Public Economics (2450B)

Topic 1: Empirical Welfare Analysis

The MVPF

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Goals of Public Economics

- What government policies do the most to improve social welfare?
  - Should we spend more (or less) on health insurance?
  - Should we raise top marginal income tax rates?
  - Should we invest more in children? At what age?

- Nobel Prize awarded for methods to estimate the causal impact of a wide range of these types of policy changes
  - Can estimate “Potential Outcomes” with vs without the policy

- How do we translate those estimates into a statement about the desirability of the policy change?
  - What causal estimates do we need?
Normative Evaluation of Policy Changes

This lecture: Discuss how to nest causal effects into a normative welfare framework

Questions to answer:
- What types of causal effects do we need?
- What else do we need to know?
- What are the key assumptions needed?

Key idea: for each policy change, want to construct its implied Marginal Value of Public Funds (MVPF)

\[
MVPF = \frac{\text{Benefits to Recipients}}{\text{Net Govt Cost}}
\]
Existing Approaches to Empirical Welfare Estimation


- **CBA + MCPF**: Conduct a benefit-cost ratio and adjust for the DWL from taxation
  - Stiglitz and Dasgupta (1971); Atkinson and Stern (1974); many others
  - Kaplow (2011) provides a nice discussion
  - Boardman (2017) provide a discussion of current methods (not much on distributional incidence)
  - Garcia and Heckman (2022) provides an opposing take; Hendren and Sprung-Keyser (2022) responds

- **MEB** – Generally applied to taxes, but framework is more general
  - Auerbach and Hines (2002) Handbook Chapter provides a nice summary

- **All rely on different conceptual frameworks**
  - The MVPF is the *unique* approach that relies on counterfactuals identified by causal effects (as opposed to decomposing those effects into income and substitution effects)
Outline

1. Theory and Measures of Welfare
2. Empirical Estimates of MVPFs for Various Policies
3. Other Welfare Measures: MEB and Cost-Benefit Analysis + MCPF
4. Relation to Optimal Tax Theory
General Welfare Framework

- Goal: Illustrate how the MVPF translates “reduced form” policy changes into precise statements about the social welfare impact of those policy changes

- Define social welfare:

\[ W = \int \psi_i u_i \]

- \( u_i \) is individual \( i \)'s utility function
  - Expected future discounted utility (e.g. \( u_i = E[\sum_{t \geq 0} \beta^j v_{it}] \))
- \( \psi_i \) is \( i \)'s Pareto weight
- Define \( \eta_i = \psi_i \lambda_i \), where \( \lambda_i \) is the marginal utility of income
- Ratios \( \frac{\eta_i}{\eta_j} \) correspond to “Okun’s Bucket” (Okun, 1976)
Impact of Policy Change on Social Welfare

- Consider policy change $dp$ (e.g. change in tax rate, educ. subsidy, etc.)

- First-order welfare impact:

$$
\frac{dW}{dp} = \int_i \psi_i \frac{du_i}{dp} = \bar{\eta}_p \int_i WTP_i
$$

- $\int_i WTP_i = \int_i \frac{du_i}{dp} \lambda_i$ is the sum of WTP by beneficiaries out of their own income for the policy

- $\bar{\eta}_p = \int \eta_i \frac{WTP_i}{\int_i WTP_i}$ is incidence-weighted average social marginal utility of income
Most policies (i.e. reduced-form variations, \( dp \)) are not budget neutral

- Let \( R \) denote govt budget and \( G = \frac{dR}{dp} \) denote impact on govt budget that must be financed
- \( G \) includes any fiscal externalities from behavioral responses to the policy

The Marginal Value of Public Funds (MVPF) of policy \( p \) is given by:

\[
MVPF_p = \frac{\int WTP_i}{G} = \frac{Willingness to pay}{Net Cost to Govt}
\]

$1 of govt spending on the policy delivers $MVPF benefits to the beneficiaries of the policy [Mayshar (1990), Slemrod and Yitzhaki (1996, 2001), Kleven and Kreiner (2006), Hendren (2017)]

- Delivers \( \tilde{\eta}_p MVPF_p \) in social welfare
Take two (non-budget neutral) policies: policy 1 and policy 2

Consider budget neutral policy, \( dp \): increase spending on policy 1 financed from less spending (greater revenue) from policy 2

To first order, combined policy increases social welfare \( \frac{dW}{dp} > 0 \) if only if

\[
\eta_1 MVPF_1 > \eta_2 MVPF_2
\]

MVPFs characterize price of delivering welfare to the beneficiaries through the policy

- Motivates comparing policies with similar distributional incidence (\( \eta_1 \approx \eta_2 \))
- Laffer effect occurs when \( WTP > 0 \) and \( Net\ Cost < 0 \) \( \rightarrow \) MVPF = \( \infty \)
Let’s compute the MVPF a policy that reduces the marginal income tax rate, \( \tau \), by \( d\tau \) (e.g. TRA86)

- Let \( \tau \) denote the marginal tax rate on earnings \( y \).
- Average earnings in the population is \( E[y] \)

Government revenue is

\[
R = \tau E[y]
\]

Where \( E[y] \) is the average revenue subjected to the tax

So, changing taxes leads to a change in revenue

\[
\frac{dR}{d\tau} = E[y] + \tau \frac{dE[y]}{d\tau} = E[y](1 + \epsilon)
\]

- \( \epsilon = \frac{\tau dE[y]}{E[y]d\tau} \) is the elasticity of tax revenue with respect to the tax rate
- Depends on the causal effect of the tax change on tax revenue
Example MVPF: Tax Rate Change

- Now, consider the WTP
  - Here’s where the envelope theorem is useful
  - To first order, individuals do not value their change in incomes
  - If you earn $100 and taxes go from 10% to 9%, WTP $1 for the decrease regardless of how you change earnings
    \[ \frac{d}{d\tau} \frac{d u_i}{\lambda_i} = y_i \]

- So, avg WTP is \( E[y] \) and the MVPF is given by
  \[ MVPF = \frac{E[y]}{E[y](1 + \epsilon)} = \frac{1}{1 + \epsilon} \]

- Key statistic one needs to know: causal effect of changing tax rates on government revenue
  - For every $1 of a tax cut, how much do individuals change their incomes

- Exercise: what if taxes only apply above some income threshold, \( \tilde{y} \)?
Infinite MVPFs

- Infinite MVPFs
  - What happens if $\epsilon < -1$?
  - Policy “pays for itself” $\rightarrow$ also known as a “Laffer” effect

- Define $MVPF = \infty$ when $WTP > 0$ and $Cost < 0$ (and $-\infty$ if $WTP < 0$ and $Cost > 0$)
  - Preserves ordering ($MVPF = \infty$ is better than other policies with finite MVPFs)

- MVPF generalizes Laffer effects to other policies
Outline

1. Theory and Measures of Welfare
2. Empirical Estimates of MVPFs for Various Policies
3. Other Welfare Measures: MEB and Cost-Benefit Analysis + MCPF
4. Relation to Optimal Tax Theory
Measuring MVPFs: Hendren and Sprung-Keyser (2019)

- Hendren and Sprung-Keyser (2019) construct 133 MVPFs for policies in social insurance, education and job training, taxes and cash transfers, and in-kind transfers
  - Additional MVPF estimates from other authors available at www.policyimpacts.org

- Construct sample from survey and review articles in the four domains

- Assess robustness to range of assumptions
  - Program Parameters (discount rate, tax rate, etc.)
  - Forecasting/Extrapolation of Observed Effects
  - Validity of Empirical Designs (RCTs/RDs vs. Diff-in-Diff; Peer Reviewed vs. not; etc.)
  - Publication Bias (Andrews and Kasy, 2018)
  - Missing Causal Estimates (e.g. restrict to subsets of policies with different sets of observed effects)

- Detailed appendices + posted .do files on GitHub for exploration
Florida International University (FIU) had a minimum GPA threshold for admission that created a fuzzy discontinuity.

Zimmerman (2014) utilizes this discontinuity to examine the impact of FIU admission on earnings for 14 years after admission.
Impact of College Attendance on Earnings: Zimmerman (2014)

Fig. 8.—Quarterly earnings by distance from GPA cutoff. Lines are fitted values based on the main specification. Dots, shown every .05 grade points, are rolling averages of values within .05 grade points on either side that have the same value of the threshold-crossing dummy.
Net Cost to Government of Admission to Florida International University

Note: All amounts in 2005 USD, discounted using a 3% real interest rate
Net Cost to Government of Admission to Florida International University

Cost per admission to FIU (IPEDS/Zimmerman (2014))

Note: All amounts in 2005 USD, discounted using a 3% real interest rate
Net Cost to Government of Admission to Florida International University

Note: All amounts in 2012 USD, discounted using CPI-U-RS and 3% real interest rate
Net Cost to Government of Admission to Florida International University

- Total FIU Cost: $11.4K
- Student Contribution: -$3.2K
- Community College Exp.: -$5.6K

5.6K reduction in community college govt spending

Note: All amounts in 2012 USD, discounted using CPI-U-RS and 3% real interest rate
Net Cost to Government of Admission to Florida International University

- Total FIU Cost: $11.4K
- Student Contribution: -$3.2K
- Community College Exp.: -$5.6K

Net Upfront Gov’t Cost: 2.6K

Note: All amounts in 2012 USD, discounted using CPI-U-RS and 3% real interest rate
Net Cost to Government of Admission to Florida International University

- Total FIU Cost: $11.4K
- Student Contribution: -$3.2K
- Community College Exp.: -$5.6K
- Taxes from age 19-25 earnings: $2.0K

Lost tax revenue from initial earnings declines from college attendance

Note: All amounts in 2012 USD, discounted using CPI-U-RS and 3% real interest rate
Net Cost to Government of Admission to Florida International University

- Total FIU Cost: $11.4K
- Student Contribution: $-3.2K
- Community College Exp.: $-5.6K
- Taxes from age 19-25 earnings
- Taxes from age 26-33 earnings: $7.3K increase in tax revenue from ages 26-33 (18.6% tax+transfer, CBO)

Note: All amounts in 2012 USD, discounted using CPI-U-RS and 3% real interest rate
Net Cost to Government of Admission to Florida International University

- Total FIU Cost: $11.4K
- Student Contribution: $-3.2K
- Community College Exp.: $-5.6K
- Taxes from age 19-25 earnings: $2.0K
- Taxes from age 26-33 earnings: $-7.3K
- Net Cost To Government: $-2.7K

Net government savings of $2.7K by age 33

Note: All amounts in 2012 USD, discounted using CPI-U-RS and 3% real interest rate
Net Cost to Government of Admission to Florida International University

Policy pays for itself → $MVPF = \infty$

Note: All amounts in 2012 USD, discounted using CPI-U-RS and 3% real interest rate
Net Cost by Age to Government of Admission to Florida International University

Observe outcomes through age 33

What about future ages?

Forecast future earnings using cross-section in ACS, following previous literature (e.g. Chetty, Hendren, Katz (2016))
Forecasting Future Earnings using the Cross-sectional Age Distribution
Mean 2015 ACS Earnings by Age with 0.5% Growth
Forecasting Future Earnings using the Cross-sectional Age Distribution

Control Group Earnings

Control group earnings are 97% of mean earnings at age 30.
Forecasting Future Earnings using the Cross-sectional Age Distribution

Control Group Forecast

Assume constant % of mean earnings over life-cycle
Forecasting Future Earnings using the Cross-sectional Age Distribution
Control Group Earnings + Treatment Effect

Add Treatment Effect to Control Group Earnings
Forecasting Future Earnings using the Cross-sectional Age Distribution

Treatment Group Forecast

Forecast assuming constant % impact on earnings
Net Cost by Age to Government of Admission to Florida International University

Forecasting Future Tax/Transfer Revenue

Original $11.4K cost returns $24.4K to the government over the person's lifetime

Acceptance/Withdrawal

$11.4K (Regardless of WTP)
Willingness to Pay for Admission into Florida International University

Baseline WTP

Baseline Estimate: Value WTP using impact on net after-tax income

- Valid if no impact on labor effort/disutility and no other impact of education on utility
Willingness to Pay for Admission into Florida International University
Baseline WTP

Private tuition payments
Age 19-25 after-tax earnings
Age 26-33 after-tax earnings
Age 34+ after-tax earnings
Baseline WTP

WTP ($)
Direct Investments in Children Historically Had Highest MVPFs
Direct Investments in Children Historically Had Highest MVPFs
Direct Investments in Children Historically Had Highest MVPFs

High MVPFs for policies targeting children
Direct Investments in Children Historically Had Highest MVPFs

Lower MVPFs for policies targeting adults
Direct Investments in Children Historically Had Highest MVPFs
With 95% Confidence Intervals Computed via Modified Bootstrap
Direct Investments in Children Historically Had Highest MVPFs

Imagine spending $1 in initial program cost on each domain

\[ MVPF_{avg} = \frac{WTP_1 + WTP_2 + WTP_3 + WTP_4}{\text{Cost}_1 + \text{Cost}_2 + \text{Cost}_3 + \text{Cost}_4} \]
Direct Investments in Children Historically Had Highest MVPFs
Category Averages

- College Child
- Child Education
- Health Child
- College Adult
- Housing Vouchers
- Cash Transfers
- Supp. Sec. Inc.
- Unemp. Ins.
- Disability Ins.
- Health Adult
- Job Training
Net Costs to Government per $1 of Initial Expenditure
Category Averages

- Child Education
- College Child
- Health Child
Net Costs to Government per $1 of Initial Expenditure
Category Averages

Age of Beneficiaries

Cost Over Program Cost

-2
-1
0
1
2

Cash Transfers
Supp. Sec. Inc.
Housing Vouchers
Job Training
Child Education
College Child
Health Child
College Adult
Unemp. Ins.
Health Adult
Top Taxes
Disability Ins.

Net Costs to Government per $1 of Initial Expenditure
Category Averages
Not All Child-Targeted Policies Have High MVPFs

![Graph showing MVPF (MVPF) vs Age of Beneficiaries](image)

- SSI Review
- MA Scholarship
- Job Corps
Infinite MVPF for 1981 Top Tax Rate…

![Graph showing MVPF vs. Age of Beneficiaries for 1981 Top Tax Rate.](image)
Infinite MVPF for 1981 Top Tax Rate…

![Graph showing the relationship between Age of Beneficiaries and MVPF with a horizontal line indicating the Top Tax 1981.](image-url)
Policies with Spillovers onto Children Have High MVPFs (e.g. MTO)
MVPF Robustness to Alternative Tax and Transfer Rates

10% Tax and Transfer Rate

- Child Education
- College Adult
- College Child
- Disability Ins.
- Health Adult
- Health Child
- Job Training
- Top Taxes
- Unemp. Ins.
- Cash Transfers
- Supp. Sec. Inc.
- Housing Vouchers

Age of Beneficiaries vs. MVPF
MVPF Robustness to Alternative Tax and Transfer Rates

30% Tax and Transfer Rate

- Child Education
- College Child
- Health Child
- College Adult
- Disability Ins.
- Health Adult
- Unemp. Ins.
- Top Taxes
- Cash Transfers
- Supp. Sec. Inc.
- Housing Vouchers
- Job Training

Age of Beneficiaries vs. MVPF

MVPF by Year of Policy
Averages by Decade

Year

MVPF

Adult Policies

Child Policies

<1
0
1
2
3
4
5
∞

1960
1970
1980
1990
2000
2010
Publication Bias

- Estimates are constrained by the existence of previous literature
- Would Perry Preschool have been published if the effects were an (imprecise) zero?
- Andrews and Kasy (2018) provide a method to test for and correct publication bias
- **Child Policies: 3-4 times** more likely to be published if they find a repayment effect
- **Adult Policies: up to 12 times** more likely to be published if they find a distortionary effect
MVPF Robustness to Publication Bias
Adjusting for Observed Publication Bias

- Child Education
- College Child
- Health Child
- College Adult
- Disability Ins.
- Health Adult
- Unemp. Ins.
- Top Taxes
- Supp. Sec. Inc.
- Cash Transfers
- Housing Vouchers
- Job Training
- College Adult

Age of Beneficiaries

MVPF

<-1 0 1 2 3 4 5 6 7 8 9 10

-0 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10
MVPF Robustness to Publication Bias
Adjusting for 35X Bias in Experimental Economics Studies [Camerer (2016)]

Age of Beneficiaries vs. MVPF

- Child Education
- Health Child
- College Child
- Top Taxes
- Housing Vouchers
- Supp. Sec. Inc.
- Cash Transfers
- Unemp. Ins.
- Disability Ins.
- Health Adult
- Job Training
- College Adult

Graph shows the relationship between the age of beneficiaries and the MVPF, with various programs and age categories plotted.
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Other Welfare Approaches: MEB

- Marginal excess burden (MEB) corresponds to another conceptual policy experiment

- Imagine doing the policy but closing the budget constraint through individual-specific lump-sum taxation (Auerbach and Hines (2002))

- Requires *compensated* not *causal* effect to calculate MEB

- Assumes budget constraint is closed with a technologically-infeasible policy

  - Key insight of Mirrlees (1971) is that individual-specific lump-sum taxation isn’t feasible – can only tax based on outcomes such as earnings
MEB of Tax Rate Change

- Let budget constraint be given by $c \leq \tau y + t$ where $t$ is a lump-sum transfer.

- Consider the revenue impact of the tax change that also rebates revenue through changing $t$:

$$\frac{dR}{d\tau^c} = E[y] + \tau \frac{dE[y]}{d\tau} - E[y] - \tau \frac{dE[y]}{dt}$$

- Or

$$\frac{dR}{d\tau^c} = \tau \left( \frac{dE[y]}{d\tau} - \frac{dE[y]}{dt} \right)$$

- Normalizing by WTP, $E[y]$, we have

$$MEB = \epsilon^c$$

- Where $\epsilon^c$ is the *compensated elasticity* of tax revenue (that subtracts the “income effect” $\frac{dE[y]}{dt}$).
Issues with the MEB Approach

- Two fundamental problems with MEB
  - Requires compensated, not causal effects
    - Income effects are hard to measure (especially if they are not invariant across environments)
  - Individual specific transfers are not feasible (this is the core idea behind Mirrlees’ optimal income tax work).
    - E.g. distortionary taxes will always look “bad”

- It is still possible to compare MEBs across policies
  - Appropriately defined, this will characterize changes in social welfare
  - But, requires compensated effects bc both policy changes need to add in, then subtract the income effects
Other Welfare Approaches: Cost-Benefit Analysis

- Benefit Cost Ratios are another method of policy comparison
  - See more recent discussion in Garcia and Heckman (2022b), Garcia and Heckman (2022a), Hendren and Sprung-Keyser (2022a), and Hendren and Sprung-Keyser (2022b)

- Compare the total benefits to the upfront programmatic cost of a policy

\[ BCR = \frac{Social\ Benefits - Social\ Costs}{Programmatic\ Cost(1 + \phi^{DWL})} \]

- Multiply costs by an adjustment for the excess burden of taxation

- Benefits accruing to the government are included as social costs
MVPF vs Benefit/Cost Ratio [Heckman et al., 2010; Zimmerman 2014]

Benefit Cost Ratio by Age of Beneficiaries

BCR, $\phi_{DWL}^{DL} = 50\%$

Age of Beneficiaries

Child Education

College Child

Health Child

Child Education

College Adult

Health Adult

College

Disability Ins.

Job Training

Unemp. Ins.

Housing Vouchers

Cash Transfers

Supp. Sec. Inc.

Disability Ins.

Health Adult
**MVPF vs Benefit/Cost Ratio** [Heckman et al., 2010; Zimmerman 2014]

Tax Revenue Impacts Counted as Social Benefits, not Government Cost Reductions

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**Diagram Description**

- **X-axis:** MVPF
- **Y-axis:** BCR, \( \phi_{DLW} = 50\% \)
- **Points:**
  - EITC 1993
  - Perry Preschool
  - Top Tax 1981
  - MC Child 83+
  - Job Corps
  - FIU GPA

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**Notes:**

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**References:**

- Heckman et al., 2010
- Zimmerman, 2014
Key Problem with Cost-Benefit Analysis

- Benefit-Cost analysis tends to suffer from three related conceptual problems

1. Revenue impacts are included in numerator but they reduce the need to raise revenue and thus the excess burden of taxation!
   - But the excess burden only multiplies the upfront cost
   - This is fixed in more recent Garcia and Heckman (2022) articles

2. They force a particular method of closing the budget constraint (linear taxation)

3. They don’t (generally) account for differential distributional incidence of the policy relative to the method used to raise revenue (but it is well known one can incorporate distributional weights)

- In contrast, the MVPF would put the net government cost in the denominator, allow the researcher to compare the MVPF to other policies, and use Okun’s bucket
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Quantifying the Tradeoffs of Redistribution through the Tax Schedule (Mirrlees 1976)

Prefer 1993 OBRA tax change iff prefer $1.12 to low-income EITC beneficiaries to $1.85 to top earners.
“Tagging” Based on Age in MTO

Approximate Income of Beneficiary

MVPF

<0.5

1

1.5

>2

>50K

Top Tax 1981

Top Tax 1986

Top Tax 1993

Top Tax 2001

Top Tax 2013

MTO Young

MTO

Top Tax 1981
Efficient Redistribution through Investments in Low-Income Children
Child Health, College and Education Programs

- Paycheck+
- Neg Inc Tax
- AFDC Term Limits
- EITC 1986
- EITC 1993
- Alaska UBI
- AFDC Generosity
- Perry Preschool
- Abecedarian
- K12 Spend
- Soc Sec College
- CUNY Pell
- Ohio Pell
- Florida Grant
- DC Grant
- TN Hope
- CC Texas
- CC Mich
- Georgia HOPE
- College Spend
- Top Tax 1981
- Top Tax 1986
- Top Tax 1993
- Top Tax 2001
- Top Tax 2013
- MVPF
- Approximate Income of Beneficiary

- 0
- 10
- 20
- 30
- 40
- >50K

- MI Child 83+
- MC Child (State Exp)
- Texas Pell
- Cal Grant GPA
- Cal Grant Inc
- Kalamazoo
- Georgia HOPE
- FIU GPA
- College Tuition
- AFDC Term Limits
- MA Scholarship
- TN Pell
- Top Tax 1986
- Top Tax 1993
- Top Tax 2001
- Top Tax 2013
- Top Tax 1981
- MVPF
- Approximate Income of Beneficiary

- <0.5
- 1
- 1.5
- 2
- >2
- ∞
Summary

- Causal estimates can be readily translated into a comparative welfare framework using the MVPF

- Close the budget constraint by comparing MVPFs of two policies

\[ \bar{\eta}_1MVPF_1 > \bar{\eta}_2MVPF_2 \]

- Still need to know incidence to calculate \( \bar{\eta}_j \)

- At an optimum, \( \bar{\eta}_1MVPF_1 = \bar{\eta}_2MVPF_2 \)
  
  - Can derive many (all?) optimal tax results through this equation
What types of estimates are necessary:

1. Measure the net cost to the government / ‘fiscal externality’
2. Measure the incidence of the policy:
   - How much are beneficiaries willing to pay? (May require more than causal effect)
   - Who are the beneficiaries (relates to $\eta_i$)

Roadmap for rest of course:
- Next Lecture: Inverse Optimum: How should we deal with redistributive concerns?
- Lecture 3: When is the income tax a more efficient method of redistribution than commodity taxes, capital taxes, or wealth taxes?