Is There ‘Too Much’ Inequality in Health Spending Across Income Groups?

Laurence Ales\textsuperscript{1} \quad Roozbeh Hosseini\textsuperscript{2} \quad Larry E. Jones\textsuperscript{3}

\textsuperscript{1}Carnegie Mellon University
\textsuperscript{2}Arizona State University
\textsuperscript{3}University of Minnesota

QSPS 2012 Summer Workshop
Health Care Spending in the U.S.

- Aggregate health care spending: large and growing (NIPA)
  - 16.5% of GDP in 2010
Health Care Spending in the U.S.

- Aggregate health care spending: large and growing (NIPA)
  - 16.5% of GDP in 2010

- Health care spending in the U.S. is unequal (MEPS)
  - Large variations by age and income
Our Questions
‘Too much’ inequality in health spending across income groups?

1. What is the ‘Ex Ante Efficient’ amount of inequality across income groups?

2. How far is the inequality across income groups in the U.S. data from ‘Ex Ante Efficient’?

3. How far is the inequality across income groups in the U.S. data from ‘Laissez Faire’?
What We Do?

• Use a framework similar to Hall and Jones (2007)
  ○ Health care spending improves survival rate
  ○ Being alive is valued

• Depart from Hall and Jones (2007) only by assuming
  ○ Individuals are heterogeneous in their productivity
  ○ Endogenous labor supply

• Look at – full info – ex ante efficient allocation
What We Find?
Preview of qualitative findings

Under full information, efficiency implies that:

- Before retirement:
  - More productive types receive more health care
  - Health care is more unequal than consumption

- After retirement:
  - All types receive same health care (Medicare?)
What We Find?
How far is data from ex ante efficient?

1. For ages 25 to 35
   ○ Inequality in ex ante efficient allocation and U.S. data are roughly equal

2. For ages 55 and above
   ○ Inequality in ex ante efficient allocation is less than U.S. data
What We Find?
How far is data from ex ante efficient?

1. For ages 25 to 35
   - Inequality in ex ante efficient allocation and U.S. data are roughly equal
     - $\frac{\text{Top income quartile}}{\text{Bottom income quartile}} = 1.8$ in model vs. 1.5 in data

2. For ages 55 and above
   - Inequality in ex ante efficient allocation is less than U.S. data
What We Find?
How far is data from ex ante efficient?

1. For ages 25 to 35
   - Inequality in ex ante efficient allocation and U.S. data are roughly equal
     - \[ \frac{\text{Top income quartile}}{\text{Bottom income quartile}} = 1.8 \text{ in model vs. } 1.5 \text{ in data} \]

2. For ages 55 and above
   - Inequality in ex ante efficient allocation is less than U.S. data
     - \[ \frac{\text{Top income quartile}}{\text{Bottom income quartile}} = 1 \text{ in model vs. } 1.5 \text{ in data} \]
What We Find?
How far is data from ‘Laissez Faire’?

• For all ages
  ○ Inequality in ‘Laissez Faire’ is significantly more than U.S. data

• For all ages
  ○ Data is much closer to ex ante efficient than it is to ‘Laissez Faire’
What We Find?
How far is data from ‘Laissez Faire’?

- For all ages
  - Inequality in ‘Laissez Faire’ is significantly more than U.S. data
    - \[ \frac{\text{Top income quartile}}{\text{Bottom income quartile}} = 7 \text{ in model vs. 1.5 in data} \]

- For all ages
  - Data is much closer to ex ante efficient than it is to ‘Laissez Faire’
Related Literature

- **Hall and Jones (2007):** efficiency and aggregate health spending.
Related Literature

- **Hall and Jones (2007):** efficiency and aggregate health spending.

- **Ozkan (2011):** Positive analysis of health spending inequality (incomplete market, moral hazard, etc.).

- **Yogo (2009); De Nardi, French and Jone (2010):** effect of health expenditures on life-cycle asset accumulation and portfolio choice.

- **Deaton (1999); Deaton and Paxon (1998, 1999); Wagstaff (2002); Skinner and Zhou (2004):** Document Inequality in health outcomes and its relation to income.
Theory
Model
Individuals

- Large number of finitely lived individuals
- Only differ in their – hump shaped – productivity profiles
  - Each productivity profile is indexed by a number $\theta$
- At age 0, they draw $\theta$ from $\pi(\theta)$
- No uncertainty in productivity, $w_a(\theta)$, after $\theta$ is realized
- Assume $\theta' > \theta \Rightarrow w_a(\theta') > w_a(\theta)$ for all $a$
Model
Health Care and Survival

- Health spending, $h$, affects survival rates
- $P_a(h)$ is the survival rate at age $a$ with health spending $h$

Assumption

$P_a(\cdot)$ is strictly increasing and concave
Model
Health Care and Survival

• Health spending, $h$, affects survival rates

• $P_a(h)$ is the survival rate at age $a$ with health spending $h$

Assumption

$P_a(\cdot)$ is strictly increasing and concave

• Let $h_a(\theta)$ be health spending on type $\theta$ at age $a$

• Then type $\theta$ survives to age $a + 1$ with probability $N_a(\theta)$

$$N_{a+1}(\theta) = P_a(h_a(\theta))N_a(\theta)$$
Model
Preferences and Technology

• Individuals care about consumption and leisure

\[
\sum_{a=0}^{A} \beta^a N_a [u(c_a) + \nu (1 - l_a)]
\]

Assumption

\[
u(c) + \nu (1 - l) > 0
\]
Model
Preferences and Technology

- Individuals care about consumption and leisure

\[ \sum_{a=0}^{A} \beta^a N_a [u(c_a) + \nu(1 - l_a)] \]

Assumption

\[ u(c) + \nu(1 - l) > 0 \]

- There is a saving technology \( R \).

- Type \( \theta \) who works \( l \) hours at age \( a \) produces \( w_a(\theta) \)
Model
Ex Ante Efficient Allocation

\[
\begin{align*}
\max_{c_a(\theta), l_a(\theta), h_a(\theta), N_a(\theta)} & \quad \sum_{\theta} \pi(\theta) \sum_{a=0}^{A} \beta^a N_a(\theta)[u(c_a(\theta)) + v(1 - l_a(\theta))] \\
\text{subject to} & \quad \sum_{\theta \in \Theta} \pi(\theta) \sum_{a=0}^{A} \frac{1}{R^a} N_a(\theta) [c_a(\theta) + h_a(\theta) - w_a(\theta)l_a(\theta)] \leq 0 \\
N_{a+1}(\theta) & = P(h_a(\theta))N_a(\theta) \quad \forall \theta \\
N_0(\theta) & = 1 \quad \forall \theta
\end{align*}
\]

Note: no incentive constraints (yet)!
Model

Ex Ante Efficient Allocation

\[
\max_{c_a(\theta), l_a(\theta), h_a(\theta), N_a(\theta)} \sum_{\theta} \pi(\theta) \sum_{a=0}^{A} \beta^a N_a(\theta) \left[ u(c_a(\theta)) + v(1 - l_a(\theta)) \right]
\]

subject to

\[
\sum_{\theta \in \Theta} \pi(\theta) \sum_{a=0}^{A} \frac{1}{R^a} N_a(\theta) \left[ c_a(\theta) + h_a(\theta) - w_a(\theta) l_a(\theta) \right] \leq 0
\]

\[
N_{a+1}(\theta) = P(h_a(\theta)) N_a(\theta) \quad \forall \theta
\]

\[
N_0(\theta) = 1 \quad \forall \theta
\]

**Note:** no incentive constraints (yet)!
Properties of Efficient Allocation

- Same consumption for all, higher productivity work more
  - Standard under full information and separability
Properties of Efficient Allocation

- Same consumption for all, higher productivity work more
  - Standard under full information and separability

- Before retirement: more health care for more productive
  - More high-\(\theta\) types means more output
  \[\Rightarrow\] Planner wants more of them around
Properties of Efficient Allocation

• Same consumption for all, higher productivity work more
  ◦ Standard under full information and separability

• Before retirement: more health care for more productive
  ◦ More high-$\theta$ types means more output
    $\Rightarrow$ Planner wants more of them around

• After retirement: same health care for all
  ◦ No efficiency reason to have different survival rates
  ◦ Costly to have different survival rates
Alternative Benchmark?
Laissez Fair Allocation

• Ex ante efficient allocation is one extreme benchmark
  ○ Full insurance against realization of ability

• Another extreme is the one that provides no such insurance
  ○ Each Individual’s spendings do not exceed their output

• We call this benchmark ‘Laissez Fair’
For each type $\theta$

$$\max_{c_a(\theta), l_a(\theta), h_a(\theta), N_a(\theta)} \sum_{a=0}^{A} \beta^a N_a(\theta)[u(c_a(\theta)) + v(1 - l_a(\theta))]$$

subject to

$$\sum_{a=0}^{A} \frac{1}{R_a} N_a(\theta) [c_a(\theta) + h_a(\theta) - w_a(\theta) l_a(\theta)] \leq 0$$

$$N_{a+1}(\theta) = P(h_a(\theta))N_a(\theta)$$

$$N_0(\theta) = 1$$
Lessons from the Model

• If individuals differ in their productivity,
  more productive should receive more health care
Lessons from the Model

• If individuals differ in their productivity, more productive should receive more health care

• **Question:** How much more?

• **Next:**
  - We compute efficient allocations in the model
  - Compare health spending by income in data and model
Quantitative Exercise

How ‘should’ healthcare spending vary with ability?
Quantitative Exercise
What do we need?

• In order to solve the model, we need

  1. Productivity profiles – $w_a(\theta)$

  2. Survival function – $P_a(h)$

  3. Parameters for the utility function

• Next: I describe the data we use to estimate 1 and 2

• We use those estimates to calibrate the preference parameters
Calibration
Productivity profiles – $w_a(\theta)$

• Quantiles of wage profiles in MEPS

• Let $\theta = 1, 2, 3 \ldots, 99$

• We choose $w_a(\theta)$ to be the $\theta$th percentile of wages at age $a$.

• I describe MEPS on the next slide
Health Spending Data
Medical Expenditure Panel Survey 1996-2008

- Overlapping rotating panel: 5 interviews in 2 years
- Contains income, hrs worked, demog. data, health status, etc.
Health Spending Data
Medical Expenditure Panel Survey 1996-2008

- Overlapping rotating panel: 5 interviews in 2 years
- Contains income, hrs worked, demog. data, health status, etc.
- Detailed information on healthcare usage and expenditure
  - Out of pocket
  - Medicare, Medicaid, TRICARE and Veteran’s admin
  - Private insurance
  - Other federal, state and local
  - Worker’s compensation

Nursing homes/institutionalized population NOT included
Health Spending Data
Medical Expenditure Panel Survey 1996-2008

- Overlapping rotating panel: 5 interviews in 2 years
- Contains income, hrs worked, demog. data, health status, etc.
- Detailed information on healthcare usage and expenditure
  - Out of pocket
  - Medicare, Medicaid, TRICARE and Veteran’s admin
  - Private insurance
  - Other federal, state and local
  - Worker’s compensation
- Nursing homes/institutionalized population NOT included
Calibration
Estimating Survival Function – $P_a(h)$

- Survival function - Hall and Jones (2007)

$$P_a(h) = \max \left\{ 1 - \frac{1}{f_a(h)}, 0 \right\}$$

$$f_a(h) = A_a h^{\eta_a}$$

- Estimate $A_a$ and $\eta_a$ using
  - mortality by age, gender, race, census region (CDC)
  - spending by year, age, gender, race, census region (MEPS)
  - control for year, tech. prog., other non health-spending factors
Calibration
Parameters chosen using the model

\[ u(c, 1 - l) = b + \frac{c^{1-\gamma}}{1-\gamma} + \psi \frac{(1 - l)^{1-\epsilon}}{1-\epsilon} \]

<table>
<thead>
<tr>
<th>( \gamma )</th>
<th>( \epsilon )</th>
<th>( \psi )</th>
<th>( b )</th>
<th>( \beta )</th>
<th>( R )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2*</td>
<td>4.442</td>
<td>0.756</td>
<td>7.0</td>
<td>0.97</td>
<td>1.04</td>
</tr>
</tbody>
</table>

Table: *Hall and Jones (2007) benchmark

- \( b \) is chosen to match value of saving a life at age 37 = $3 miln (DOT estimate)
- \( \epsilon \) is chosen to match labor supply elasticity = 0.38
- \( \psi \) is chosen to match average hours = 0.372
Ex Ante Efficient vs. Laissez Faire
Average Health Spending by Age

Ex ante Efficient

Age
2005 $

Ex ante Efficient

Too Much' Inequality in Health Spending?
Ex Ante Efficient vs. Laissez Faire
Average Health Spending by Age

Ex ante Efficient
Laissez Faire

Age
2005 $

Ex ante Efficient
Laissez Faire

0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2 x 10^4

0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2 x 10^4

25 30 35 40 45 50 55 60 65 70 75 80

Age
2005 $
Ex Ante Efficient vs. Laissez Faire
Average Health Spending by Age – Top and Bottom Income Quartile

Age
2005 $

1st Quartile (EaE)
4th Quartile (EaE)
Ex Ante Efficient vs. Laissez Faire

Ratio of Health Spending by Age – Top to Bottom Income Quartile
Ex Ante Efficient vs. Laissez Faire
Share of Health Spending by Income Quartile, 25-35yrs old

Ex ante Efficient
Ex Ante Efficient vs. Laissez Faire
Share of Health Spending by Income Quartile, 25-35yrs old

![Graph showing the share of health spending by income quartile for ages 25-35, comparing Ex Ante Efficient and Laissez Faire. The graph indicates a higher share of spending in the 4th income quartile under Ex Ante Efficient compared to Laissez Faire.]
Ex Ante Efficient vs. Laissez Faire
Share of Health Spending by Income Quartile, 55-65yrs old

Ex ante Efficient

- 1st Quartile: 20%
- 2nd Quartile: 25%
- 3rd Quartile: 30%
- 4th Quartile: 40%

Note: The diagram illustrates the share of health spending by income quartile, with the 4th quartile showing the highest expenditure.
Ex Ante Efficient vs. Laissez Faire
Share of Health Spending by Income Quartile, 55-65yrs old

Ex ante Efficient
Laissez Faire

1st 2nd 3rd 4th

0 10 20 30 40 50 60

%
Ex Ante Efficient vs. Laissez Faire
Share of Health Spending by Income Quartile, 70-80yrs old
Ex Ante Efficient vs. Laissez Faire
Share of Health Spending by Income Quartile, 70-80yrs old

![Chart showing share of health spending by income quartile comparing Ex ante Efficient and Laissez Faire. The x-axis represents the income quartiles (1st, 2nd, 3rd, 4th), and the y-axis represents the percentage of health spending. The chart indicates that Ex ante Efficient has a higher share in the 1st and 4th quartiles compared to Laissez Faire.](chart.png)
How does health spending vary with ability?
MEPS Data
Constructing Data Summaries Comparable to Model

- People of the same income in MEPS data may have drastically different health spending
  - Some people are sick and some are not sick

- Our model is very stylized and abstracts from various features in data (including sickness)

- To construct data summaries that are comparable with model quantities we look at average health spending over an income group, e.g., top and bottom income quartiles by age
Data
Average Health Spending by Age

2005 $ × 10^4

Age

0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

25 30 35 40 45 50 55 60 65 70 75 80
Data

Average Health Spending by Age – Top and Bottom Income Quartile

1st Quartile–entire sample
4th Quartile–entire sample

Age

2005 $
Income Endogeneity Issue

- It appears that in MEPS data spending on poor individuals is higher than spending on rich individuals.

- This may be due to an income endogeneity:
  - A productive high income individual who does not work due to sickness will show up low income with high spending in MEPS data.
  - This causes an upward (downward) bias on poor (rich) types.

- In order to partially control for this we restrict our sample.
Restricting the Sample
Focus on Median Health Status

- MEPS contains self-reported health status: 1-Excellent, ..., 5-Poor.

- We construct an individual time average of the reported health status
  - Suppose the report is 1 for the first 6 months in a year and 2 for the next 6 months
  - Then the time average is 1.5

- We restrict the sample to only contain individuals with time average health status between 45th and 55th percentile.
Data: Filtered vs. nonFiltered
Average Health Spending by Age – Top and Bottom Income Quartile
Data: Filtered vs. nonFiltered
Average Health Spending by Age – Top and Bottom Income Quartile

[Graph showing average health spending by age for the 1st and 4th quartiles of income, both in the entire sample and filtered sample.]
Data: Filtered vs. nonFiltered
Share of Health Spending by Income Quartile, 25-35yrs old

Entire Sample

1st 2nd 3rd 4th

%
Data: Filtered vs. nonFiltered
Share of Health Spending by Income Quartile, 25-35yrs old
Data: Filtered vs. nonFiltered
Share of Health Spending by Income Quartile, 55-65yrs old

- 1st
- 2nd
- 3rd
- 4th

Entire Sample

0%
10%
20%
30%
40%
50%
60%

%
Data: Filtered vs. nonFiltered
Share of Health Spending by Income Quartile, 55-65yrs old
Data: Filtered vs. nonFiltered
Share of Health Spending by Income Quartile, 70-80yrs old

[Bar chart showing the share of health spending by income quartile for the entire sample.]

Roozbeh Hosseini (ASU) 'Too Much' Inequality in Health Spending?
Data: Filtered vs. nonFiltered
Share of Health Spending by Income Quartile, 70-80yrs old
Comparing Model and Data
How Far is U.S. Data from Ex Ante Efficient? Laissez Faire?
Ex Ante Efficient vs. Laissez Faire vs. Data
Average Health Spending by Age

Ex ante Efficient
Ex Ante Efficient vs. Laissez Faire vs. Data
Average Health Spending by Age

![Graph showing average health spending by age for Ex Ante Efficient and Laissez Faire scenarios.](image)
Ex Ante Efficient vs. Laissez Faire vs. Data
Average Health Spending by Age

- Ex ante Efficient
- Laissez Faire
- MEPS data

Age
2005 $

Ex ante Efficient
Laissez Faire
MEPS data
Ex Ante Efficient vs. Laissez Faire vs. Data
Average Health Spending by Age – Top and Bottom Income Quartile

![Chart showing average health spending by age for the 1st and 4th income quartiles in 2005 dollars.](chart.png)
Ex Ante Efficient vs. Laissez Faire vs. Data
Average Health Spending by Age – Top and Bottom Income Quartile

2005 $

1st Quartile (EaE)
4th Quartile (EaE)
1st Quartile (LF)
4th Quartile (LF)
Ex Ante Efficient vs. Laissez Faire vs. Data
Average Health Spending by Age – Top and Bottom Income Quartile

Roozbeh Hosseini (ASU) 'Too Much' Inequality in Health Spending?

2005 $ vs. Age

1st Quartile (EaE) vs. 4th Quartile (EaE)
1st Quartile (LF) vs. 4th Quartile (LF)
1st Quartile (MEPS) vs. 4th Quartile (MEPS)
Ex Ante Efficient vs. Laissez Faire vs. Data
Ratio of Health Spending by Age – Top to Bottom Income Quartile

Age

EaE LF MEPS
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 25-35yrs old

Ex ante Efficient

1st 2nd 3rd 4th

0
10
20
30
40
50
60
%

Ex ante Efficient
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 25-35yrs old
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 25-35yrs old

- Ex ante Efficient
- Laissez Faire
- MEPS data

[Diagram showing the share of health spending by income quartile for individuals aged 25-35 years old, comparing Ex ante Efficient vs. Laissez Faire vs. MEPS data.]
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 55-65yrs old

[Bar chart showing share of health spending by income quartile, 55-65 years old, with Ex ante Efficient spending depicted.]

Roozbeh Hosseini (ASU) ‘Too Much’ Inequality in Health Spending? 46 of 77
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 55-65yrs old

- Ex ante Efficient
- Laissez Faire

1st 2nd 3rd 4th
0 10 20 30 40 50 60%

Roozbeh Hosseini (ASU) 'Too Much' Inequality in Health Spending?
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 55-65yrs old
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 70-80yrs old

[Diagram showing the share of health spending by income quartile for 70-80 year olds, with Ex ante Efficient distribution indicated.]
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 70-80yrs old

![Bar chart showing the share of health spending by income quartile for Ex Ante Efficient and Laissez Faire models. The x-axis represents the income quartiles (1st, 2nd, 3rd, 4th), and the y-axis represents the percentage of health spending. The 1st quartile shows a significant difference between Ex Ante Efficient and Laissez Faire, with a much higher percentage of spending for the former.]

Roozbeh Hosseini(ASU) ‘Too Much’ Inequality in Health Spending?
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Income Quartile, 70-80yrs old

[Graph showing the share of health spending by income quartile for 70-80yrs old individuals.

- Ex Ante Efficient
- Laissez Faire
- MEPS data

The graph compares the share of health spending across different income quartiles: 1st, 2nd, 3rd, and 4th. The Ex Ante Efficient category shows a consistent share across all quartiles, while Laissez Faire and MEPS data show variability, with a significant increase in the 4th quartile.]
Sensitivity
Sensitivity
Value of Life

- Literature on estimating *Value of Statistical Life*:
  - Large range of estimates

- Our benchmark is $3 million (from DOT). We experiment with
  - $7 million (EPA recommended benchmark)
  - $1.5 million (arbitrary low value)
  - In each case we re-calibrate the model

- In this talk we report results on ex ante efficient allocation for
  - Average spending by age
  - Share of spending by wage quartiles
Sensitivity: Ex Ante Efficient vs. Data
Average Health Spending by Age

Ex ante Efficient, VSL = $1.5mil
Ex ante Efficient, VSL = $3mil
Ex ante efficient, VSL = $7mil
MEPS data
Sensitivity: Ex Ante Efficient vs. Data
Ratio of Health Spending by Age – Top to Bottom Income Quartile

Ex ante Efficient, VSL = $1.5mil
Ex ante Efficient, VSL = $3mil
Ex ante efficient, VSL = $7mil
MEPS data
Sensitivity: Ex Ante Efficient vs. Data
Share of Health Spending by Income Quartile, 25-35yrs old
Sensitivity: Ex Ante Efficient vs. Data
Share of Health Spending by Income Quartile, 55-65yrs old

![Bar chart showing sensitivity analysis of health spending by income quartile.](chart.png)
Sensitivity: Ex Ante Efficient vs. Data
Share of Health Spending by Income Quartile, 79-80yrs old
Adding Private Information
(Preliminary)
Adding Private Information
Preliminary example

• When productivity types are private information,
  ◦ More productive types receive more consumption
  ◦ They enjoy higher flow of utility as long as they live

• Gives additional benefit to planner for keeping them around
  ⇒ The inequality in health is larger relative to full info case, particularly for post retirement ages
Adding Private Information

Only two productivity types

- Suppose there are only two productivity types

- The efficient allocation must be incentive compatible

\[
\sum_a \beta^a N_a(\theta_H) \left[ b + \frac{c_a(\theta_H)^{1-\gamma}}{1-\gamma} + \phi \frac{(1 - l_a(\theta_H))^{1-\epsilon}}{1-\epsilon} \right] \geq \\
\sum_a \beta^a N_a(\theta_L) \left[ b + \frac{c_a(\theta_L)^{1-\gamma}}{1-\gamma} + \phi \frac{(1 - l_a(\theta_L)w_a(\theta_L)/w_a(\theta_H))^{1-\epsilon}}{1-\epsilon} \right]
\]

- One consequence is that consumption is no longer equalized
Constrained Efficient vs. Data
Average Health Spending by Age for High and Low Income

Below median income – MEPS
Above median income – MEPS
Low Productivity – C.E.
High Productivity – C.E.
Constrained Efficient vs. Data
Share of Health Spending for High and Low Income, 25-35yrs old

- Bottom Half
- Top Half

Constrained efficient
MEPS data

%
Constrained Efficient vs. Data
Share of Health Spending for High and Low Income, 55-65yrs old

![Bar chart showing the share of health spending for the bottom and top halves of income distribution, comparing constrained efficient and MEPS data.](chart.png)
Constrained Efficient vs. Data
Share of Health Spending for High and Low Income, 70-80yrs old

Constrained efficient
MEPS data

Bottom Half
Top Half

%
Conclusion
Three Lessons

1. If health spending increases survival probability,
   ○ It is efficient (‘First Best’) to spend more on more productive.

2. Data inequality is close to efficient inequality. Specially at younger age.

3. Data inequality is much closer to ex ante efficient, than to Laissez Faire.
1. If health spending increases survival probability,
   ◦ It is efficient (‘First Best’) to spend more on more productive.

2. Data inequality is close to efficient inequality. Specially at younger age.

3. Data inequality is much closer to ex ante efficient, than to Laissez Faire.

   Current social insurance doesn’t look bad!
Back up slides: Supplementary Graphs
Back up Slide
Survival Production Function Parameters

Elasticity $\eta_a$

Survival TFP $A_a$

\[
P_a(h) = \max \left\{ 1 - \frac{1}{f_a(h)}, 0 \right\}, \quad f_a(h) = A_a h^{\eta_a}
\]
Back up slides: Calibration of $b$
Calibration of $b$
What exactly do we do to choose $b$?

We choose $b$ such that

$$3 \text{ miln} = \text{utility from consumption and leisure} + \text{extra production beyond use}$$
Calibration of $b$

What exactly do we do to choose $b$?

We choose $b$ such that

$$3 \text{ miln} = \frac{\sum_{\theta} \pi(\theta) \sum_{a=37}^{A} \beta^{a-37} \frac{N_a(\theta)}{N_{37}(\theta)} [u(c_a(\theta)) + v(1 - l_a(\theta))] + u'(c_{37})}{\text{utility from consumption and leisure}}$$

$$+ \text{extra production beyond use}$$
Calibration of $b$

What exactly do we do to choose $b$?

We choose $b$ such that

\[
3 \text{ miln} = \frac{\sum_\theta \pi(\theta) \sum_{a=37}^A \beta^{a-37} \frac{N_a(\theta)}{N_{37}(\theta)} \left[ u(c_a(\theta)) + v(1 - l_a(\theta)) \right]}{u'(c_{37})}
\]

utility from consumption and leisure

\[
+ \lambda \frac{\sum_\theta \pi(\theta) \sum_{a=37}^A \frac{1}{R^{a-37}} \frac{N_a(\theta)}{N_{37}(\theta)} \left[ w_a(\theta)l_a(\theta) - c_a(\theta) - h_a(\theta) \right]}{u'(c_{37})}
\]

extra production beyond use
Back up slides: Comparing median spending
Ex ante efficient vs. Laissez Faire vs. Data
Median health Spending for top and bottom Income quartile

![Graph showing median health spending for different income quartiles over age groups. The x-axis represents age from 25 to 80, and the y-axis represents spending in 2005 dollars. Different lines represent 1st and 4th quartiles for EaE, LF, and MEPS.](image-url)
Ex ante efficient vs. Laissez Faire vs. Data
Ratio of Median health Spending for top and bottom Income quartile.
Back up slides: Elasticity of Health Spending w.r.t Income
Ex ante efficient vs. Laissez Faire vs. Data
Elasticity of health spending w.r.t productivity
Back up slides: Using wage to rank individual in MEPS
Ex Ante Efficient vs. Laissez Faire vs. Data
Average Health Spending by Age – Top and Bottom Wage Quartile

Roozbeh Hosseini (ASU) 'Too Much' Inequality in Health Spending?
Ex Ante Efficient vs. Laissez Faire vs. Data
Ratio of Health Spending by Age – Top to Bottom Wage Quartile

Roozbeh Hosseini (ASU)
'Too Much' Inequality in Health Spending?
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Wage Quartile, 25-35yrs old

Roozbeh Hosseini (ASU) 'Too Much' Inequality in Health Spending?
Ex Ante Efficient vs. Laissez Faire vs. Data
Share of Health Spending by Wage Quartile, 55-65yrs old

Ex ante Efficient
Laissez Faire
MEPS data (wage quartiles)