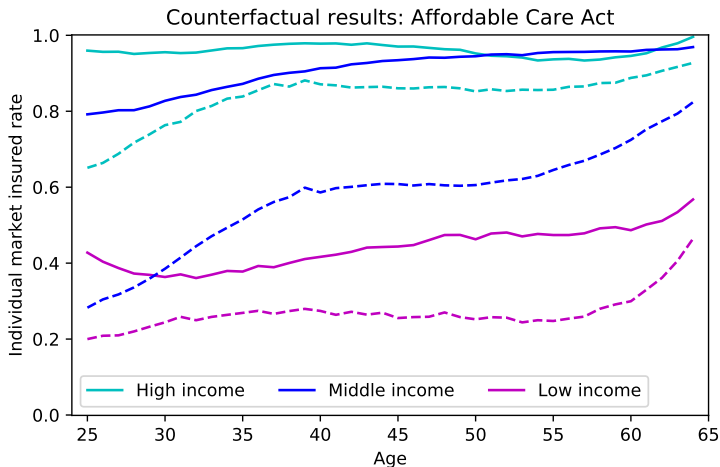
IMI Premiums Under the ACA



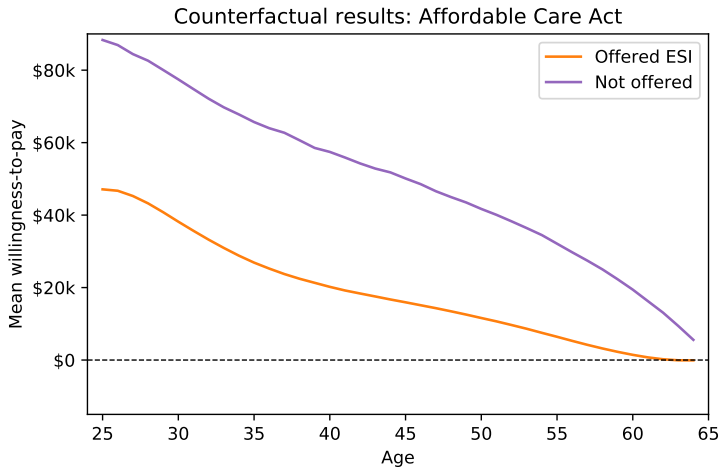
IMI Insured Rate by Health Status Under the ACA



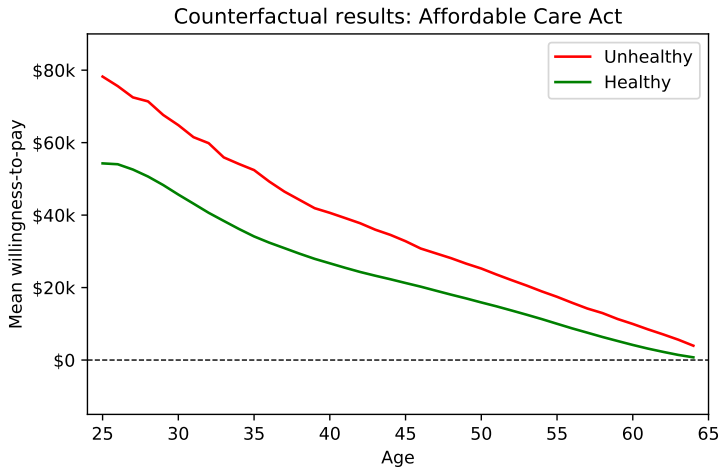
IMI Insured Rate by Income Under the ACA



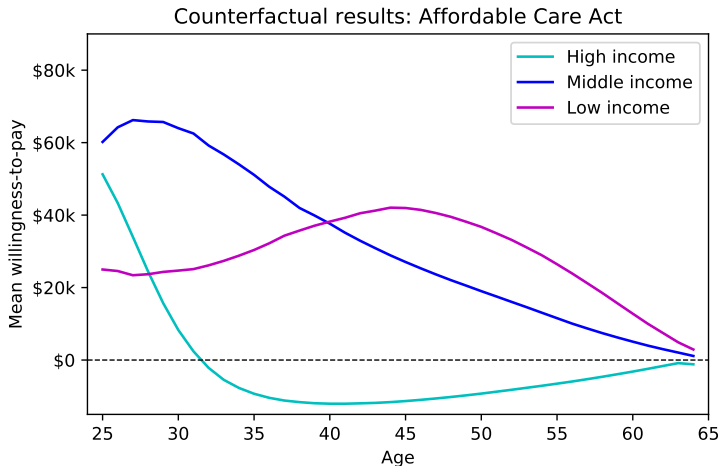
Mean WTP for the ACA by ESI Offer Status



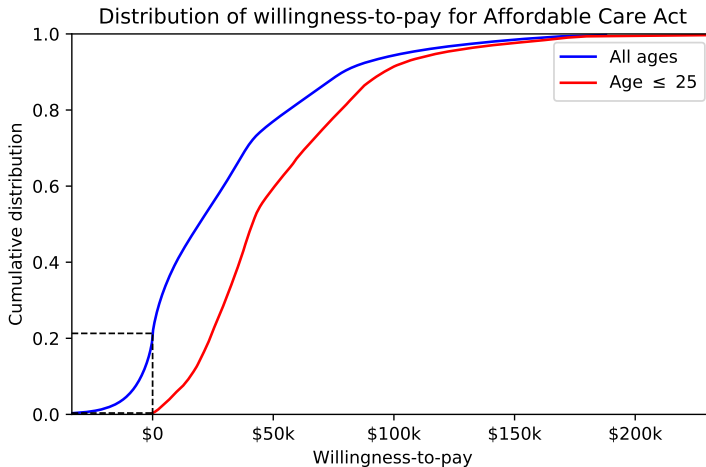
Mean WTP for the ACA by Health Status



Mean WTP for the ACA by Income



Distribution of WTP for the ACA



Characterizing the Sign of the ACA's Welfare Effect

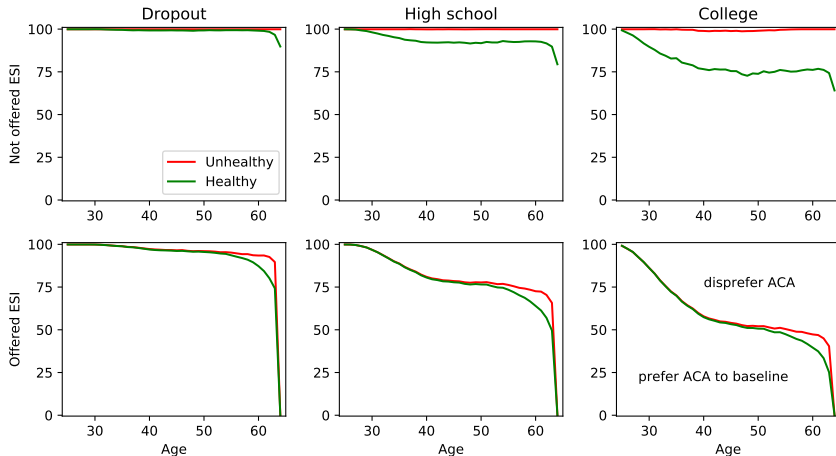
- Lower income people get more benefits from ACA
- Higher income people pay more for the ACA (flat τ)
- How rich must you be for costs to outweigh benefits?
- Hold fixed $e_i, j_{it}, h_{it}, o_{it}$, $E[b/Y \mid j_{it}] \equiv \bar{w}_j$
- Find “break even” \hat{Y}_{ejho} where WTP is exactly zero

$$\begin{aligned}
 & V_j^e \left(\underbrace{\hat{Y} \bar{w}_j}_{=b}, \hat{Y}, h, o \mid \text{pre-ACA baseline} \right) \\
 &= V_j^e \left(\hat{Y} \bar{w}_j, \hat{Y}, h, o \mid \text{counterfactual} \right).
 \end{aligned}$$

- Convert \hat{Y}_{ejho} to conditional percentile of permanent income

Characterizing the Sign of the ACA's Welfare Effect

Indifference to the ACA as a conditional permanent income percentile



Decomposing the ACA's Effects

- The (simulated) ACA has a lot of moving parts
- What drove the changes in premiums, welfare, and uptake?
- Decompose effects of the ACA one policy provision at a time
- Welfare effect dominated by insurance subsidies
- Subsidies drive IMI uptake for low- and mid-income
- Individual mandate relevant for young or high income
- Community rating very valuable for the unhealthy

Too many figures

Decomposing ACA Policy by Age Group

Group	Premium subsidies	Individual mandate	Community rating	Limited age rating	Whole ACA
All 22-64	\$28,544 (+5.6%)	−\$1,434 (+4.5%)	\$2,088 (−2.6%)	\$121 (−0.4%)	\$29,434 (+5.6%)
Ages 22-25	\$53,917 (+8.4%)	−\$6,715 (+9.6%)	\$4,911 (−2.8%)	\$785 (−1.3%)	\$51,647 (+7.6%)
Ages 25-34	\$47,004 (+7.6%)	−\$2,284 (+7.7%)	\$3,272 (−2.7%)	\$498 (−0.9%)	\$47,529 (+7.2%)
Ages 35-44	\$26,867 (+5.0%)	−\$351 (+3.8%)	\$1,621 (−3.3%)	\$220 (−0.2%)	\$28,951 (+5.3%)
Ages 45-54	\$15,917 (+4.4%)	−\$199 (+2.0%)	\$1,264 (−2.4%)	−\$536 (+0.2%)	\$17,539 (+4.8%)
Ages 55-64	\$5,232 (+3.6%)	−\$135 (+1.0%)	\$464 (−1.8%)	−\$117 (+0.2%)	\$5,941 (+3.8%)

Decomposing ACA Policy by Demographics

Group	Premium subsidies	Individual mandate	Community rating	Limited age rating	Whole ACA
Healthy	\$28,417 (+5.8%)	−\$1,426 (+4.9%)	\$1,411 (−3.2%)	\$76 (−0.4%)	\$29,078 (+5.6%)
Unhealthy	\$29,952 (+3.8%)	−\$1,522 (+0.3%)	\$9,543 (+4.0%)	\$624 (+0.2%)	\$33,361 (+5.4%)
High income	−\$2,452 (+0.8%)	\$2,523 (+1.3%)	−\$2,207 (−2.4%)	\$59 (−0.3%)	−\$750 (+1.0%)
Mid income	\$35,266 (+5.2%)	\$195 (+4.9%)	\$2,152 (−2.8%)	\$40 (−0.4%)	\$36,166 (+5.3%)
Low income	\$27,362 (+10.3%)	−\$7,391 (+4.0%)	\$4,798 (−2.4%)	\$124 (+0.0%)	\$29,129 (+10.1%)
Not offered	\$57,221 (+26.8%)	−\$6,764 (+21.8%)	\$3,813 (−12.8%)	\$422 (−1.4%)	\$56,821 (+28.2%)
Offered ESI	\$21,467 (+0.4%)	−\$120 (+0.2%)	\$1,662 (−0.1%)	\$47 (−0.1%)	\$22,692 (+0.0%)

Concluding Remarks

- Structural model of consumption, saving, medical care, and health insurance
- Estimated model fits empirical data rather well
- ACA improves welfare broadly, but not universally
- Further policy counterfactuals to explore:
 - Universal Medicaid expansion
 - Alternative ACA financing schemes
 - Changing policy parameters: increase eligibility cap?
- Model extensions and improvements:
 - More sophisticated income taxes
 - Endogenize extensive margin of medical care
 - Improved specification of health dynamics
 - Combine with work on health investment

THANK YOU!

(Stop scrolling, Matt)

(Stop scrolling, Matt)

(Stop scrolling, Matt)

Background: Pre-ACA Insurance Market

- Most private insurance plans are employer-sponsored (ESI)
- ESI **not** individually rated on health (HIPAA & ADA)
- ESI can be individually rated on age... but uncommon
- If no access to ESI, can buy individual market insurance (IMI)
- IMI was individually rated on anything: age, sex, health, etc
- Can exclude or deny coverage on same
- Significant underwriting and marketing costs
- Adverse selection significant (potential) problem
- Less robust than group plans: higher cost sharing, excluded services, annual and lifetime caps on benefits

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Literature & Contribution

- Definitely not the first paper to try to model the ACA
- “Macro health”: Hsu (2013); Paschenko & Porapakkarm (2013); Chivers, Feng, & Villamil (2017); Ferreira & Gomes (2017); Jung & Tran (2016); Zhao (2017), etc
- “Micro health”: Bundorf, Levin, & Mahoney (2012); Einav, Finkelstein, et al (2013); Hackmann, Kolstad, & Kowalski (2015); DeNardi, Pashchenko, & Porapakkarm (2018); Aizawa (2019); Aizawa & Fang (2020), etc
- This paper tries to find a happy medium of approaches to focus on question of welfare heterogeneity

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State Variables

Agent i 's personal circumstances at time t are characterized by...

- e_i education (dropout, high school, college)
- j_{it} age in years (22 to 120)
- h_{it} categorical health status (poor to excellent)
- o_{it} categorical ESI status (four states)
- Y_{it} permanent income or labor productivity
- b_{it} bank balances or cash on hand

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Control Variables

Agent i makes choices at time t about...

- c_{it} consumption [Budget set](#)
- m_{it} medical care [Medical needs](#)
- z_{it} medical insurance (none, IMI, ESI, Medicare) [Insurance choice](#)
- Choice of insurance is a **state variable** after being chosen

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Shock Variables

Agent i faces risk at time t from...

- ψ_{it} persistent shock to labor income Income process
- ξ_{it} transitory shock to labor income
- η_{it} medical need shock (≥ 0) Medical needs
- End-of-period mortality shock Mortality
- Transitions among categorical health states Health process
- Transitions among ESI offer status ESI process

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Utility and Preferences

$$u(c, m; \eta) = \frac{c^{1-\rho}}{1-\rho} + \frac{(m/\eta)^{1-\nu}}{1-\nu}, \quad \nu > 1.$$

- Future utility discounted by factor β per year
- CRRA preferences over consumption c and medical care m
- Both goods have price 1, but insurance reduces OOP med cost
- When $\eta = 0$, no medical care needed, second term zero
- When $\eta > 0$, purchase m to reduce utility penalty
- Higher ν makes medical care more of a necessity good

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Labor Income Dynamics

- Idiosyncratic permanent labor productivity is Y_{it} .
- When under 65, $\log(Y_{it})$ evolves as an AR(1):

$$Y_{it} = \exp(\kappa \log(Y_{it-1}) + \psi_{it}), \quad \psi_{it} \sim N(-\sigma_{\psi j}^2/2, \sigma_{\psi j}^2).$$
- Expected labor prod growth at age j and education e is Γ_j^e
- Expected labor productivity: $\lambda_j^e = \lambda_0^e \prod_{k=22}^j \Gamma_k^e$
- Actual labor income is $y_{it} = \lambda_j^e Y_{it} \xi_{it}$
- Transitory income shock $\xi_{it} \sim \mathcal{N}(-\sigma_{\xi j}^2/2, \sigma_{\xi j}^2)$, with point mass representing unemployment
- Retirement at age 65; no labor income dynamics thereafter
- SocSec income determined by approximation to AIME formula

ESI Offer Status Dynamics

Working age agents have ESI offer status o_{it} :

$$o_{it} \in \begin{cases} 1 : & \text{not offered ESI, can buy IMI} \\ 2 : & \text{offered ESI, but must pay entire premium} \\ 3 : & \text{offered ESI, pays some of the premium} \\ 4 : & \text{offered ESI, pays none of the premium} \end{cases}$$

- Exogenous transition in each working period
- Transitions in and out of $o_{it} = 1$ depend on age, income, educ
- Probabilities among $o_{it} = 2, 3, 4$ are constant, except age 60+
- Retired agents have no ESI offer status, get Medicaid

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Health Dynamics & Mortality

- Health status is discrete: five states (plus death)
- Exogenous transitions among health states (no investment)
- Markov(1) health process estimated from SRHS transitions
- 60-95 mortality estimated as probit on health & quartic in age
- < 60 and > 95 mortality calibrated to match SSA table
- Enter model at age 22, lifespan capped at 120 years

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Medical Need Shocks

- Medical need shock η_{it} drawn from dstn $f_{\eta}(\eta \mid j_{it}, h_{it})$
- Lognormal with point mass at zero
- Zero shock probabilities estimated as probit on MEPS data
- Mean (stdev) of underlying normal process is quartic (quadratic) in age with linear health interaction
- 24 medical need distribution parameters to estimate!

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Insurance Choice

- Insurance contract z_{it} chosen from menu Z_{it}
- z_{it} transforms medical care m_{it} into OOP spending
- z_{it} defined by premium, coinsurance, deductible: (p, k, d)
$$OOP_{it} = \min(m_{it}, km_{it} + (1 - k)d) \equiv z_{it}(m_{it}).$$
- Being uninsured represented by “null contract” $z_0 = (0, 1, 0)$
- ESI contract has \$400 deductible and 8% coinsurance rate
- ESI premium p_E depends on o_{it} , but not j_{it} nor h_{it}
- IMI policies z_I have \$1000 deductible and 8% coinsurance rate
- IMI premium p_I can depend on age and health status

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Insurance Choice

Menu of insurance contracts Z_{it} given by:

$$Z_{it} = \begin{cases} \{z_0, z_I\} & \text{if } j_{it} < 65 \text{ \& } o_{it} = 1 \\ \{z_0, z_I, z_E \equiv (p_E - 0, 0.08, \$400)\} & \text{if } j_{it} < 65 \text{ \& } o_{it} = 2 \\ \{z_0, z_I, z_C \equiv (p_E - s, 0.08, \$400)\} & \text{if } j_{it} < 65 \text{ \& } o_{it} = 3 . \\ \{z_0, z_I, z_F \equiv (p_E - p_E, 0.08, \$400)\} & \text{if } j_{it} < 65 \text{ \& } o_{it} = 4 \\ \{z_M\} & \text{if } j_{it} \geq 65 \end{cases}$$

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Household Budget

Household budget dynamics given by:

$$b_{it} = Ra_{it-1} + y_{it},$$

$$b'_{it} = b_{it} - p_{it},$$

$$a_{it} = b'_{it} - c_{it} - z_{it}(m_{it}) \geq 0.$$

- Agent carries assets a_{it-1} into period t from $t - 1$
- Has risk free interest factor R on assets, labor income y_{it}
- Choice of insurance determines premium paid p_{it} , leaving b'_{it}
- Agent learns medical need shock η_{it} after buying insurance
- Insurance contract z_{it} determines OOP medical spending
- Hard liquidity constraint at zero assets

Consumption Floor & Welfare

- Medical need shocks η_{it} unbounded above, but resources finite
- Massive utility risk when $m_{it} \ll \eta_{it}$, as $u(c_{it}, m_{it}; \eta_{it}) \rightarrow -\infty$
- Government implements consumption floor \underline{c} as social welfare
- After learning η_{it} , agent may accept alternate outcome:

$$a_{it} = 0, \quad c_{it} = \underline{c}, \quad m_{it} = k^{-1/\nu} \eta_{it}^{1-1/\nu} \underline{c}^{\rho/\nu}.$$

- Medical care at consumption floor determined by FOC if the agent had chosen $c_{it} = \underline{c}$ on their own
- Cost of consumption floor bundle remaining after a_{it} used is funded by government as “welfare” (Medicaid, etc)

[Back to choices](#)

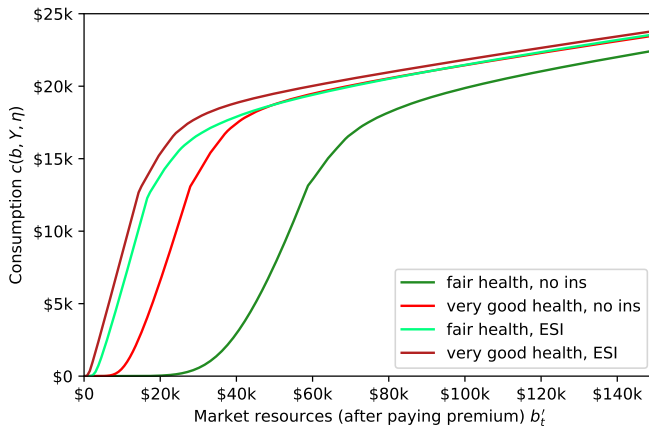
[Back to control variables](#)

Nested Solution Method

- Optimal behavior depends on future premiums when older...
- ...but premiums depend on expected medical benefits...
- ...which are a choice variable that depend on agent's state...
- ...which is the result of past behavior!
- Solving for equilibrium premiums requires fixed point loop:
 - 1 Guess premiums for all insurance pools
 - 2 Solve agent's model by backward induction
 - 3 Simulate model, determine who buys each contract
 - 4 Update premiums: ex post correct premium
 - 5 Check for convergence, else go to step (2)
- Need to do this for every structural parameter guess!

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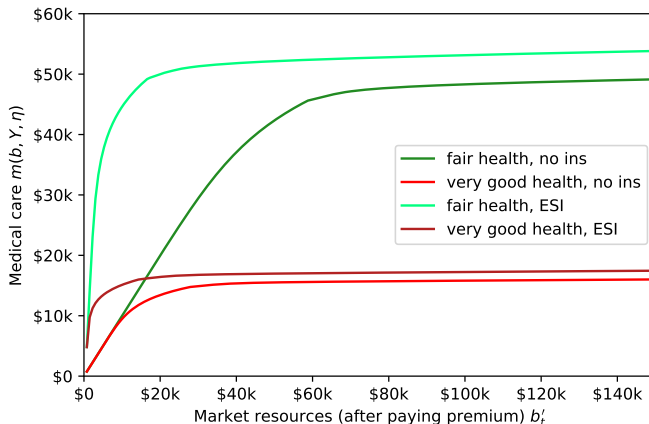
Example Consumption Functions



(45 y.o. HS-educated man, \$30k perm inc, η_{it} 2 s.d. above mean)

[Back to agent's solution](#)

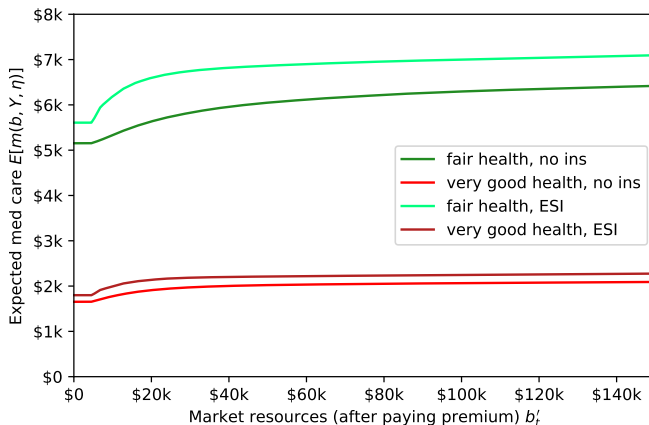
Example Medical Care Functions



(45 y.o. HS-educated man, \$30k perm inc, η_{it} 2 s.d. above mean)

[Back to agent's solution](#)

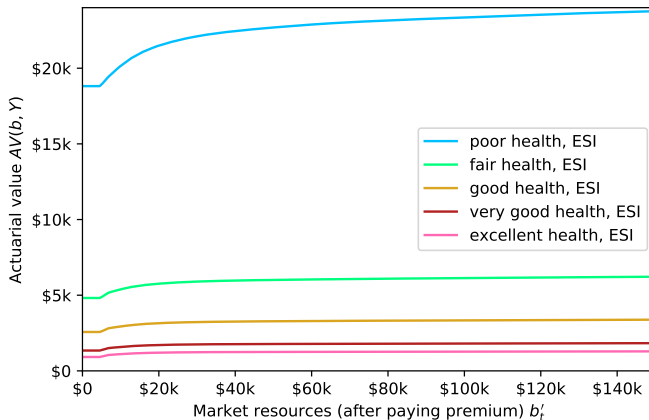
Example Expected Medical Care Functions



(45 y.o. HS-educated man, \$30k perm inc)

[Back to agent's solution](#)

Example Actuarial Value Functions



(45 y.o. HS-educated man, \$30k perm inc)

[Back to agent's solution](#)

Equilibrium Tax Rate

- Medicare and consumption floor are government spending
- Counterfactual policies offer subsidies and collect taxes
- Need budget neutral policy to model welfare redistribution
- Tax revenue received must equal government medical spending
- Flat “medical tax rate” τ found in outer loop with premiums
- Later: implement more sophisticated income tax scheme

[Back to solution](#)

MEPS Data for Estimation

- Categorical health: excellent, very good, good, fair, poor
- Whether died since last wave
- Total medical expenses *and* decomposition by payer
- Whether offered ESI
- Whether purchased ESI or IMI (or uninsured)
- Out-of-pocket insurance premiums
- Whether employer made *any* contribution to ESI
- Household's labor income
- Respondent's education level: dropout, HS, college

[Back to MEPS](#)

Other Data Sources for Estimation

- MEPS has poor data on wealth of respondents
- Use wealth & income data from Survey of Consumer Finance (2007, 2010, 2013 waves)
- Education-conditional age profiles of expected permanent income growth factors from Cagetti (2003)
- Age profiles of permanent and transitory income shock variance from Sabelhaus and Song (2010)
- Social Security Administration mortality table
- Health and Retirement Study: mortality probit by age-health

[Back to MEPS](#)

Identification Overview

Param(s)	Identifying data features
β	Slope of mean wealth-income ratio by age
ρ	Level of ESI and IMI uptake rate
ν	Variation by income in mean log OOP medical costs
\underline{c}	Variation by income quintile in IMI uptake rate
s	Mean out-of-pocket premiums for ESI
γ_0^h	Variation by health in level of mean log total medical costs
γ_1^h	Variation by health in age-slope of mean log total medical costs
$\gamma_2, \gamma_3, \gamma_4$	Non-linear shape of mean log total medical costs by age
δ_0^h	Variation by health in level of stdev log total medical costs
δ_1^h	Variation by health in age-slope of stdev log total medical costs
δ_2	Curvature of stdev log total medical costs by age

[More identification details](#)

[Back to estimation](#)

Identification of Preferences

- This model has intra- *and* inter-temporal risk management
- Lifecycle planning: wealth accumulation driven by β
- Insurance is *actuarially unfair*, but risk averse agents buy it
- ESI and IMI uptake rates identify risk aversion ρ
- Higher ν makes medical care more of a necessity good
- ρ/ν identified by income gradient in medical care

[Back to identification](#)

Identification of Preferences

ρ/ν identified by income gradient in medical care:

$$\text{FOC: } m_{it} = \eta_{it}^{1-1/\nu} k_{it}^{-1/\nu} c_{it}^{\rho/\nu} \implies$$

$$\log m_{it} = \left(1 - \frac{1}{\nu}\right) \log \eta_{it} - \frac{1}{\nu} \log k_{it} + \frac{\rho}{\nu} \log c_{it} \implies$$

$$E[\log m_{it}] = \left(1 - \frac{1}{\nu}\right) E[\log \eta_{it}] - \frac{1}{\nu} E[\log k_{it}] + \frac{\rho}{\nu} \log E[\log c_{it}] \implies$$

$$\frac{d E[\log m_{it}]}{d \log Y_{it}} = \left(1 - \frac{1}{\nu}\right) \underbrace{\frac{d E[\log \eta_{it}]}{d \log Y_{it}}}_{\approx 0} - \frac{1}{\nu} \underbrace{\frac{d E[\log k_{it}]}{d \log Y_{it}}}_{\approx 0} + \frac{\rho}{\nu} \underbrace{\frac{d E[\log c_{it}]}{d \log Y_{it}}}_{\approx 1} \approx \frac{\rho}{\nu}.$$

[Back to identification](#)

Identification of Money Parameters

- Consumption floor \underline{c} provides catastrophic insurance
- More likely to bind for low income than high income agents
- Acts as a substitute for private insurance
- Level of \underline{c} identified by income gradient in IMI uptake
- Level of ESI premiums pinned down by actuarial assumptions, matching ESI uptake rate by age, matching medical care dstn
- Fraction of agents who pay some/none/all is calibrated
- Employer contribution s identified by OOP ESI premiums

[Back to identification](#)

Estimated Parameters for Mean Medical Needs

	Est	Std Err	Description
γ_0^E	-3.587	(0.036)	Excellent health constant for mean log med shock
γ_0^V	-3.418	(0.035)	Very good health constant for mean log medical need shock
γ_0^G	-3.058	(0.039)	Good health constant for mean log medical need shock
γ_0^F	-2.537	(0.064)	Fair health constant for mean log medical need shock
γ_0^P	-1.086	(0.078)	Poor health constant for mean log medical need shock
γ_1^E	3.42e-2	(0.11e-2)	Excellent health linear coefficient on age for mean log m
γ_1^V	3.79e-2	(0.10e-2)	Very good health linear age coefficient for mean log me
γ_1^G	3.63e-2	(0.10e-2)	Good health linear age coefficient for mean log med sho
γ_1^F	3.44e-2	(0.14e-2)	Fair health linear age coefficient for mean log med shock
γ_1^P	2.01e-2	(0.18e-2)	Poor health linear age coefficient for mean log med sho
γ_2	-1.53e-3	(0.04e-3)	Quadratic coefficient on age for mean log medical need
γ_3	6.04e-5	(0.16e-5)	Cubic coefficient on age for mean log medical need sho
γ_4	-5.89e-7	(0.19e-7)	Quartic coefficient on age for mean log medical need sh

[Back to parameter estimates](#)

Estimated Parameters for Stdev Medical Needs

	Est	Std Err	Description
δ_0^E	0.409	(0.009)	Excellent health constant for stdev log med shock
δ_0^V	0.362	(0.010)	Very good health constant for stdev log medical need shock
δ_0^G	0.575	(0.014)	Good health constant for stdev log medical need shock
δ_0^F	0.626	(0.028)	Fair health constant for stdev log medical need shock
δ_0^P	0.733	(0.036)	Poor health constant for stdev log medical need shock
δ_1^E	7.07e-4	(3.94e-4)	Excellent health linear coefficient on age for stdev log med
δ_1^V	2.81e-3	(0.39e-3)	Very good health linear age coefficient for stdev log med
δ_1^G	-1.80e-3	(0.56e-3)	Good health linear age coefficient for stdev log med shock
δ_1^F	-1.51e-3	(0.80e-3)	Fair health linear age coefficient for stdev log med shock
δ_1^P	-2.67e-3	(0.74e-3)	Poor health linear age coefficient for stdev log med shock
δ_2	-2.59e-5	(0.65e-5)	Quadratic coefficient on age for stdev log medical need

[Back to parameter estimates](#)

Compensating Variation in Permanent Income

- Simulated agent i has age j_{it} and education e_i
- State is $(b_{it}, Y_{it}, h_{it}, o_{it}) \equiv (\text{money, perm inc, health, offer})$
- Value function is $V_j^e(\text{state} \mid \text{circumstance})$
- Want alternate \tilde{Y}_{it} s.t. agent is indifferent to policy change:

$$\begin{aligned} & V_j^e \left(b_{it}, Y_{it}, h_{it}, o_{it} \mid \text{pre-ACA baseline} \right) \\ &= V_j^e \left(b_{it}, \tilde{Y}_{it}, h_{it}, o_{it} \mid \text{counterfactual} \right). \end{aligned}$$

- That's just a univariate search for each agent!

[Back to counterfactual basics](#)

Willingness-to-Pay Calculation

- For each simulated agent, have j_{it} , e_i , h_{it} , Y_{it} , and \tilde{Y}_{it}
- Calc present value of expected lifetime income for Y_{it} & \tilde{Y}_{it}
- Willingness-to-pay is their difference: amount of lifetime income agent would *give up* to attain counterfactual policy

$$WTP_{it} \equiv E_t \left[\sum_{s=j} R^{j-s} (1 - d_{is}) y_{is} \mid Y_{it}, e_i, j_{it}, h_{it} \right] \\ - E_t \left[\sum_{s=j} R^{j-s} (1 - d_{is}) y_{is} \mid \tilde{Y}_{it}, e_i, j_{it}, h_{it} \right].$$

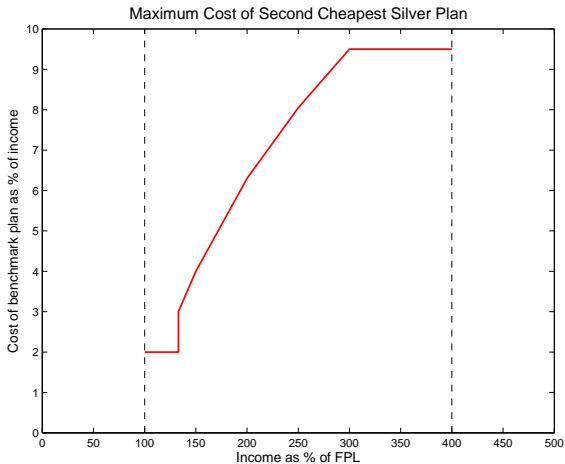
[Back to counterfactual basics](#)

Private Insurance Subsidies

- Formally: advance premium tax credits (APTC)
- Eligibility: income 100-400% of FPL, not offered ESI
- Subsidy set to make “benchmark plan” have OOP premium of a specified percentage of income (depending on income/FPL)
- Real world: several insurers competing, multiple “metal tiers”
- Real world: benchmark is second cheapest “silver” plan
- Model: only one IMI plan, and it’s the benchmark

[Back to reform policies](#)

APTC Subsidy Calculation



Individual Mandate Tax Penalty

- ACA as written imposes 2.5% income tax penalty if uninsured
- Minimum penalty is \$695, maximum is lowest “bronze” prem
- Zeroed out by Tax Cuts & Jobs Act, starting in 2019
- Still worth looking at: what does the model say it does?
- Various exemptions from individual mandate:
 - Offered qualifying affordable ESI
 - Don’t have to file income taxes
 - No plan has OOP cost of less than 9% of income
 - Various other: grandfathered, Indigenous Americans
- Model: state-dependent increase in price of null contract z_0

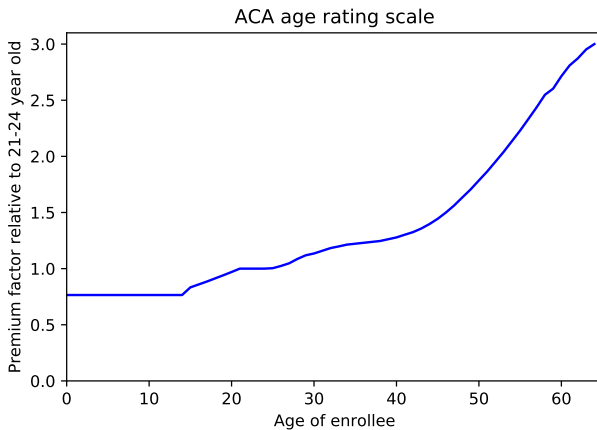
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Community Health Rating & Limited Age Rating

- Pre-ACA: IMI premiums can depend on age, sex, health, etc
- Community rating: single insurance pool per “rating area”
- Can charge up to 30% for tobacco-users
- Model: No split insurance pools by health status
- Limited age rating: statutory schedule for premium age profile, relative to premium for 21 to 24 year olds
- Ratio of 64 year old to 24 year old premium set at 3:1
- Model: One insurance pool for all ages, find **one** IMI premium

[Back to reform policies](#)

Limited Age Rating



Decomposing the ACA

- Add APTC subsidies to pre-ACA baseline [Add APTC subsidies](#)
- Remove APTC subsidies from the ACA [Remove APTC subsidies](#)
- Add individual mandate to pre-ACA baseline [Add individual mandate](#)
- Remove individual mandate from the ACA [Remove individual mandate](#)
- Add community rating to pre-ACA baseline [Add community rating](#)
- Remove community rating from the ACA [Remove community rating](#)
- Add limited age rating to pre-ACA baseline [Add limited age rating](#)
- Remove limited age rating from the ACA [Remove limited age rating](#)

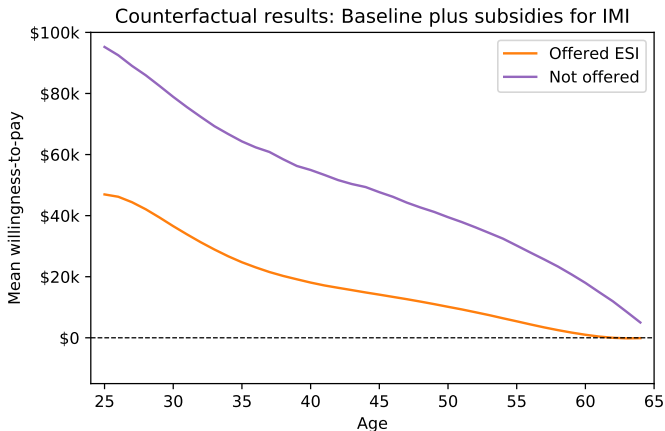
[Back to decomposition](#)

Decomposition: Adding Insurance Subsidies

- Subsidies greatly reduce OOP cost of IMI premiums even if full premium remains high (for unhealthy)
- But funds needs to be raised through higher taxes
- Mean WTP closely tracks with overall ACA
- Welfare effects of the ACA are dominated by APTC
- IMI uptake change similar to overall ACA **except** for high income, who are ineligible (above 400% FPL)

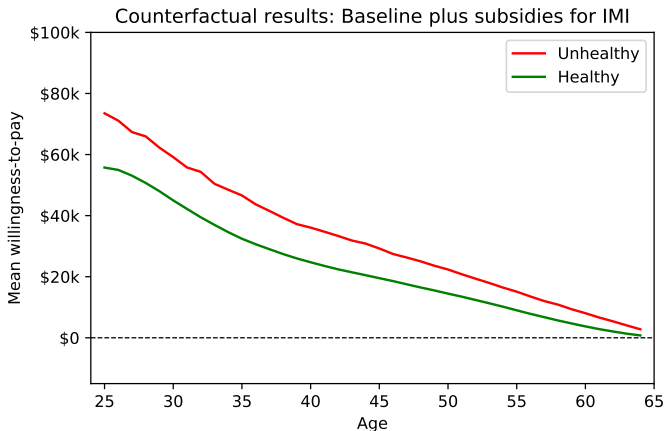
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Mean WTP for APTC by ESI Offer Status



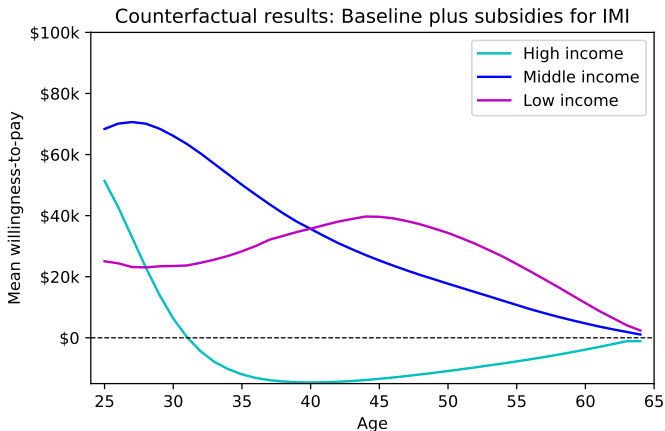
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Mean WTP for APTC by Health Status



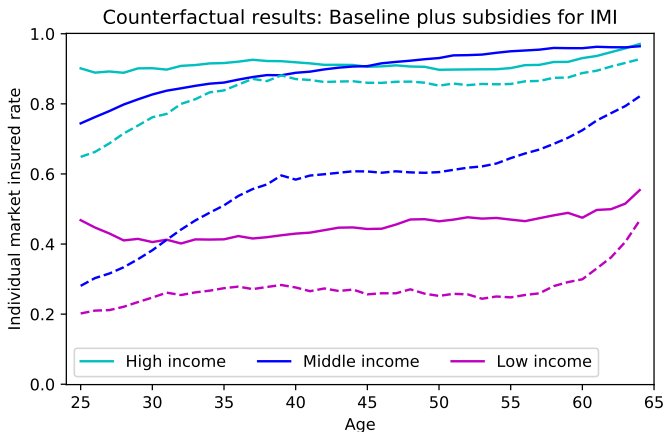
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Mean WTP for APTC by Income



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IMI Insured Rate by Income with APTC



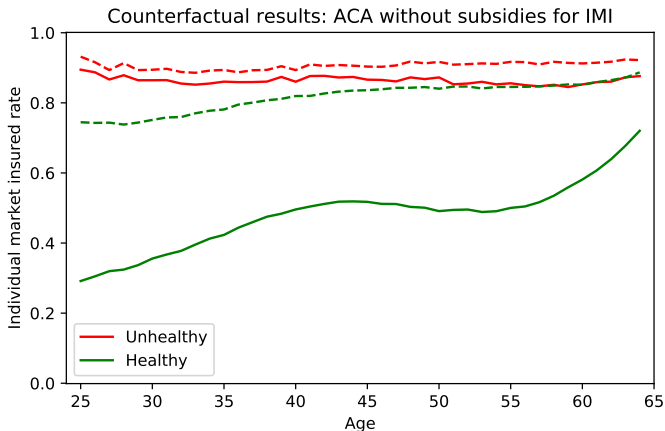
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Decomposition: Removing Insurance Subsidies

- What if we stopped offering APTC subsidies for IMI plans?
- Many healthy workers unwilling to pay full premium, drop coverage
- Some only retain IMI because of the individual mandate
- Few unhealthy workers drop coverage: still relatively cheap!
- Model predicts IMI premiums would increase by 26.5%
- Large welfare losses for most groups (asymmetric due to IM)

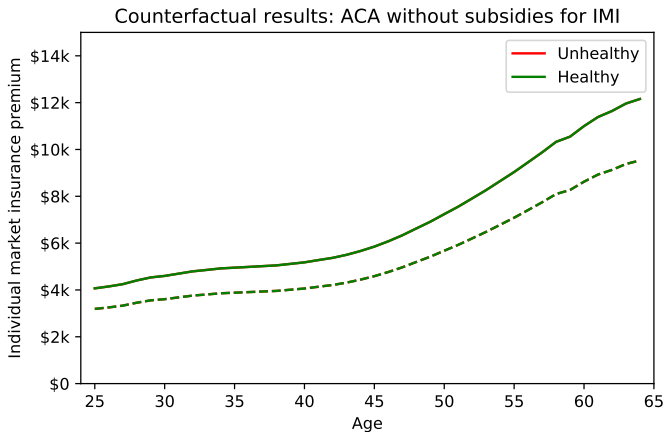
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IMI Insured Rate When Dropping APTC Subsidies



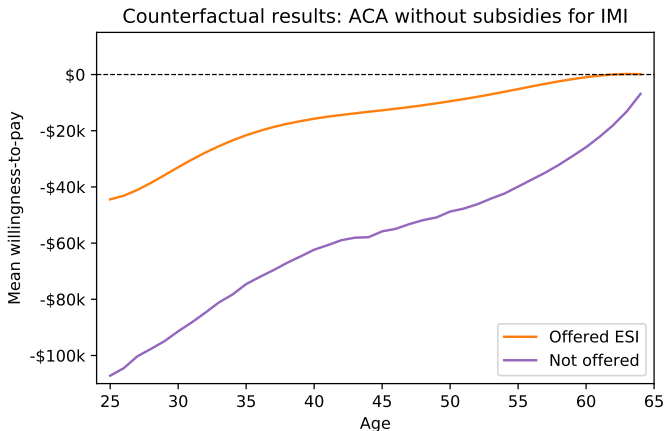
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IMI Premiums When Dropping APTC Subsidies



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Mean WTP to Drop APTC by ESI Offer Status



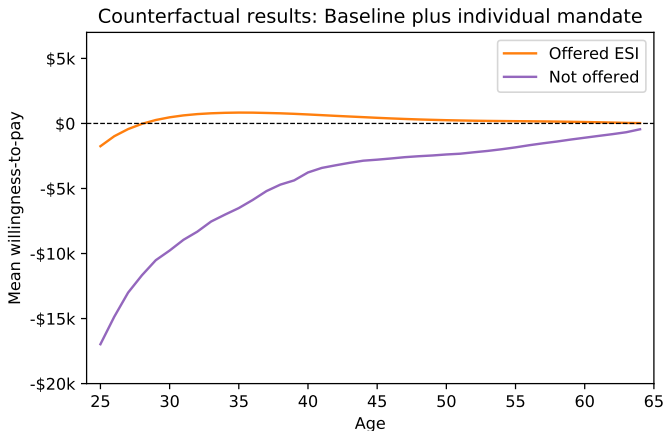
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Decomposition: Adding Individual Mandate

- Individual mandate is new source of revenue, reduces τ
- This is good if you anticipate **never** paying penalty
- Who anticipates being subject to individual mandate? Low and middle income people without access to ESI
- Who never pays the penalty? High income people with ESI
- People **hurt** by mandate were already in “bad states”
- The individual mandate is a regressive policy
- Strong motivator for young and/or high income to buy IMI

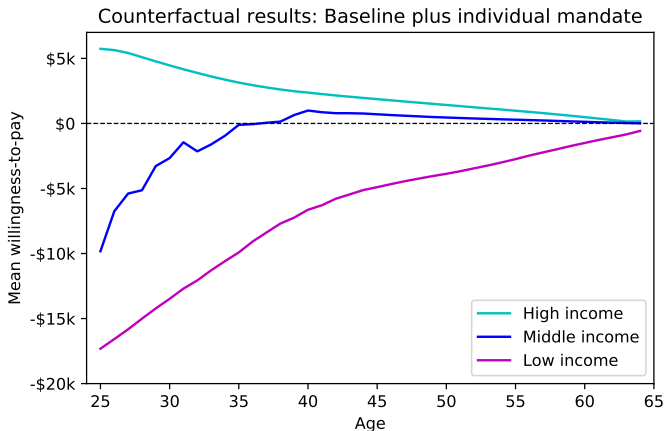
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Mean WTP for Individual Mandate by ESI Offer Status



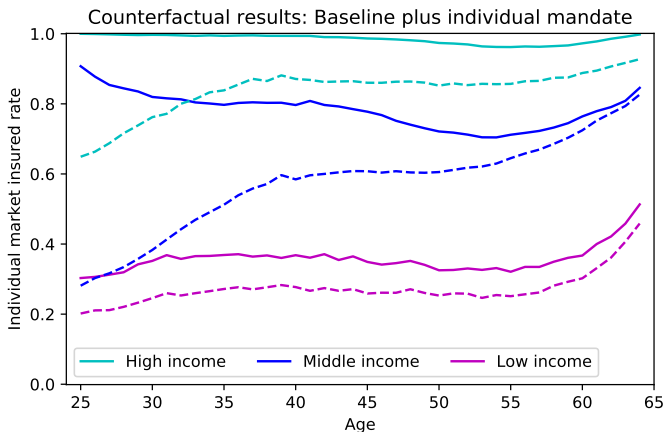
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Mean WTP for Individual Mandate by Income



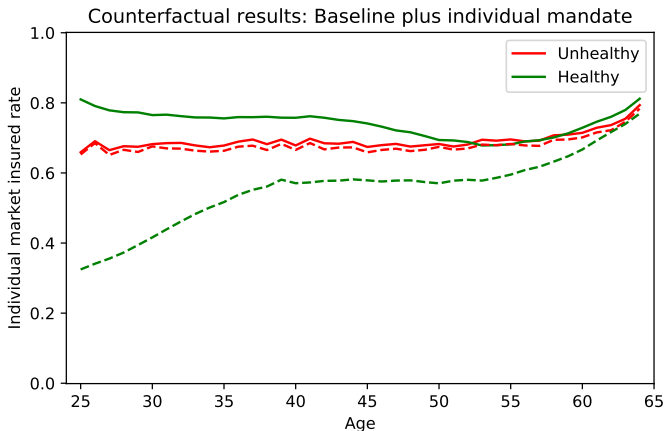
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IMI Insured Rate by Income with Individual Mandate



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IMI Insured Rate by Health with Individual Mandate



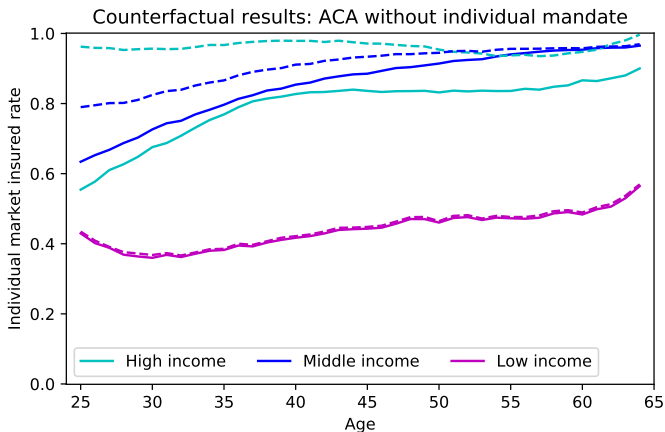
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Decomposition: Removing the Individual Mandate

- Individual mandate was repealed in late 2017, effective 2019
- What does the model say will happen?
- High income, healthy people withdraw from IMI market
- IMI premiums increase by about 4%
- Reality: individual mandate repeal increased premiums $\sim 8\%$
- Only 22% of workers have positive WTP (62% for 22-25)

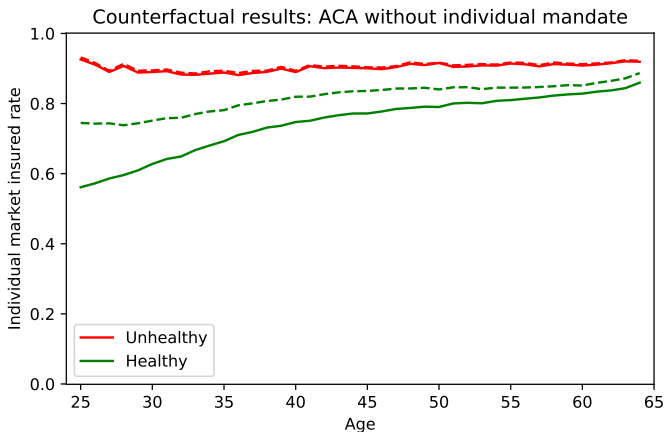
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IMI Insured Rate by Income When Dropping Individual Mandate



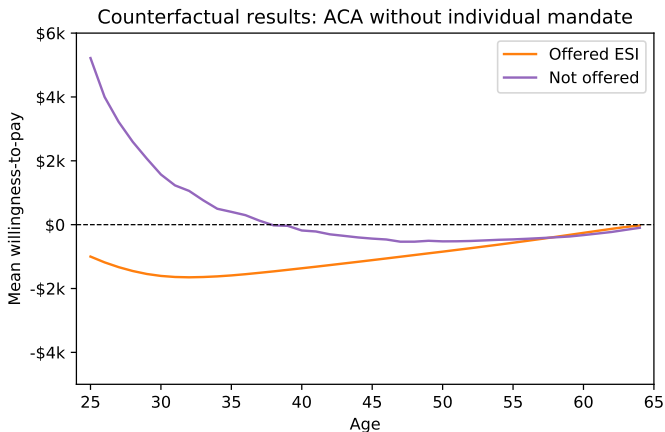
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IMI Insured Rate by Health When Dropping Individual Mandate



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Mean WTP to Drop Individual Mandate by ESI Offer Status



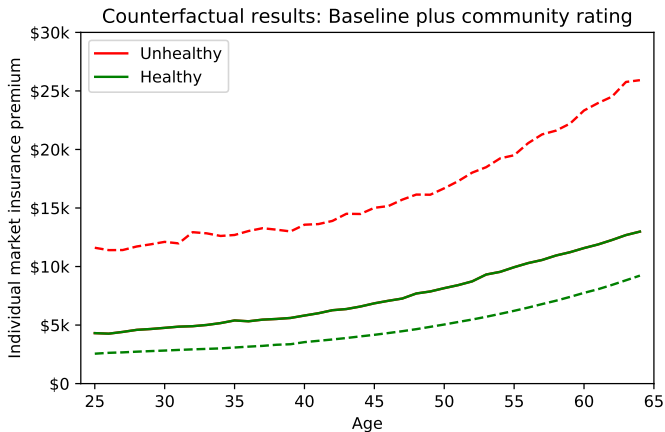
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Decomposition: Adding Community Rating

- Combine healthy and unhealthy in one pool (by age)
- Fix who buys IMI; premium would be health-weighted avg
- Premium **decreases** for unhealthy and **increases** for healthy
- More unhealthy would want IMI, fewer healthy want IMI
- Equilibrium premium is greater than health-weighted avg
- Large welfare gain for unhealthy, small loss for healthy
- But there are many more healthy than unhealthy!

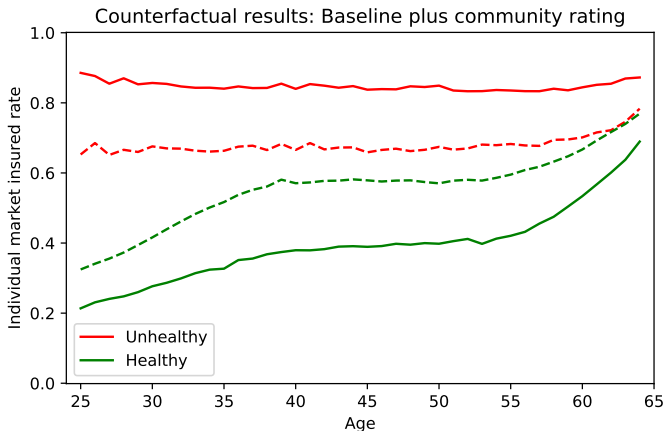
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IMI Premiums Under Community Rating



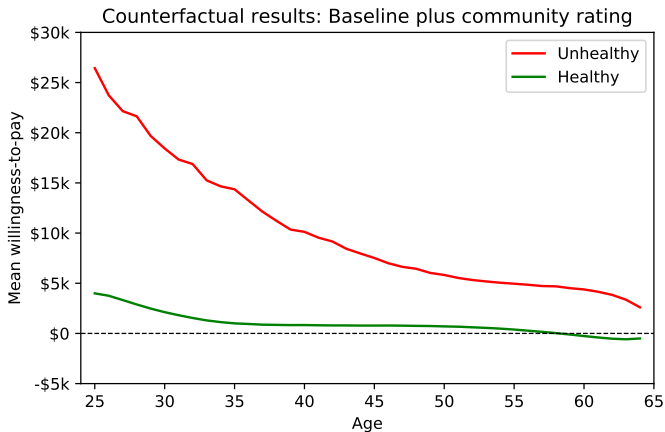
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IMI Insured Rate by Health with Community Rating



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Mean WTP for Community Rating by Health



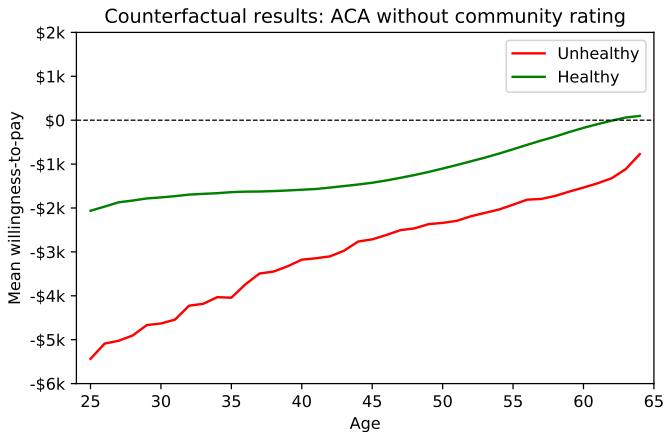
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Decomposition: Removing Community Rating

- Community health rating **in isolation** hurts about 67% agents
- What about in conjunction with other ACA provisions?
- 92% of workers would pay to **keep** community rating
- Losing community rating risks exposure to very high premiums if you lose ESI while unhealthy but high income
- Even healthy people have positive WTP on average

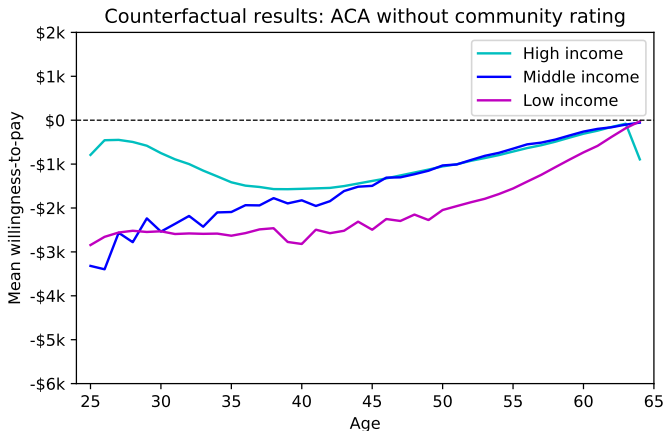
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Mean WTP to Drop Community Rating by Health



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Mean WTP to Drop Community Rating by Income



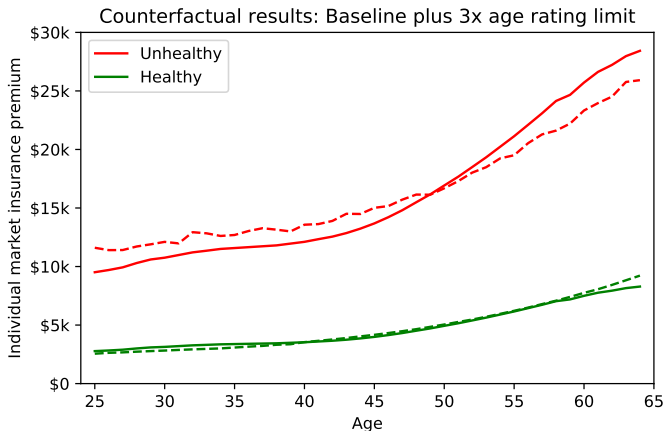
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Decomposition: Adding Limited Age Rating

- What if the 3:1 ratio of 64 to 24 y.o. premiums were implemented on its own?
- Not much! 3:1 is close to “right” ratio **within** each health group
- Shape of statutory premium profile also pretty close
- Result: premiums shift slightly at all ages, small change in insured rate
- Small welfare effects, non-monotonic in age

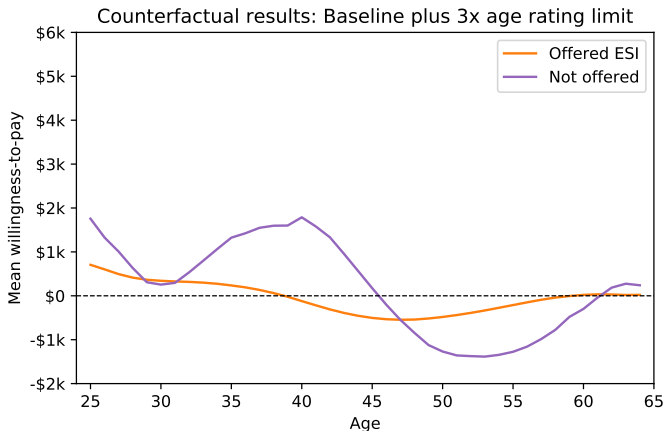
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IMI Premiums When Adding Limited Age Rating



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Mean WTP When Adding Limited Age Rating by ESI Offer



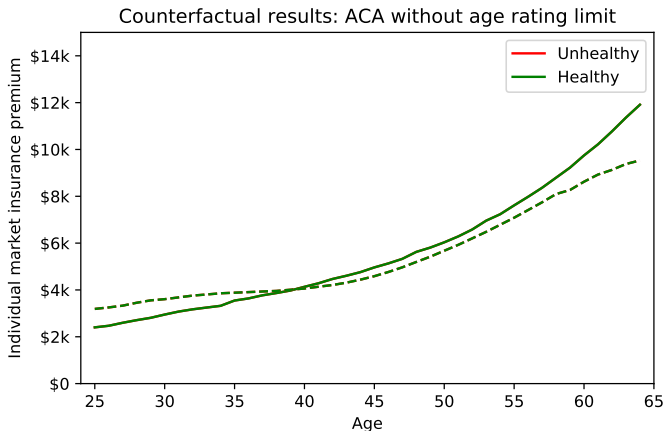
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Decomposition: Removing Limited Age Rating

- Limited age rating **in isolation** has very limited effect
- Small, non-monotone changes to premiums, uptake, welfare
- Effects of **eliminating** limited age rating more interesting
- Ratio of 64- to 24-year-old premium goes from 3 to ~ 5.5
- Would benefit young people by about \$900 on average...
- ...but 94% of all workers have negative WTP for it

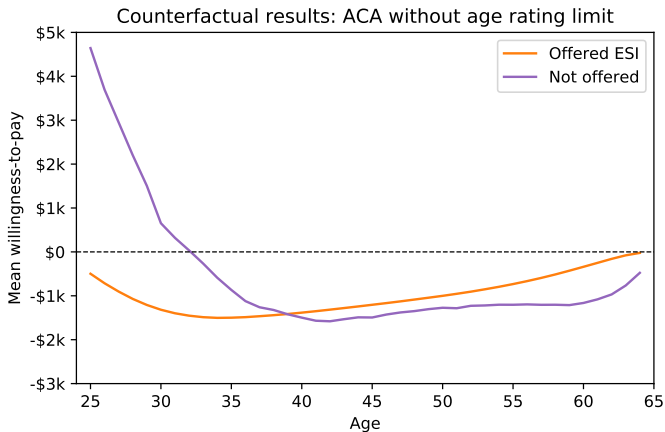
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IMI Premiums When Dropping Limited Age Rating



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Mean WTP to Drop Limited Age Rating by ESI Offer



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