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)

$$MVPF = \frac{Benefits\ to\ Recipients}{Net\ Govt\ Cost}$$

Existing Approaches to Empirical Welfare Estimation

- MVPF: Mayshar (1990), Slemrod and Yitzhaki (1996, 2001), Kleven and Kreiner (2006), Hendren (2016), Hendren and Sprung-Keyser (2019), Finkelstein (2019 -- You'll like this one… ☺)

- 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. $u_i = E[\sum_{t \geq 0} \beta^j v_{it}]$)
  - ψ_i is i's Pareto weight
  - Define $\eta_i = \psi_i \lambda_i$, where λ_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:

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

- $\int_i WTP_i = \int_i \frac{\frac{du_i}{dp}}{\lambda_i}$ 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

Compare Policies by Normalizing by Cost

- 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 $\bar{\eta}_p MVPF_p$ in social welfare

MVPF Facilitates Construction of Policies that Increase 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 ($\frac{dW}{dp} > 0$) **<u>if only if</u>**

$$\bar{\eta}_1 MVPF_1 > \bar{\eta}_2 MVPF_2$$

- MVPFs characterize price of delivering welfare to the beneficiaries through the policy
  - Motivates comparing policies with similar distributional incidence ($\bar{\eta}_1 \approx \bar{\eta}_2$)
  - Laffer effect occurs when $WTP > 0$ and $Net\ Cost < 0 \rightarrow MVPF = \infty$

Example MVPF: Tax Rate Change

- Let's compute the MVPF a policy that reduces the marginal income tax rate, τ, by $d\tau$ (e.g. TRA86)
  - Let τ 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

$$\frac{d}{d\tau}\frac{du_i}{\lambda_i} = y_i$$

- 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, $\bar{y}$?

Infinite MVPFs

- Infinite MVPFs
  - What happens if $\epsilon < -1$?
  - Policy "pays for itself" → 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

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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

MVPF Example: Admission to Florida International University

- 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)

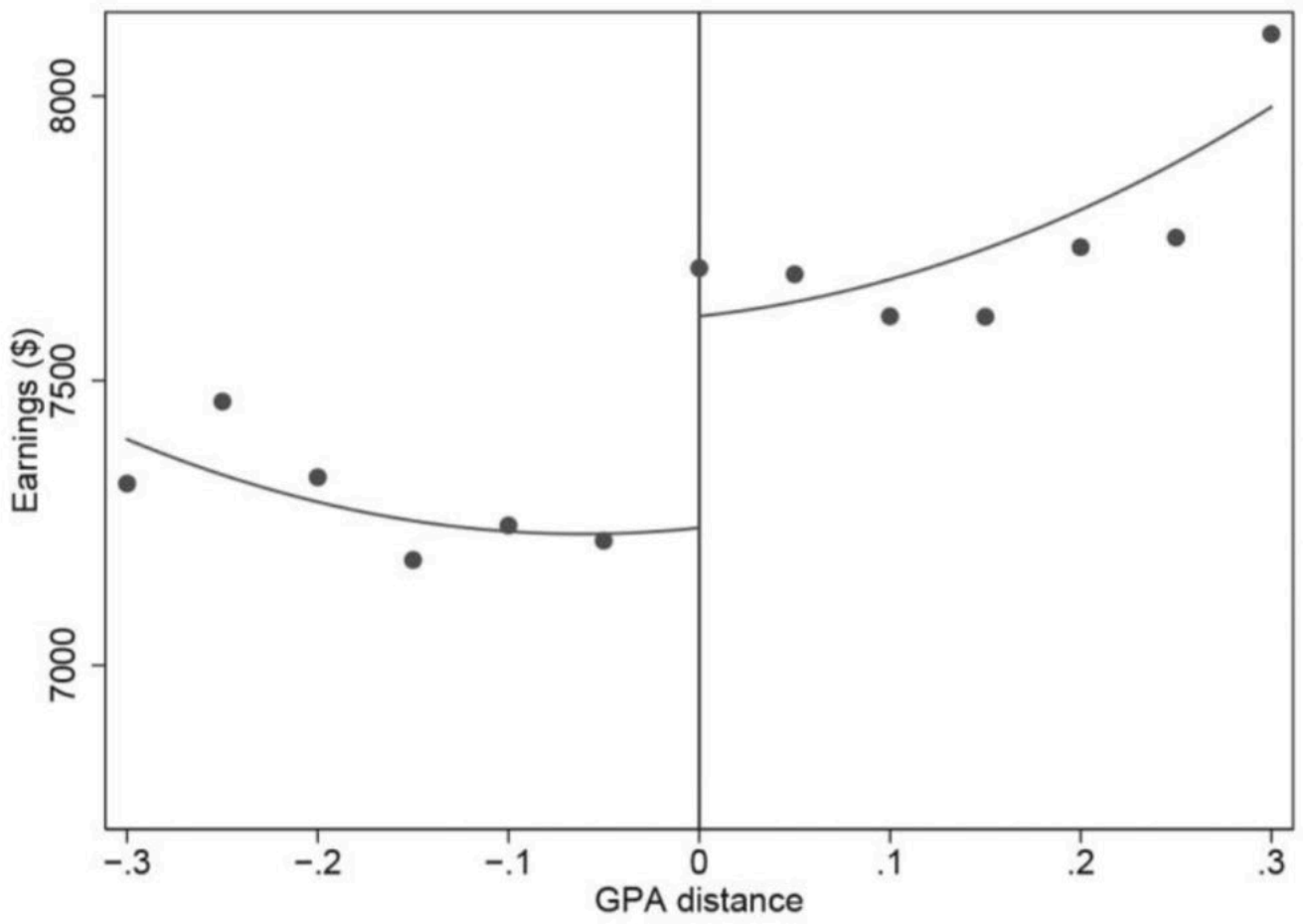
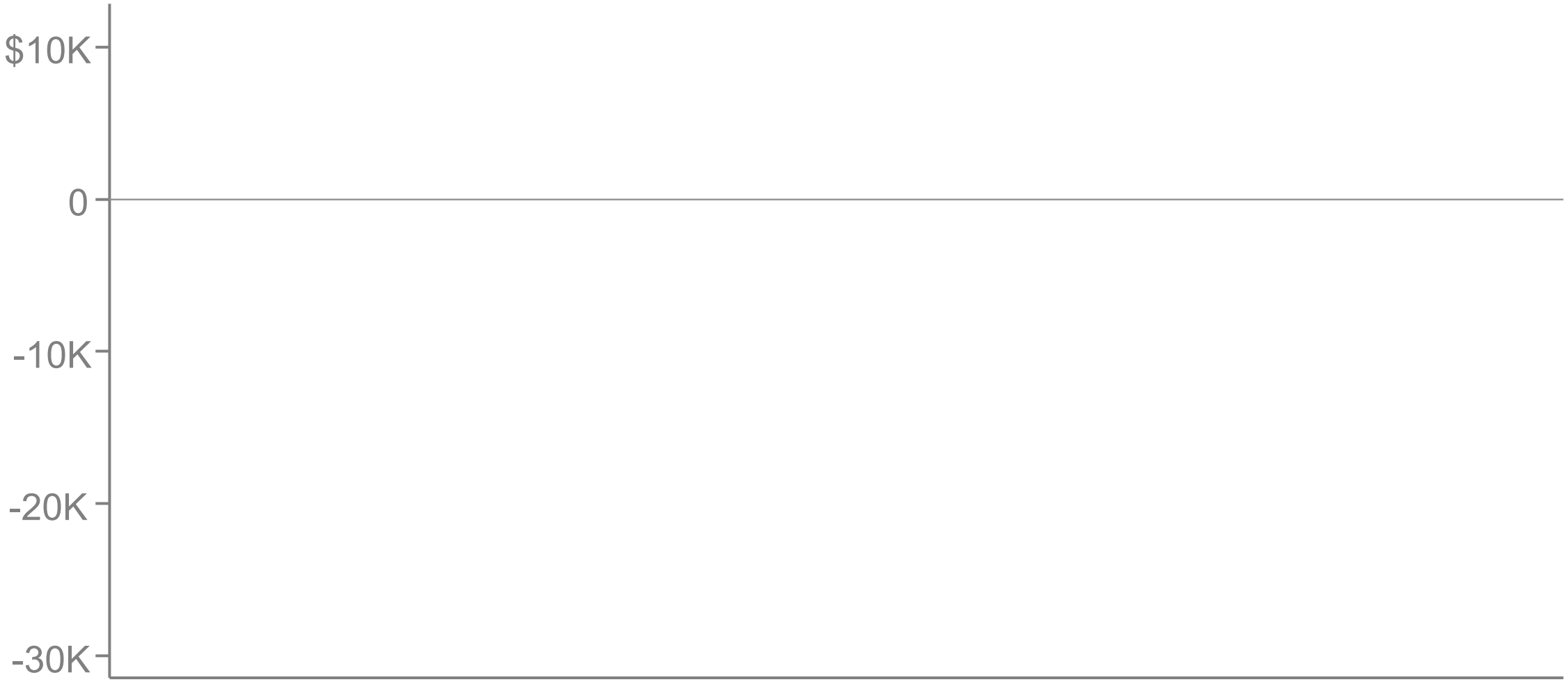


FIG. 8.—Quarterly earnings by distance from GPA cutoff. Lines are fitted values based on the main specification. Dots, shown every .05 grade points, are rolling averages of values within .05 grade points on either side that have the same value of the threshold-crossing dummy.

Net Cost to Government of Admission to Florida International University



Note: All amounts in 2005 USD, discounted using a 3% real interest rate

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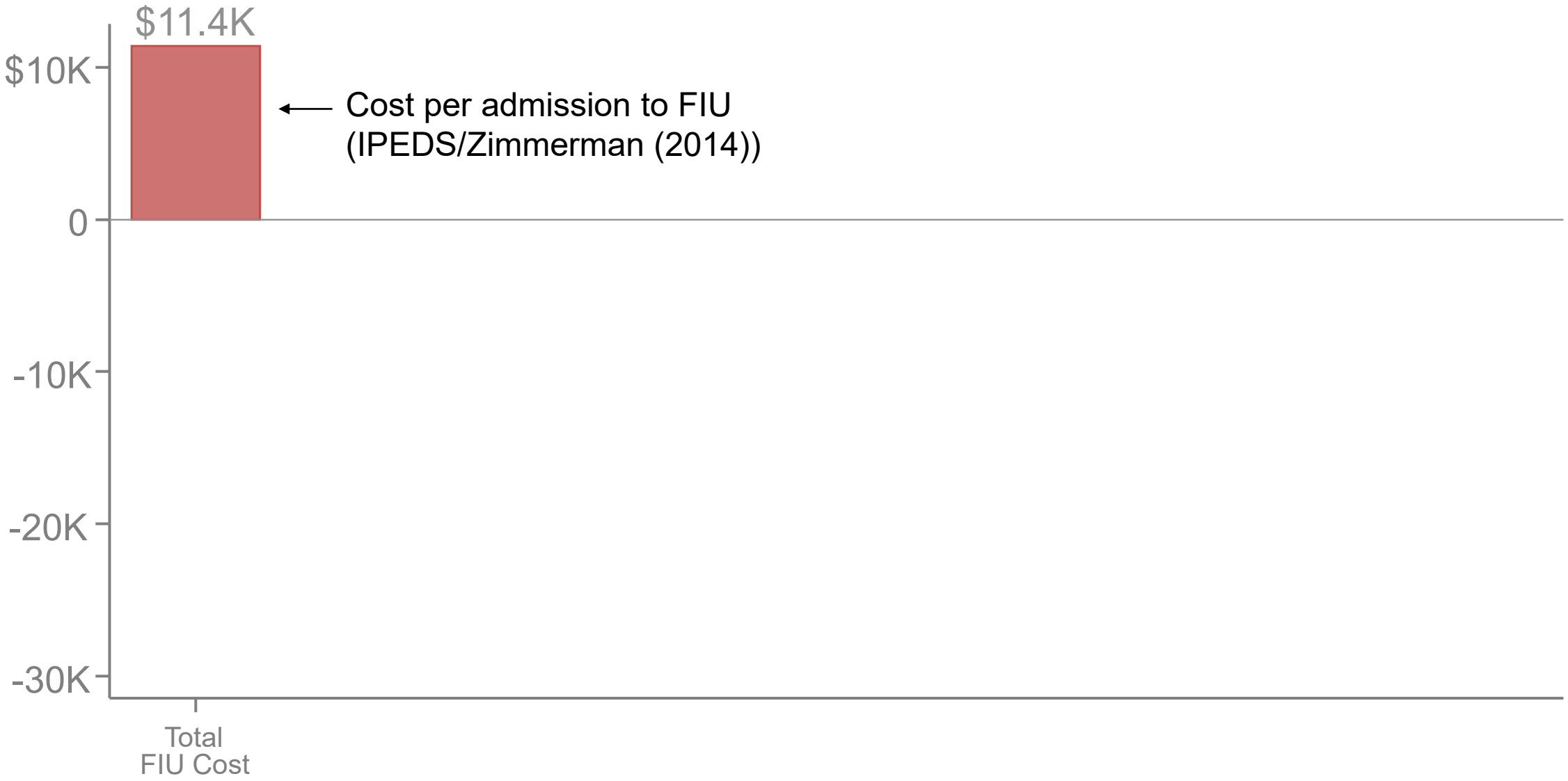

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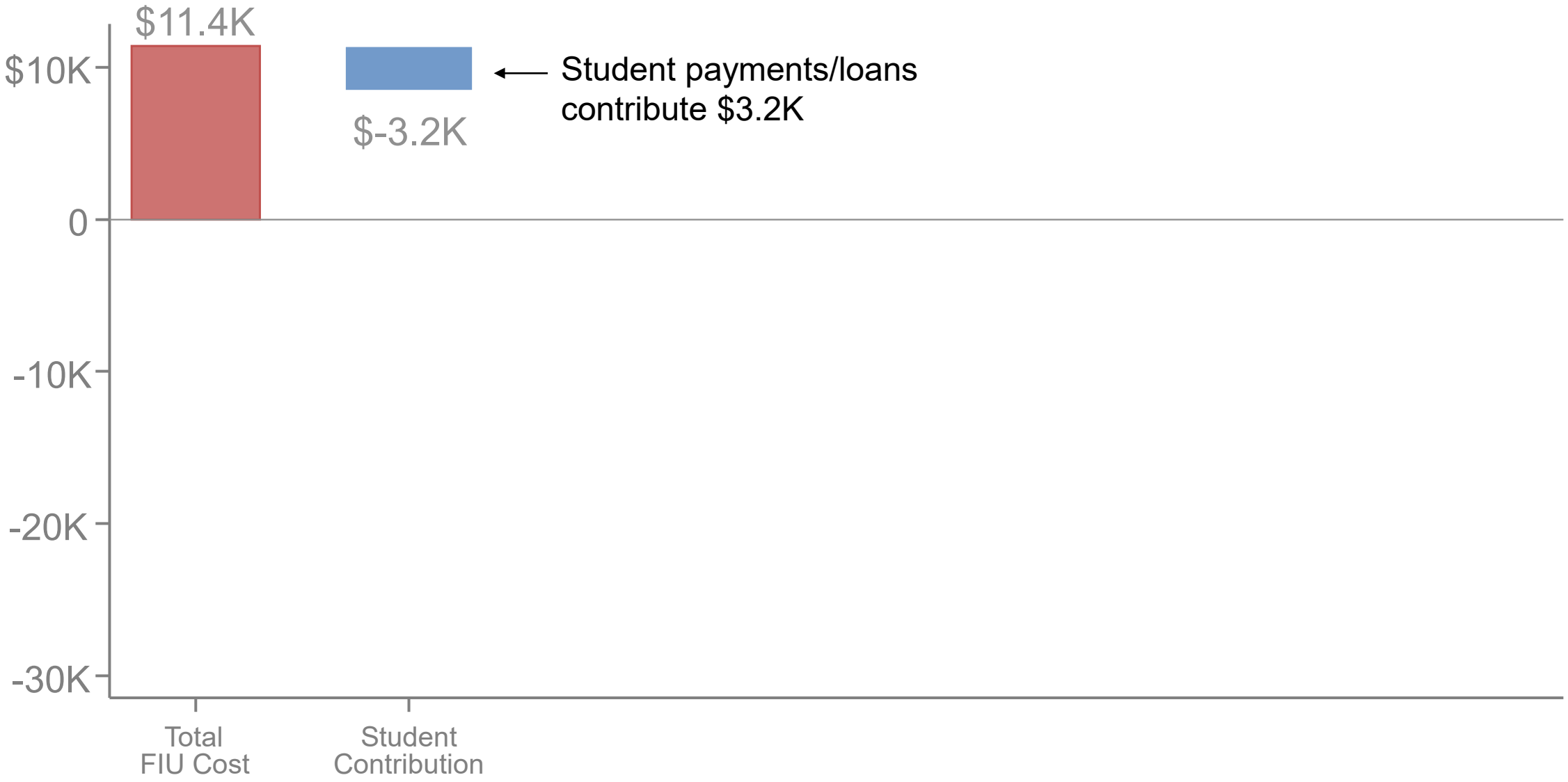

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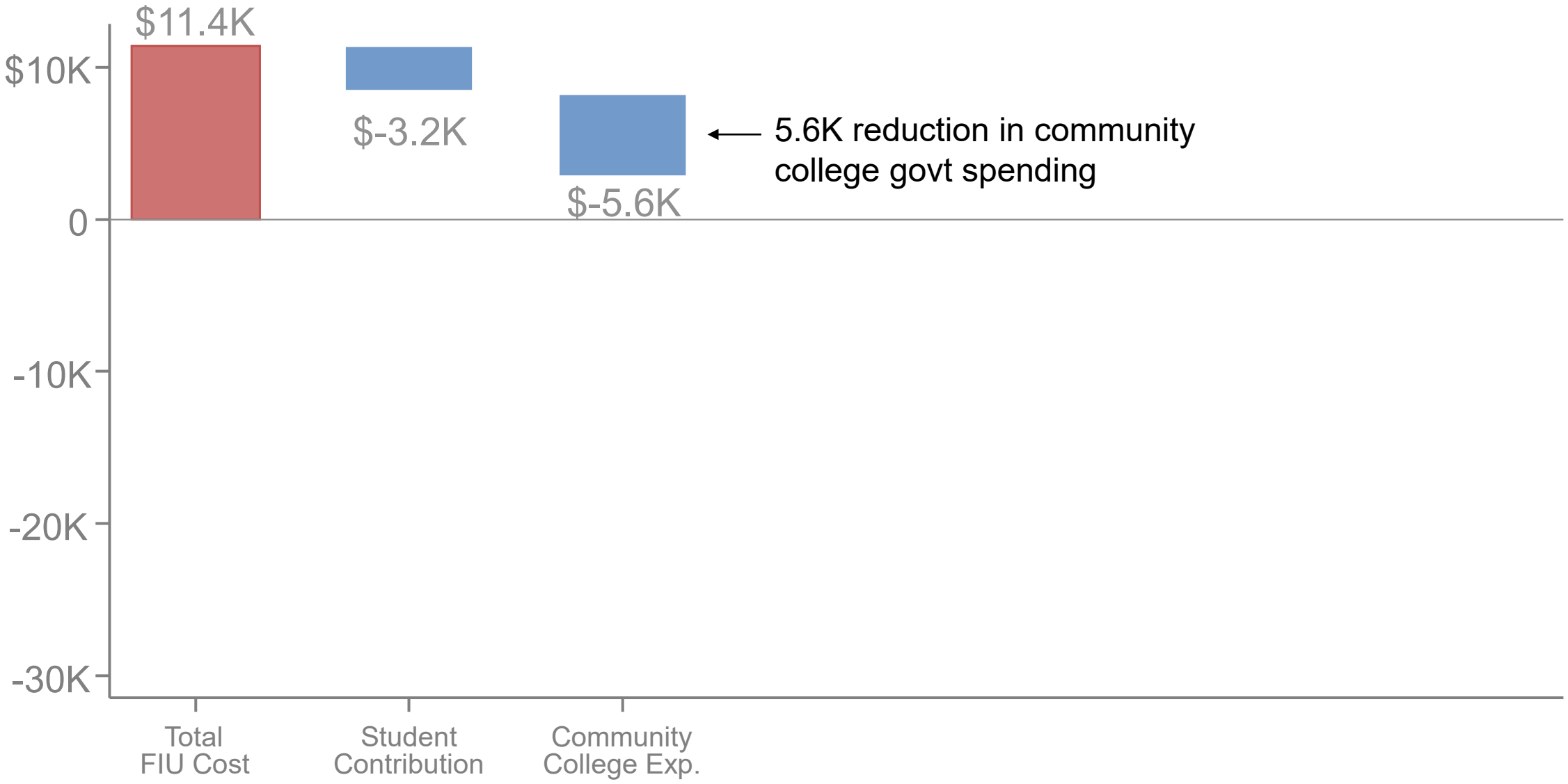

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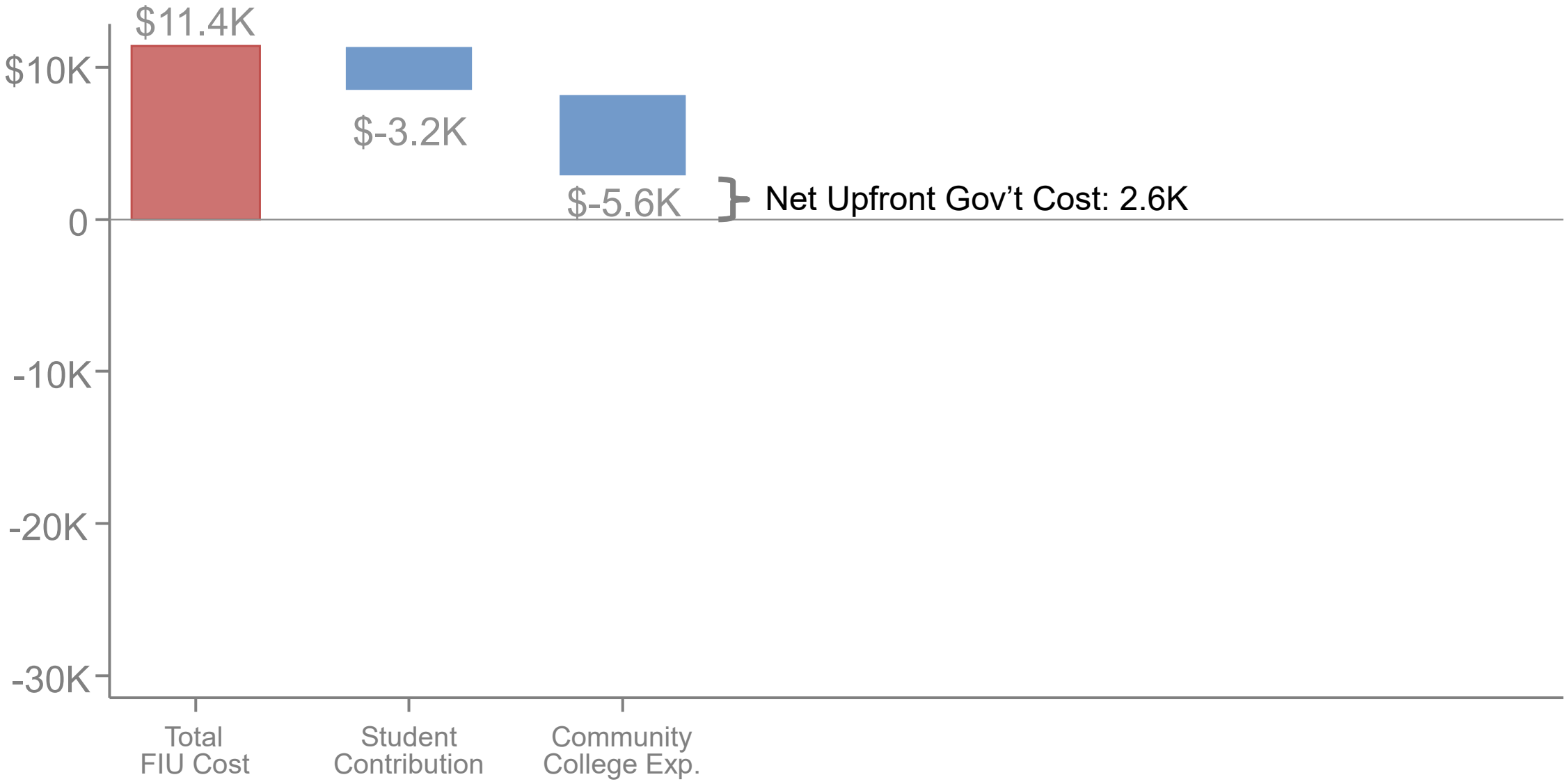

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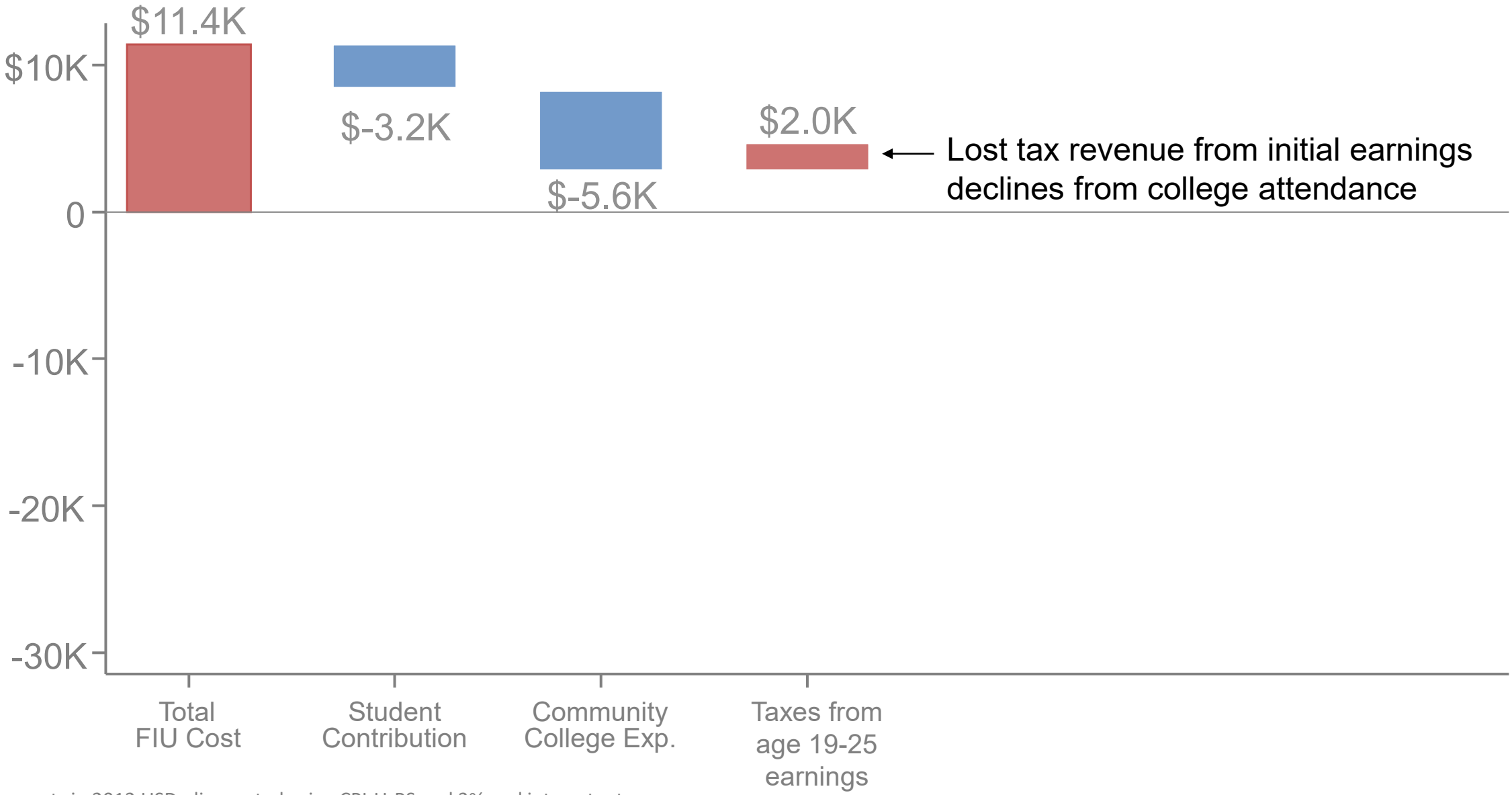

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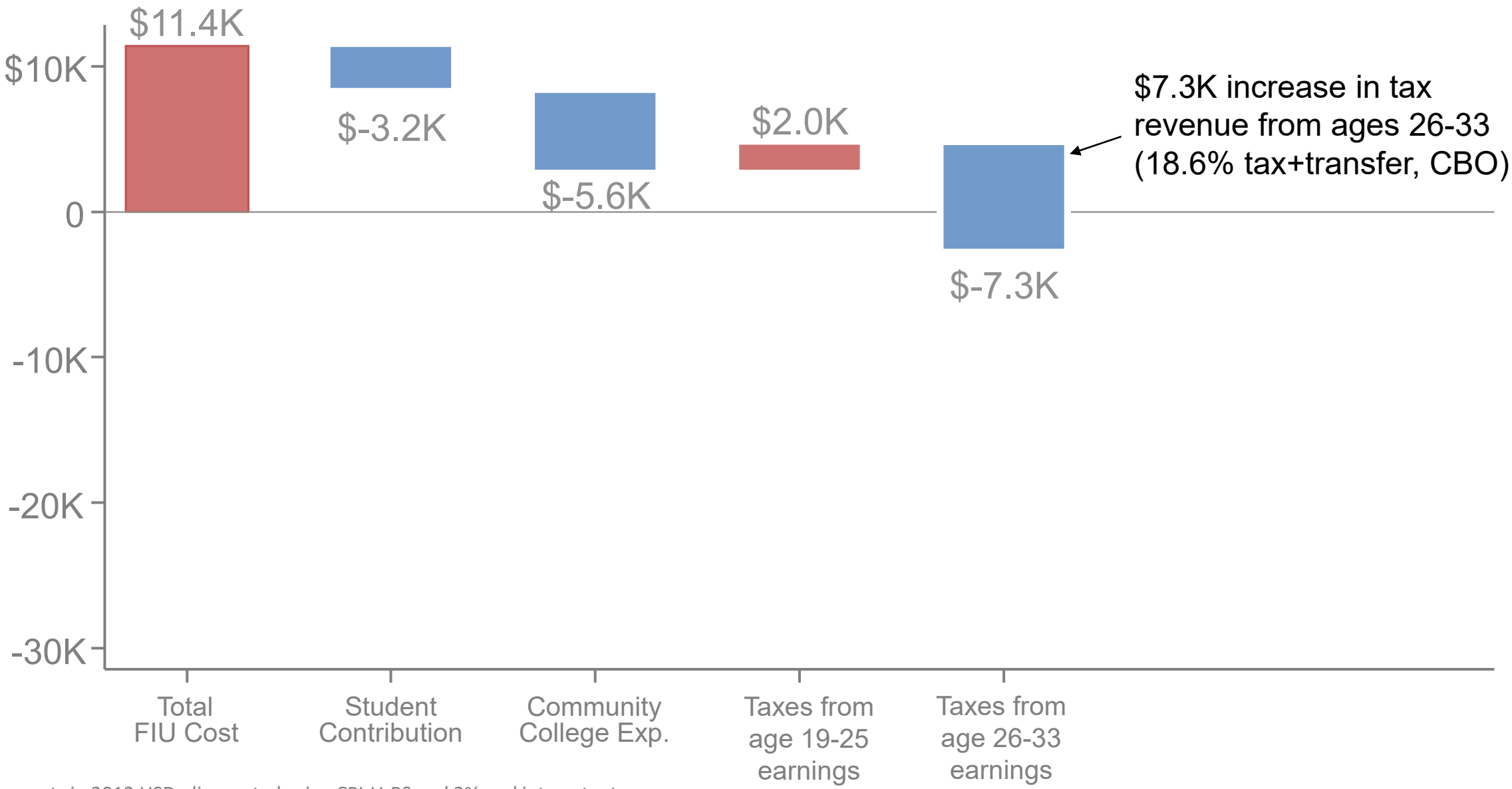

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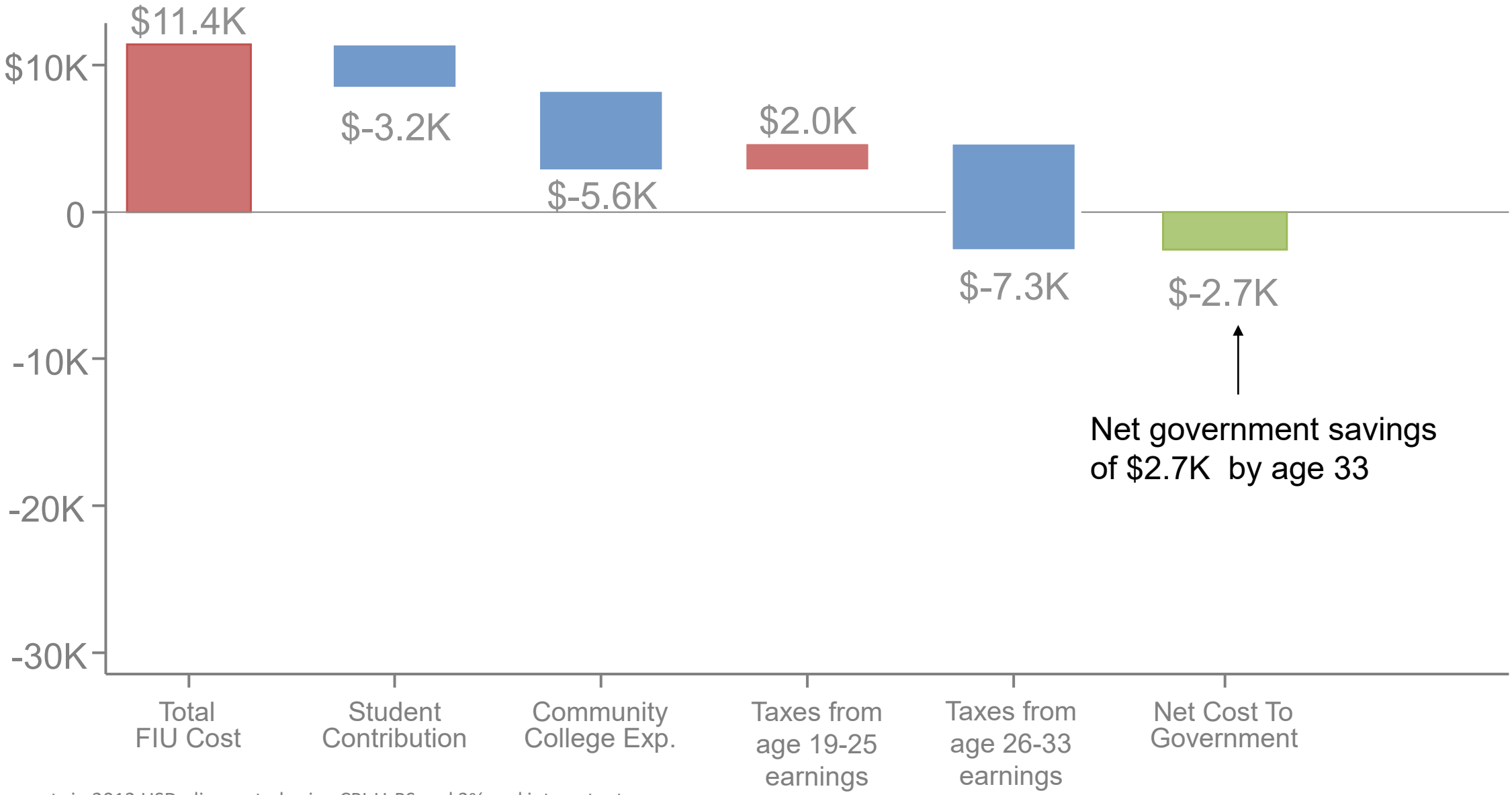

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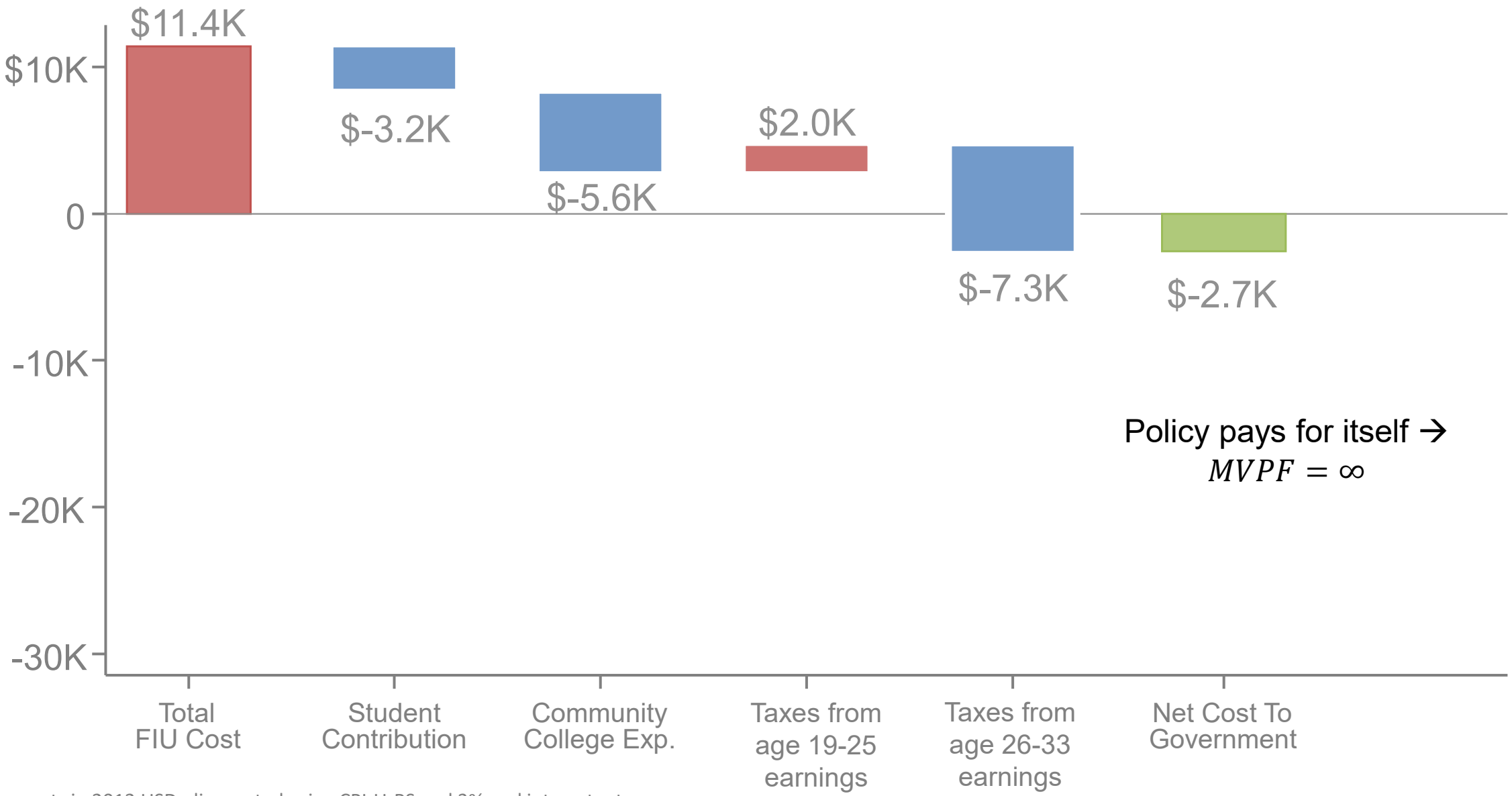

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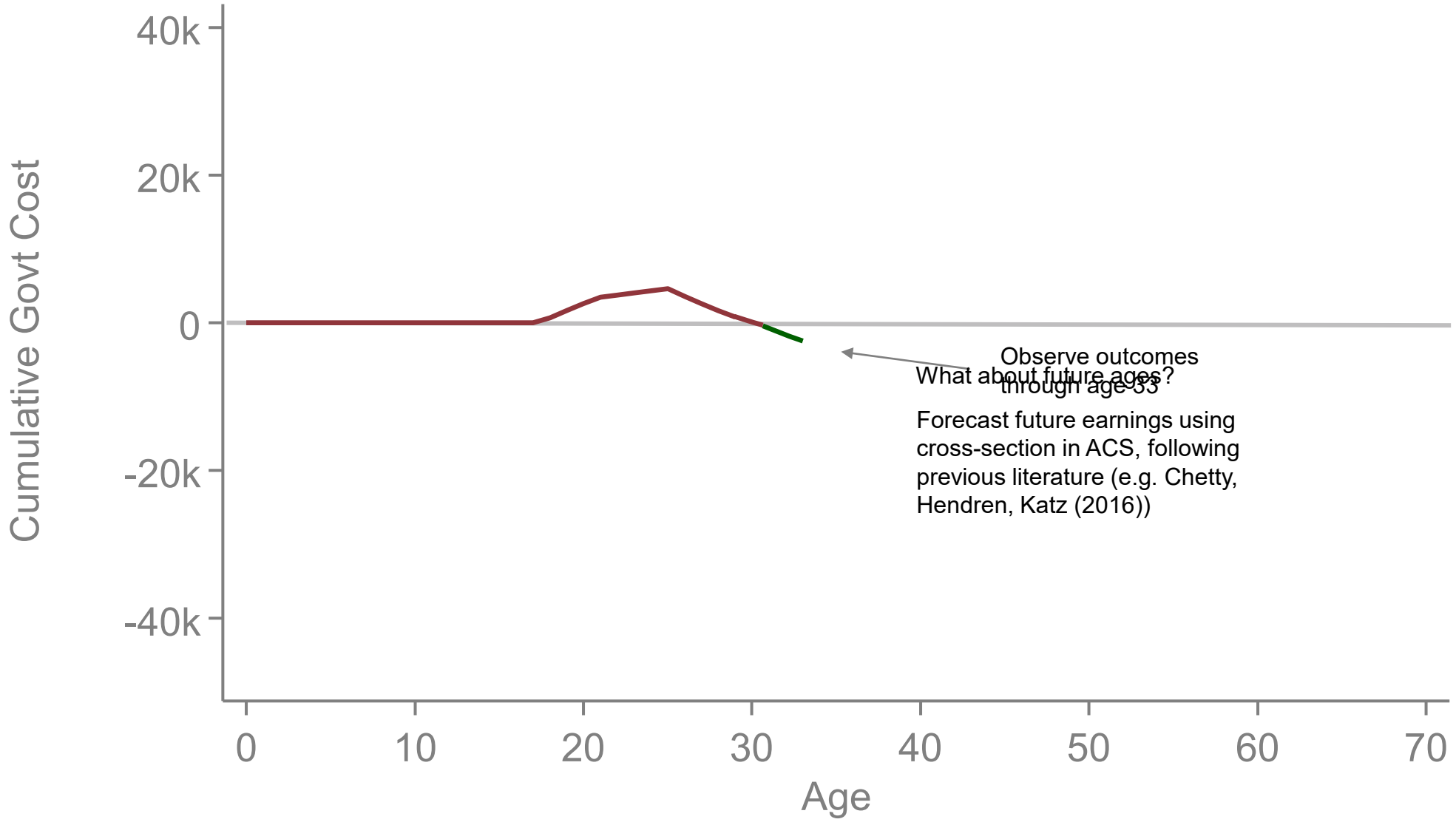
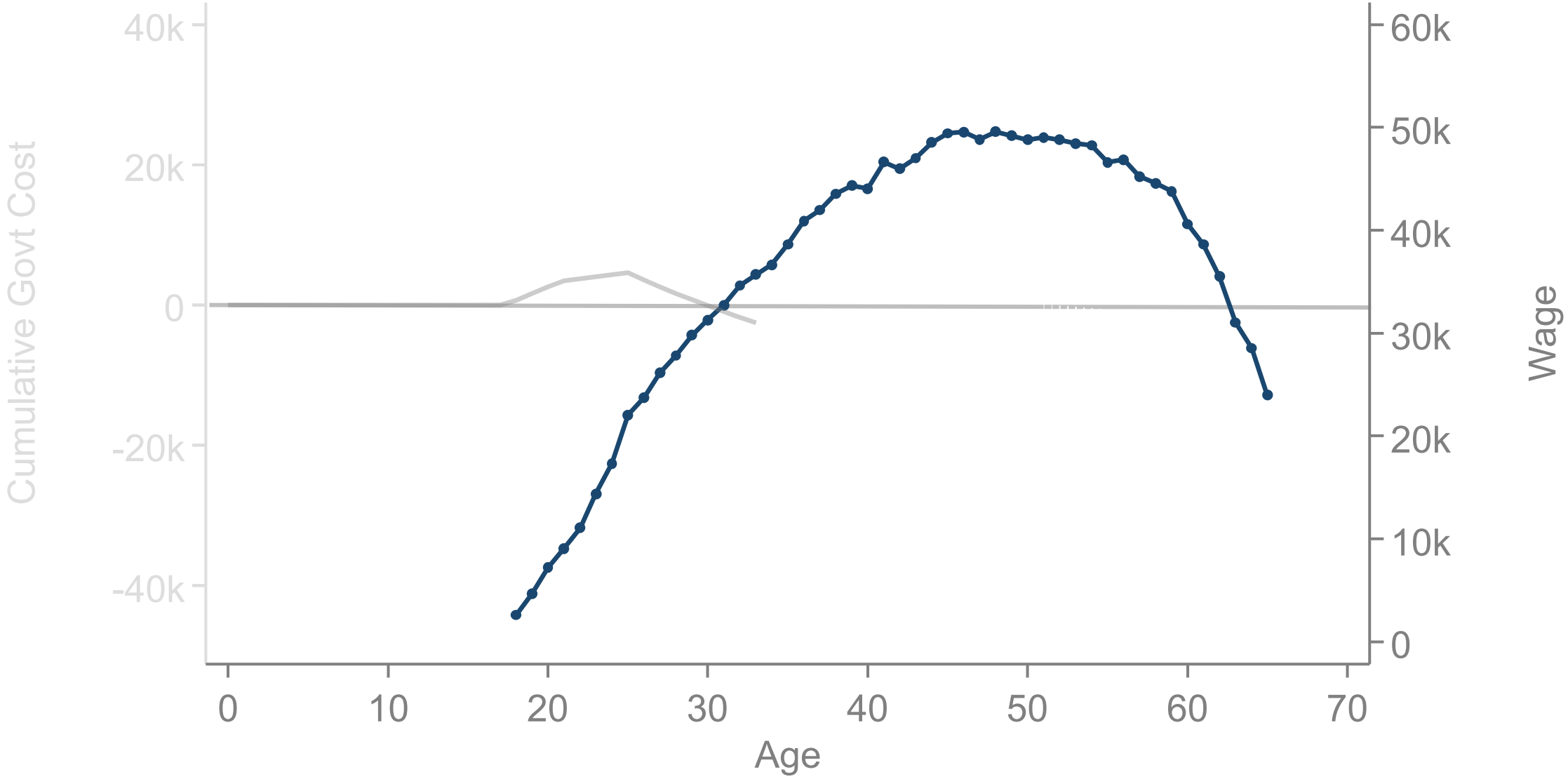
Net Cost by Age to Government of Admission to Florida International University



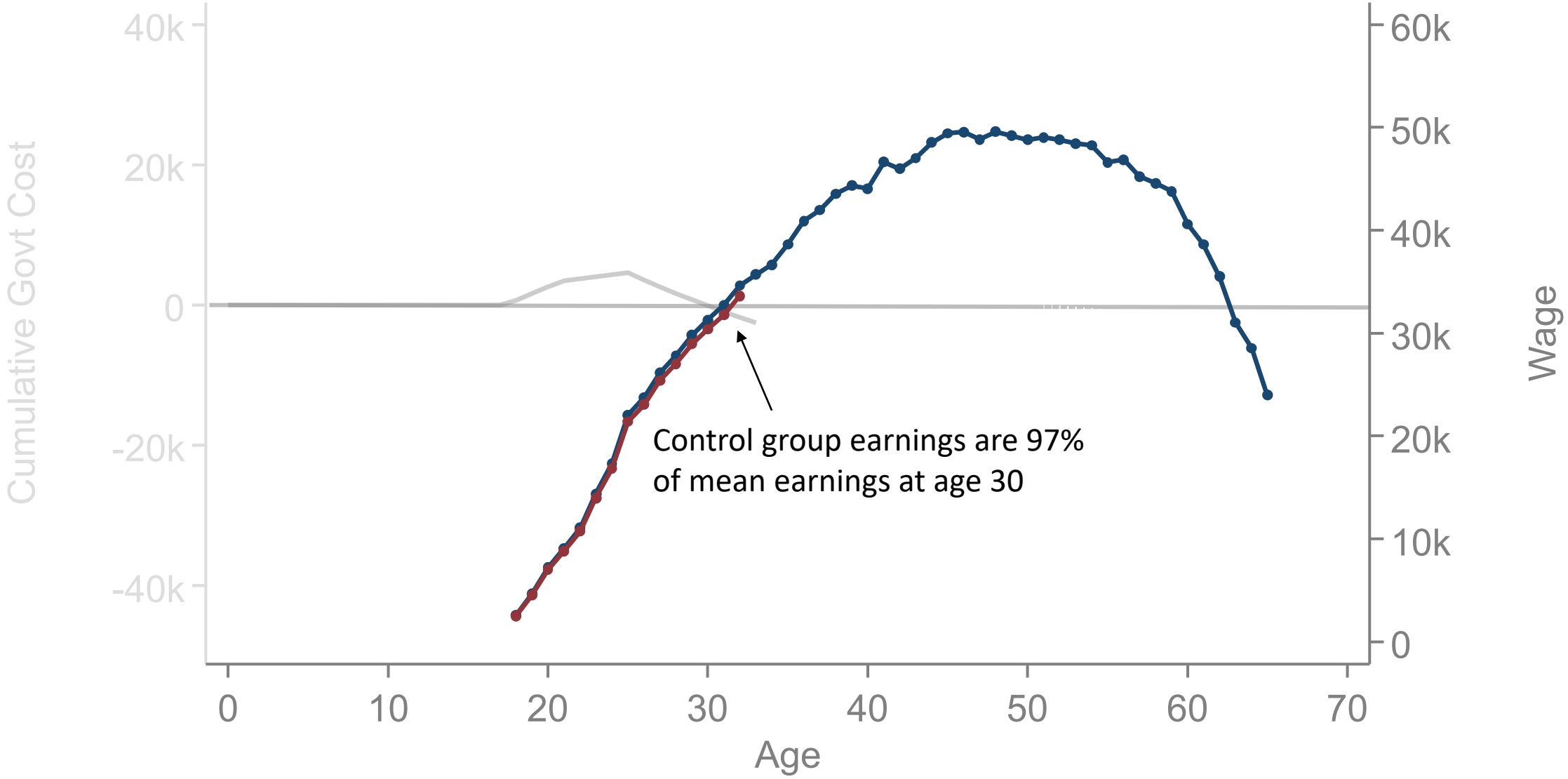
Forecasting Future Earnings using the Cross-sectional Age Distribution

Mean 2015 ACS Earnings by Age with 0.5% Growth



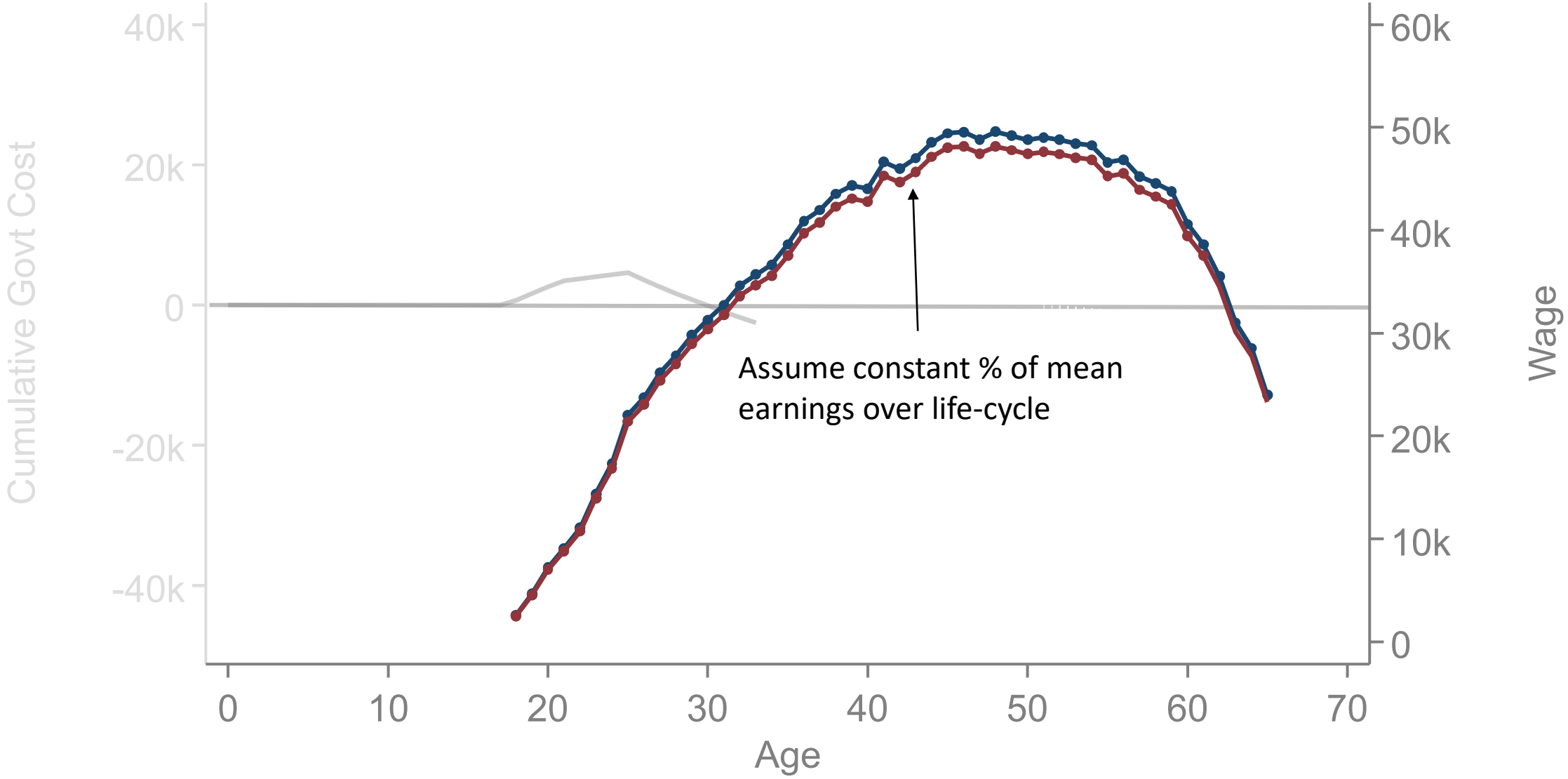
Forecasting Future Earnings using the Cross-sectional Age Distribution

Control Group Earnings



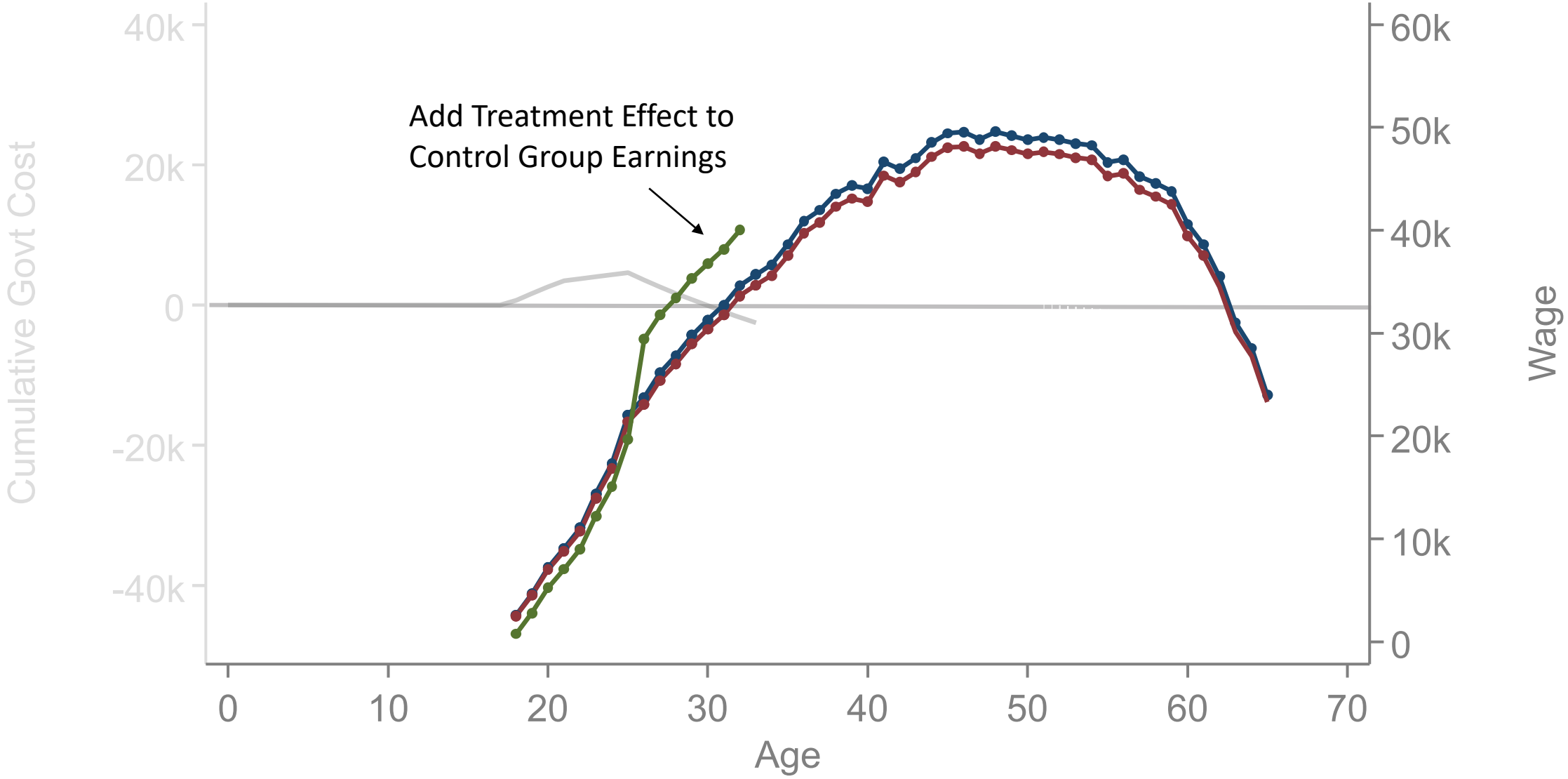
Forecasting Future Earnings using the Cross-sectional Age Distribution

Control Group Forecast



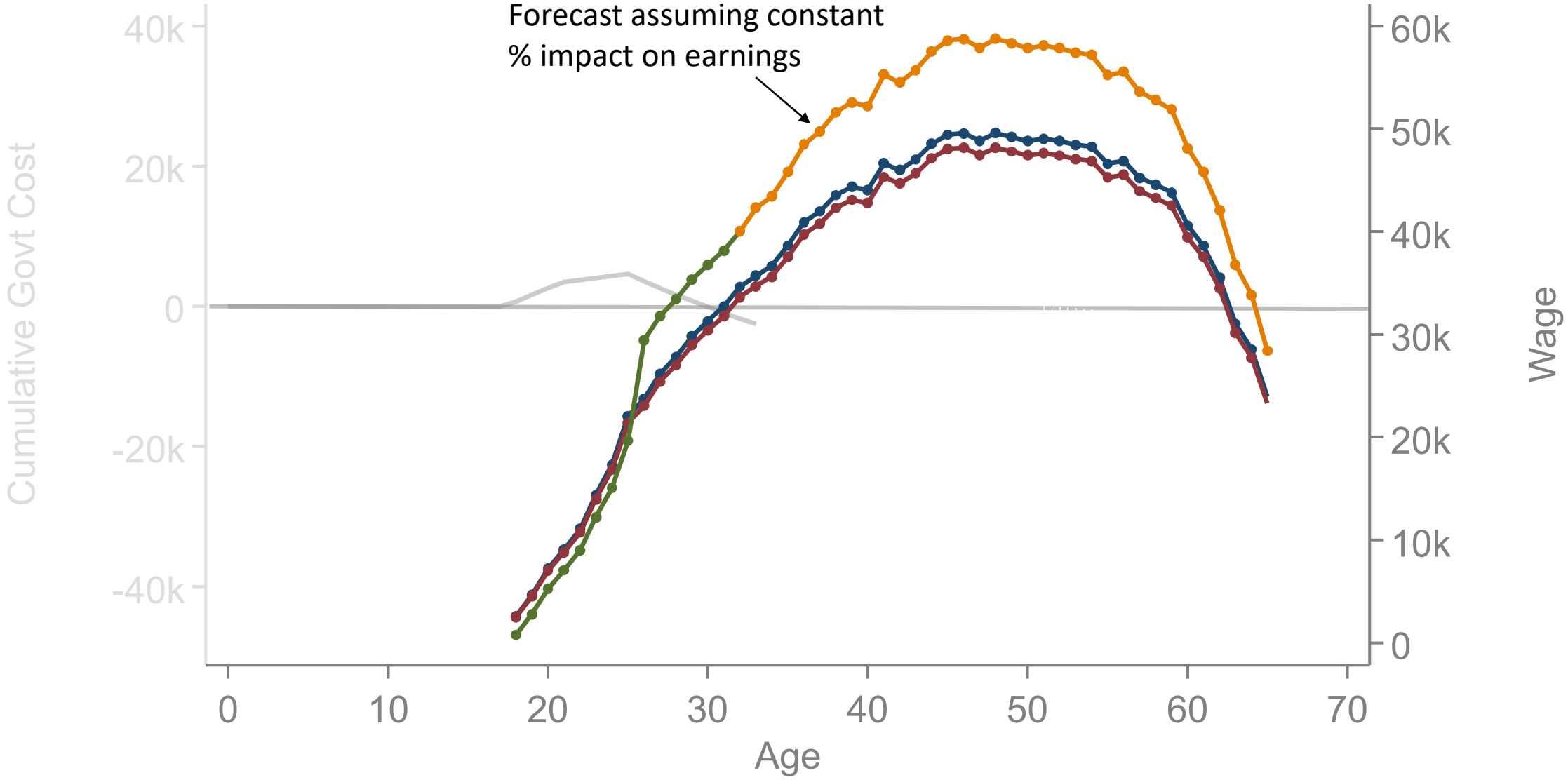
Forecasting Future Earnings using the Cross-sectional Age Distribution

Control Group Earnings + Treatment Effect



Forecasting Future Earnings using the Cross-sectional Age Distribution

Treatment Group Forecast



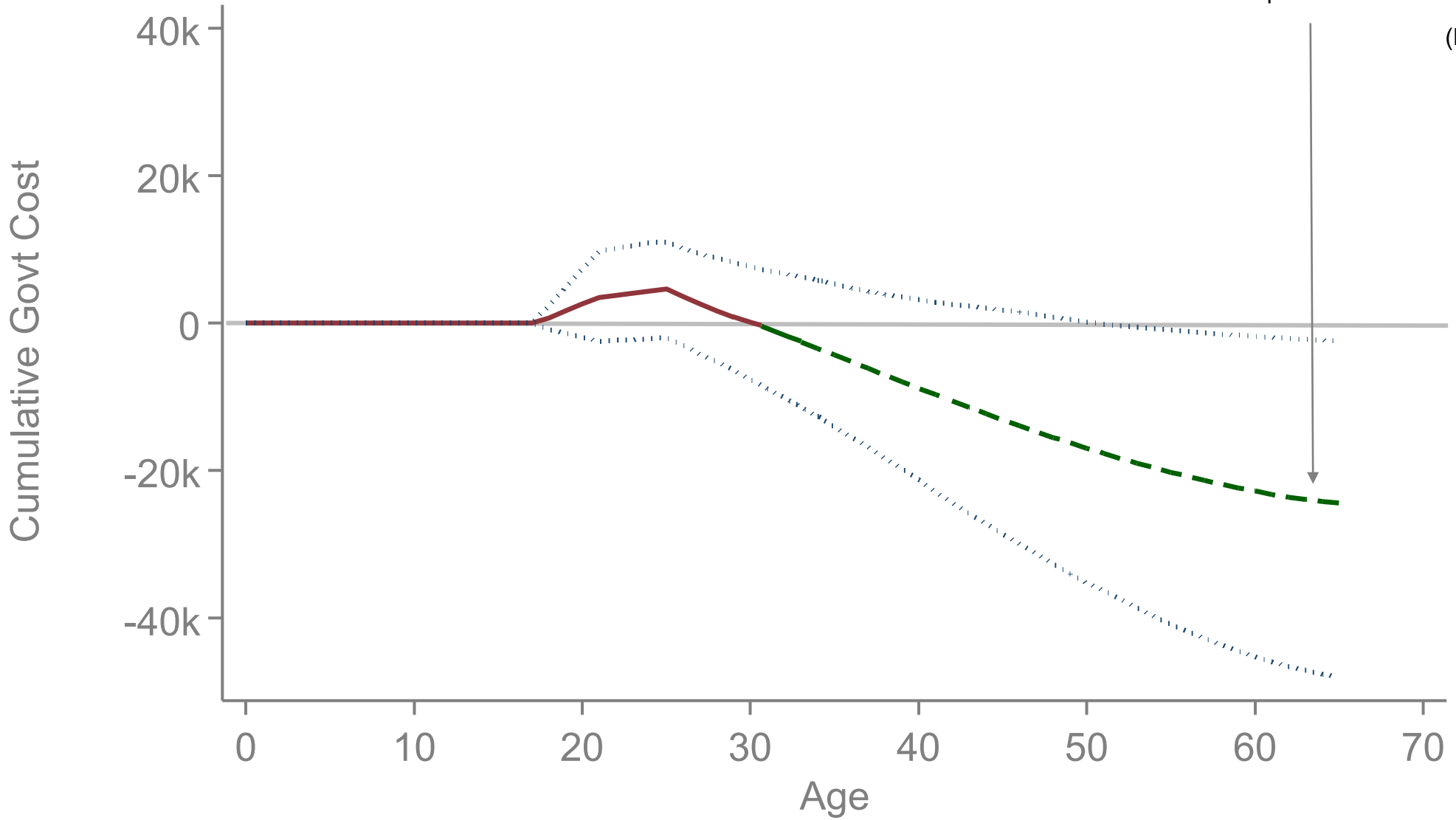
Net Cost by Age to Government of Admission to Florida International University

Forecasting Future Tax/Transfer Revenue

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

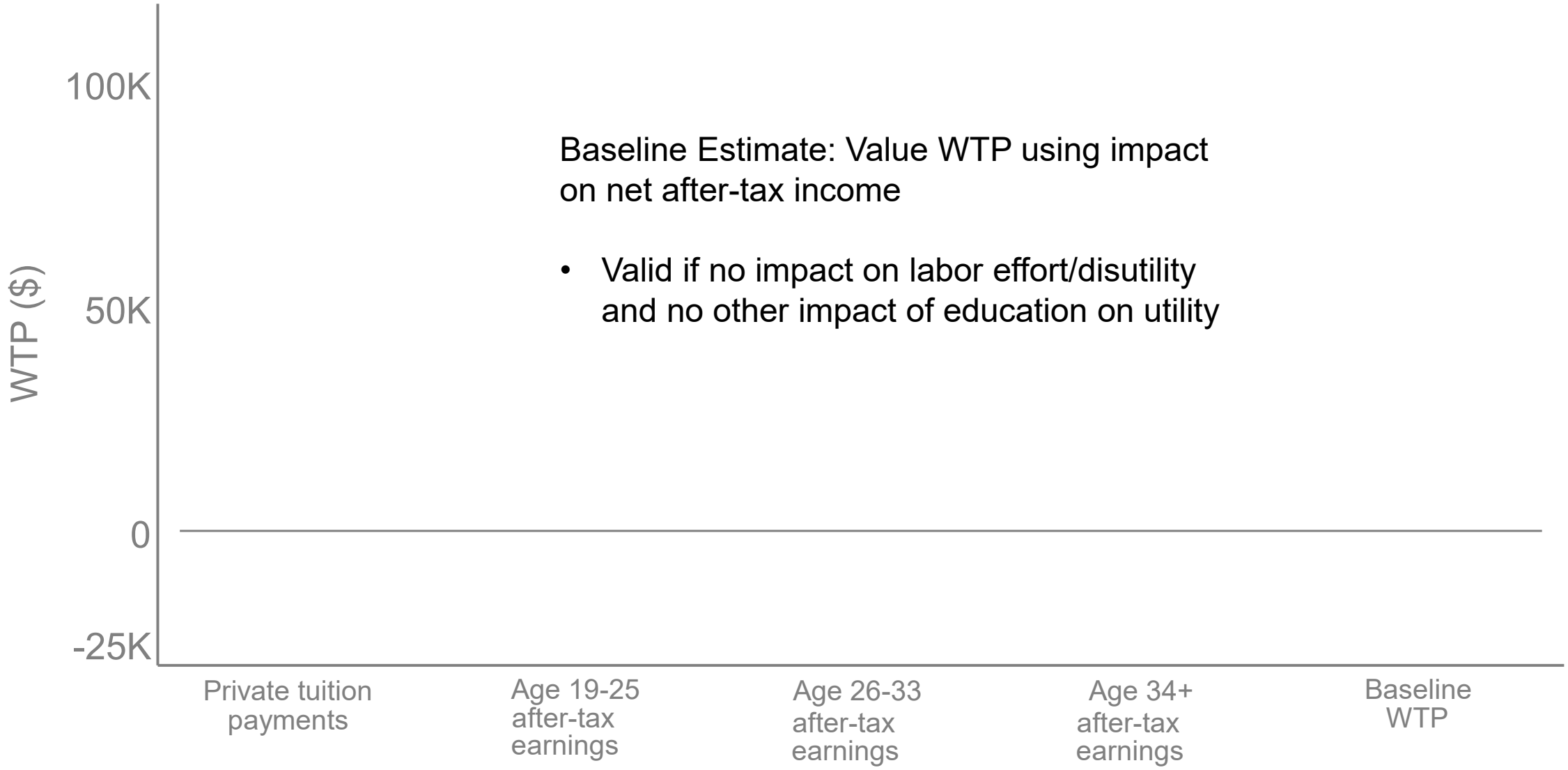
$$MVPF = \infty$$

(Regardless of WTP)



Willingness to Pay for Admission into Florida International University

Baseline WTP

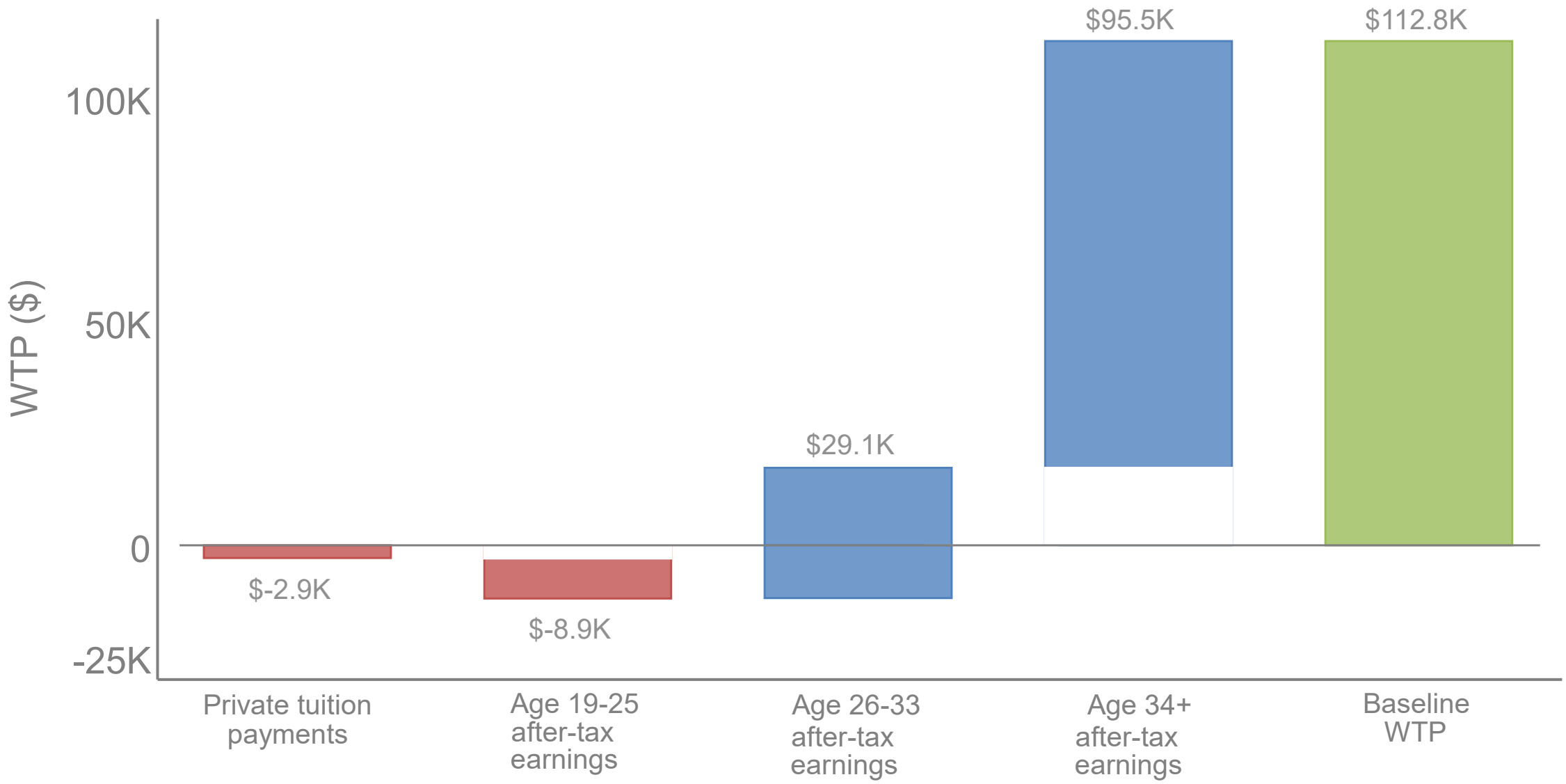


Baseline Estimate: Value WTP using impact on net after-tax income

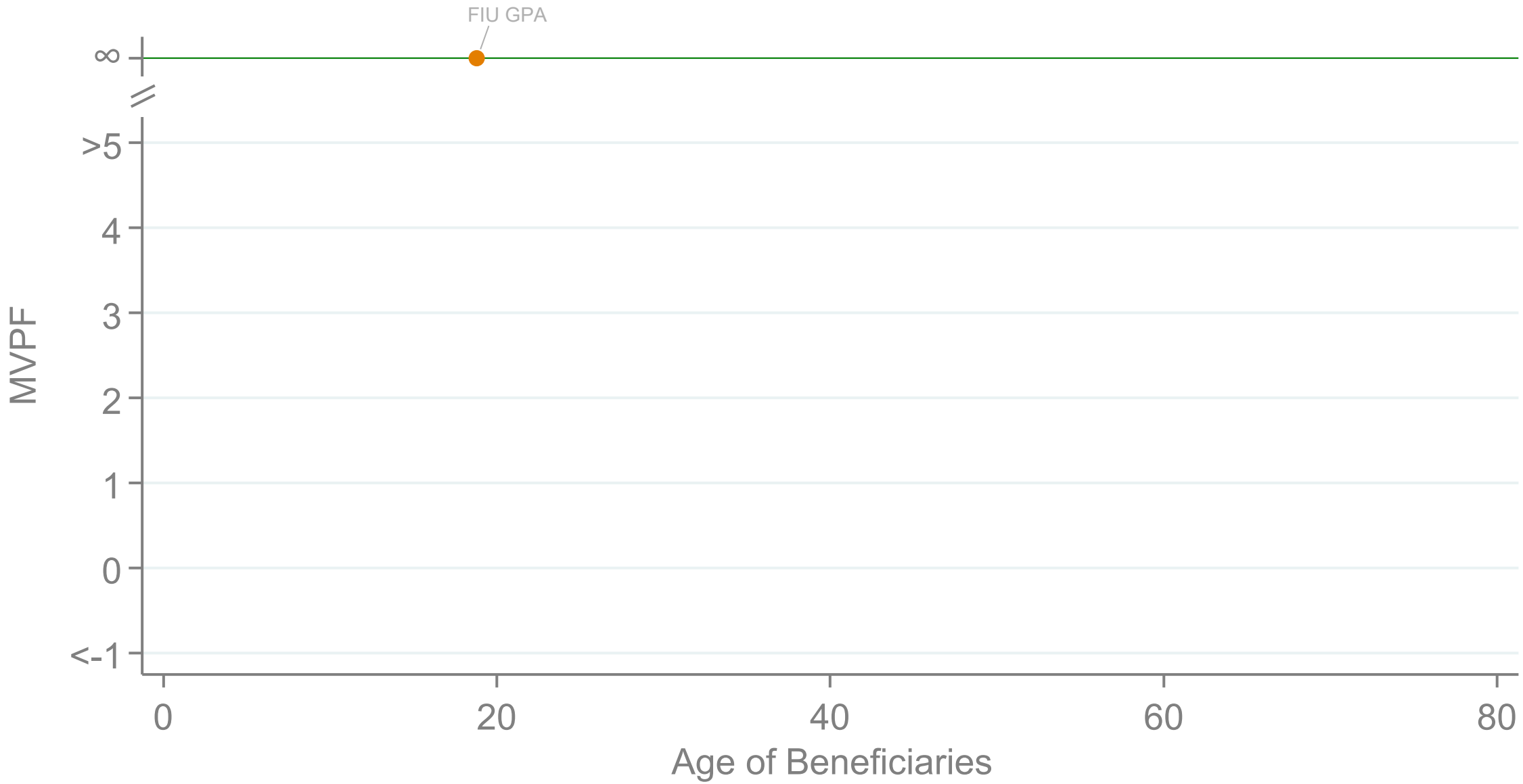
- Valid if no impact on labor effort/disutility and no other impact of education on utility

Willingness to Pay for Admission into Florida International University

Baseline WTP



Direct Investments in Children Historically Had Highest MVPFs



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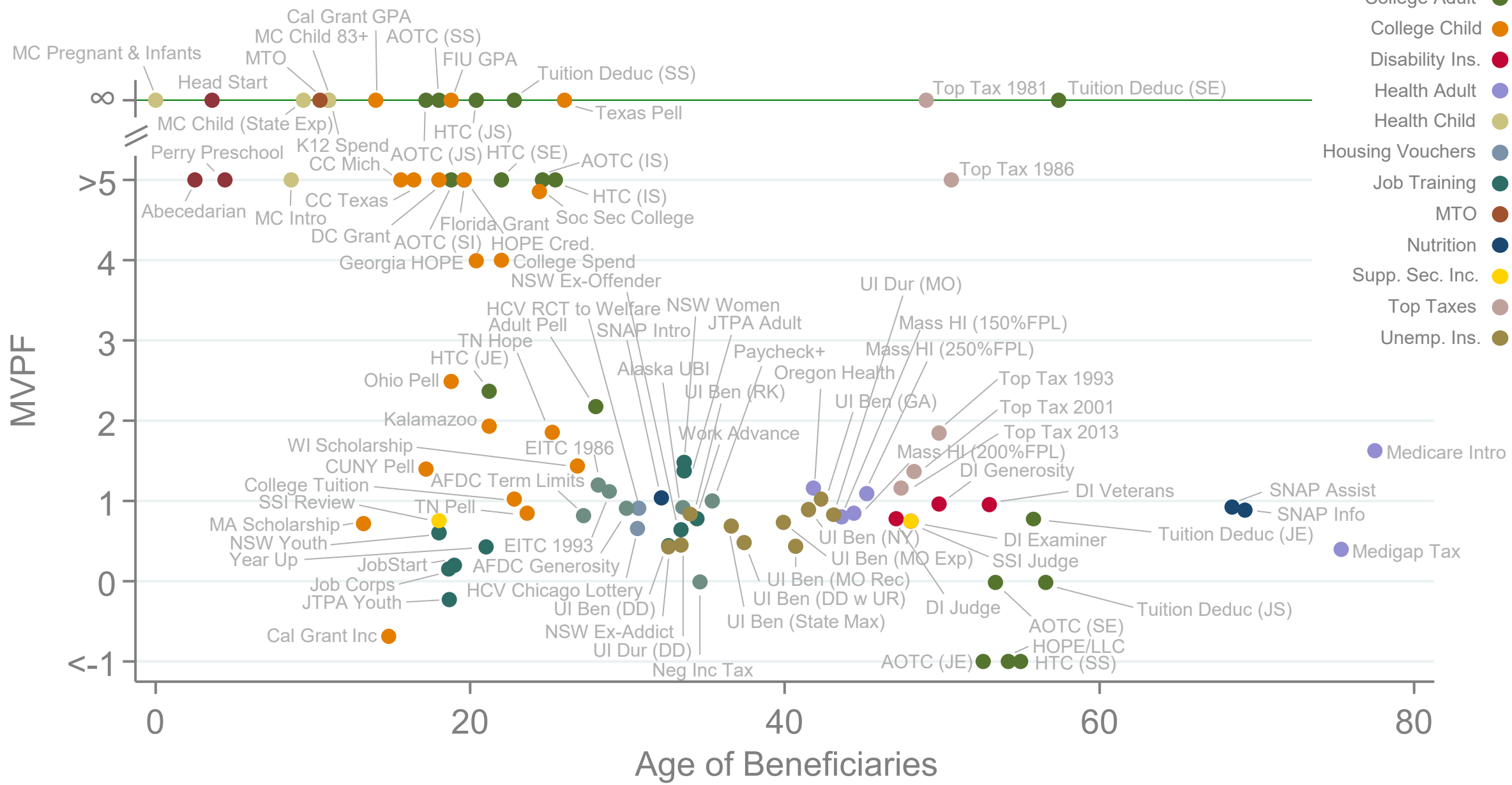

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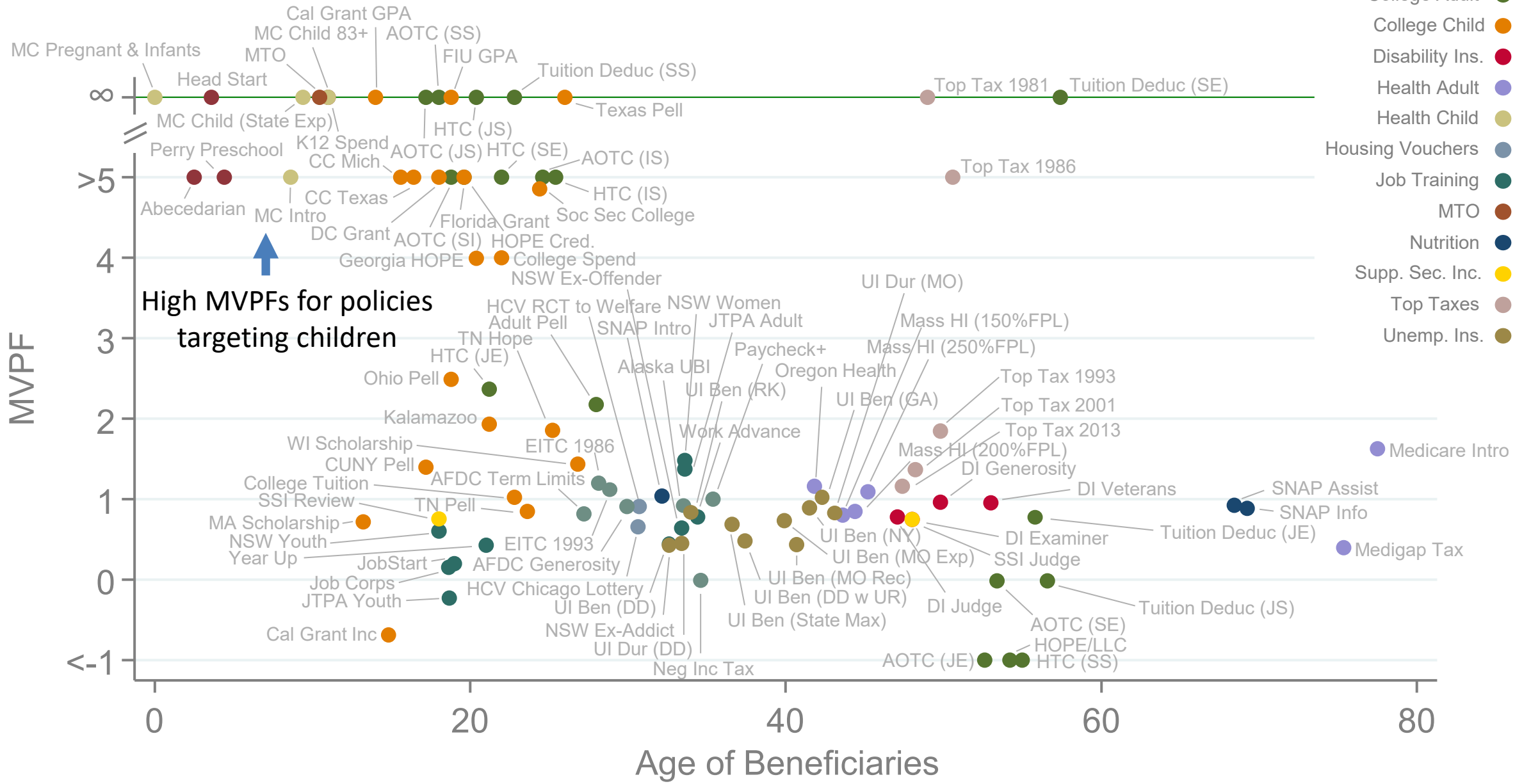

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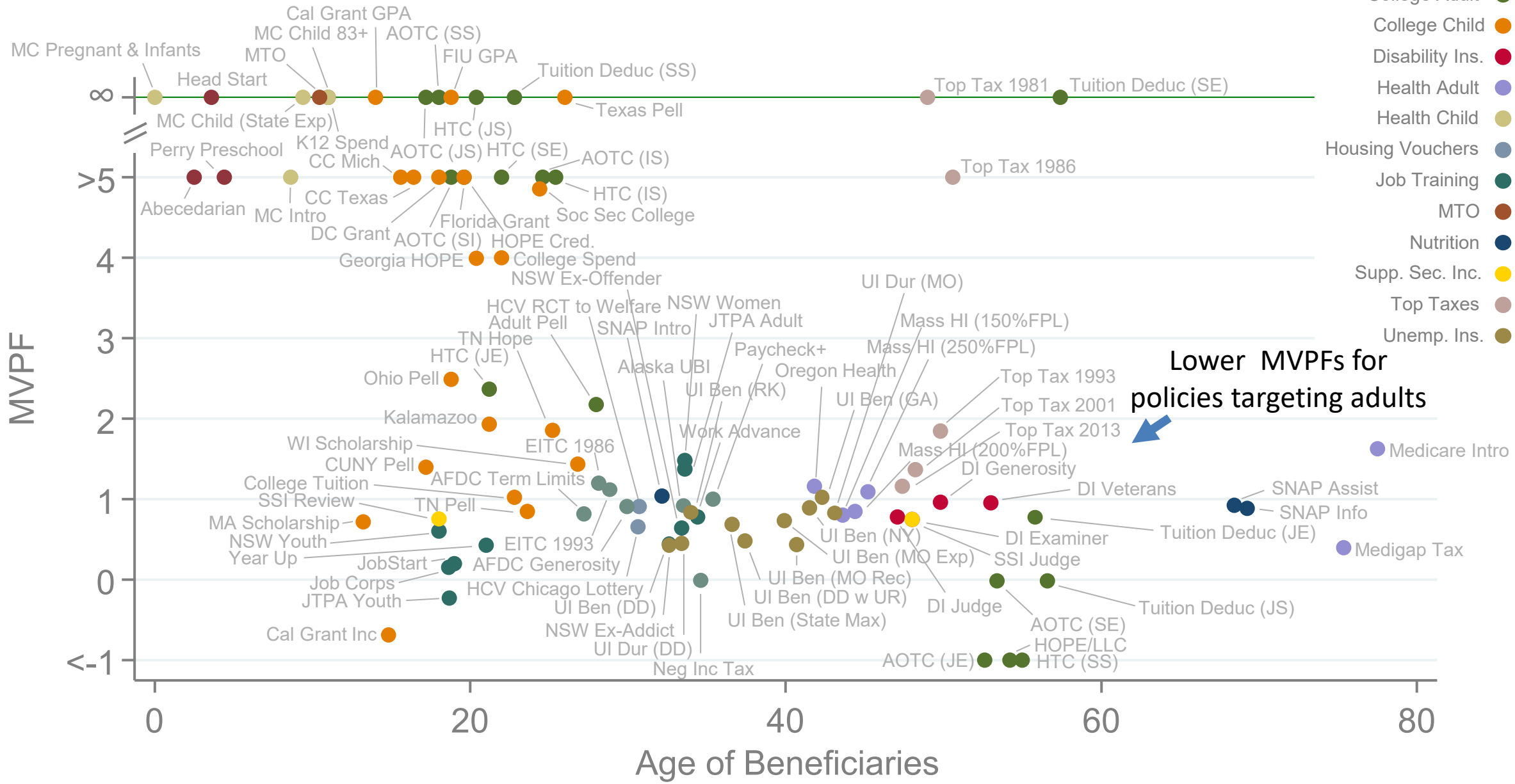
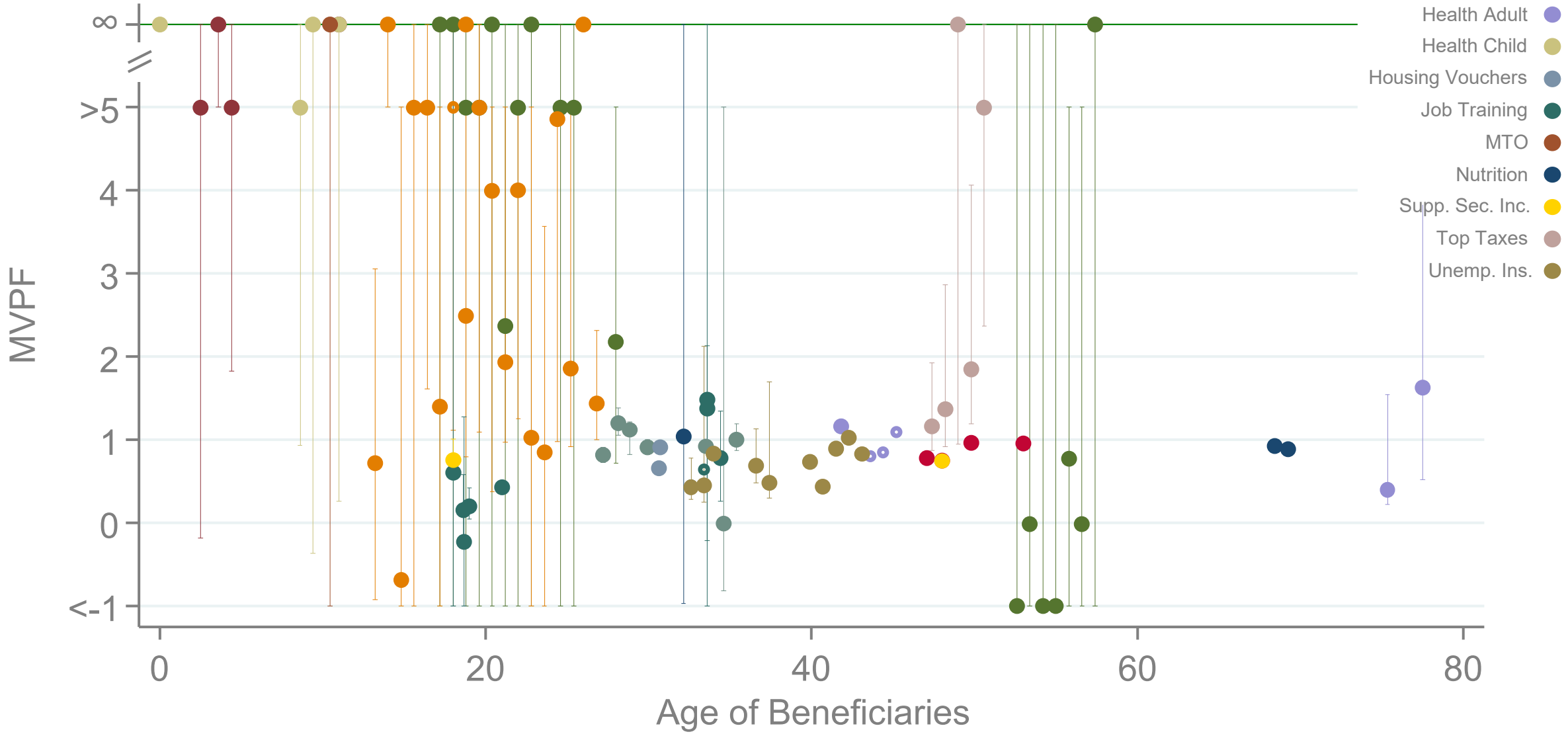
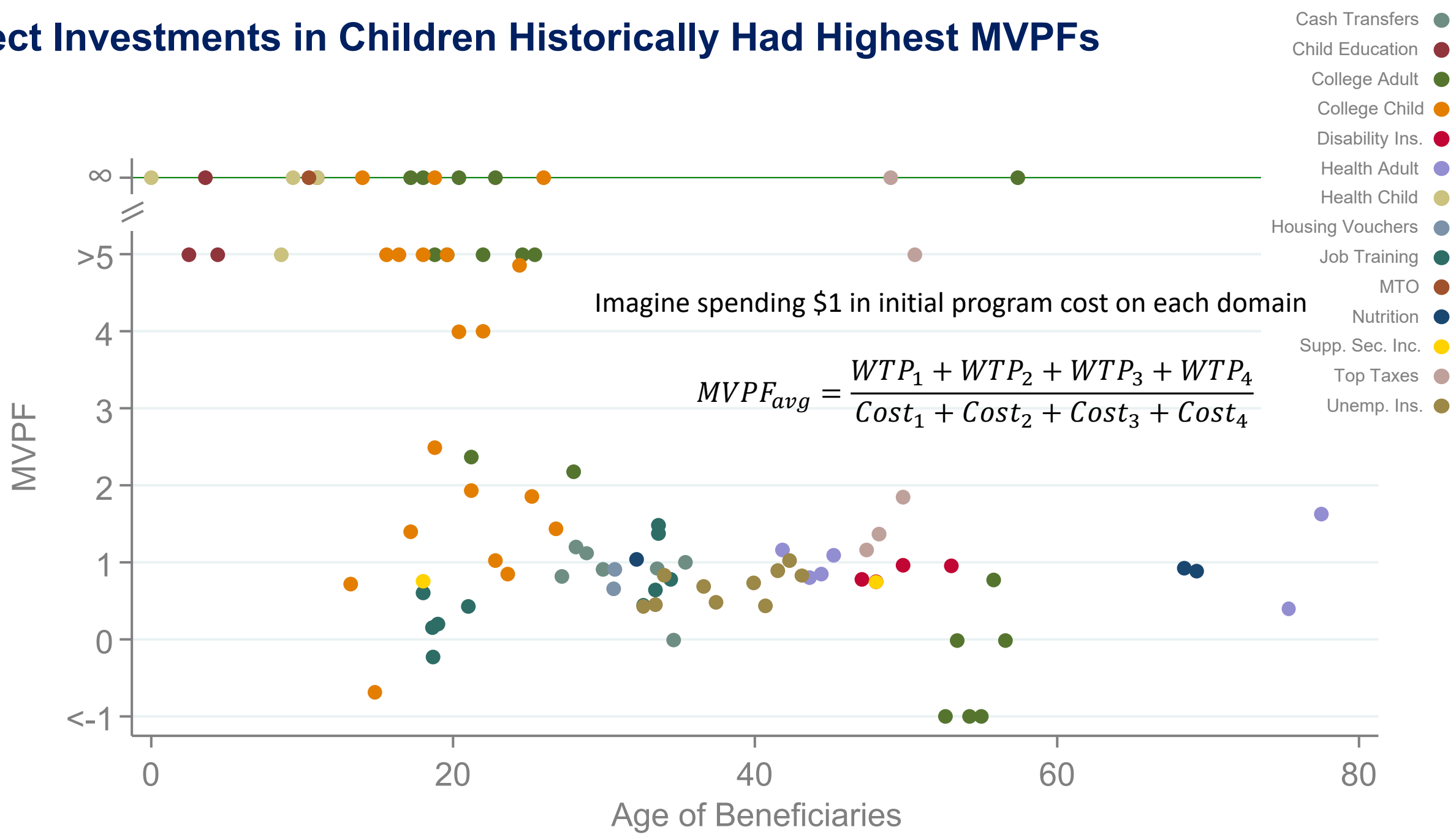


Direct Investments in Children Historically Had Highest MVPFs

With 95% Confidence Intervals Computed via Modified Bootstrap

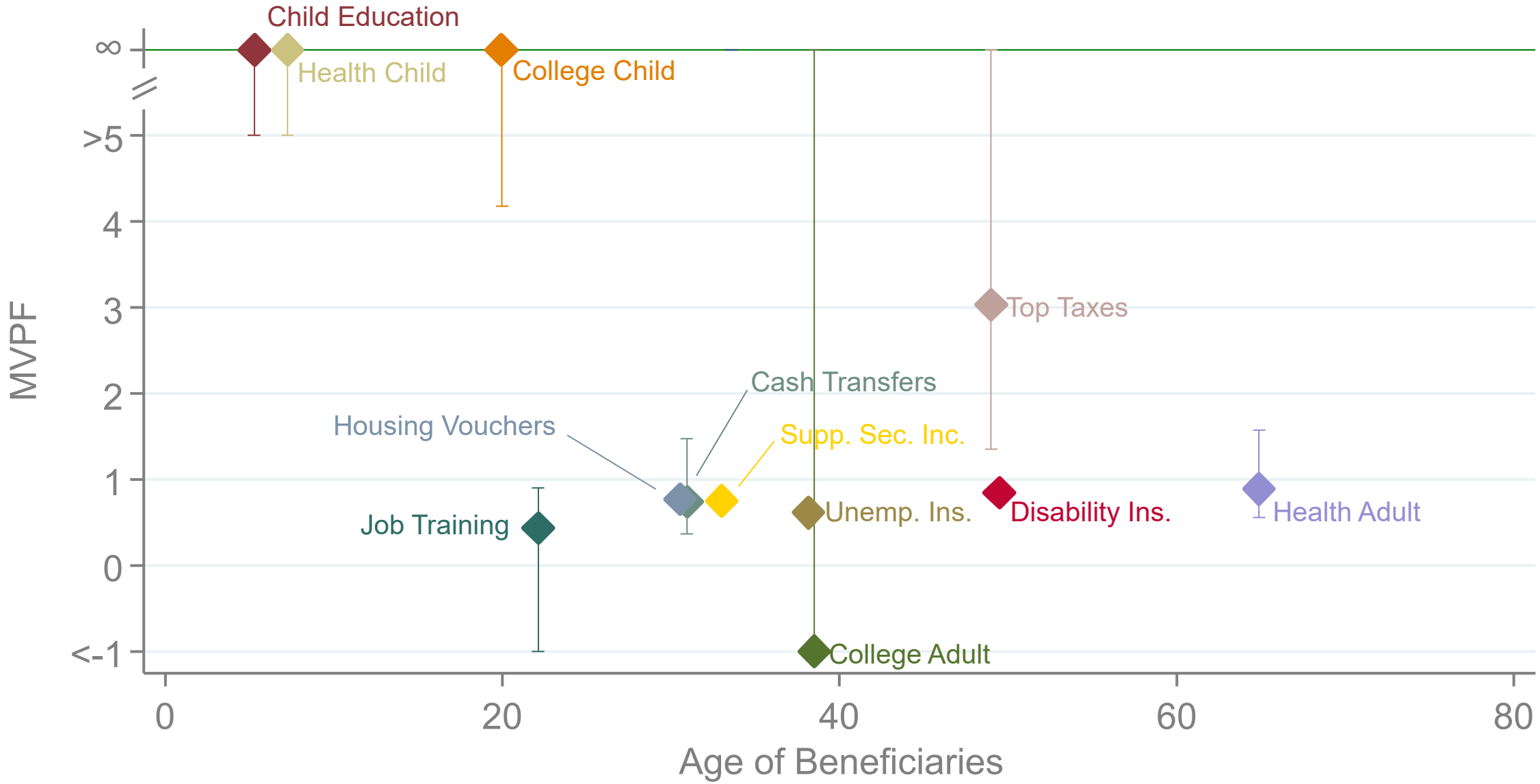


Direct Investments in Children Historically Had Highest MVPFs



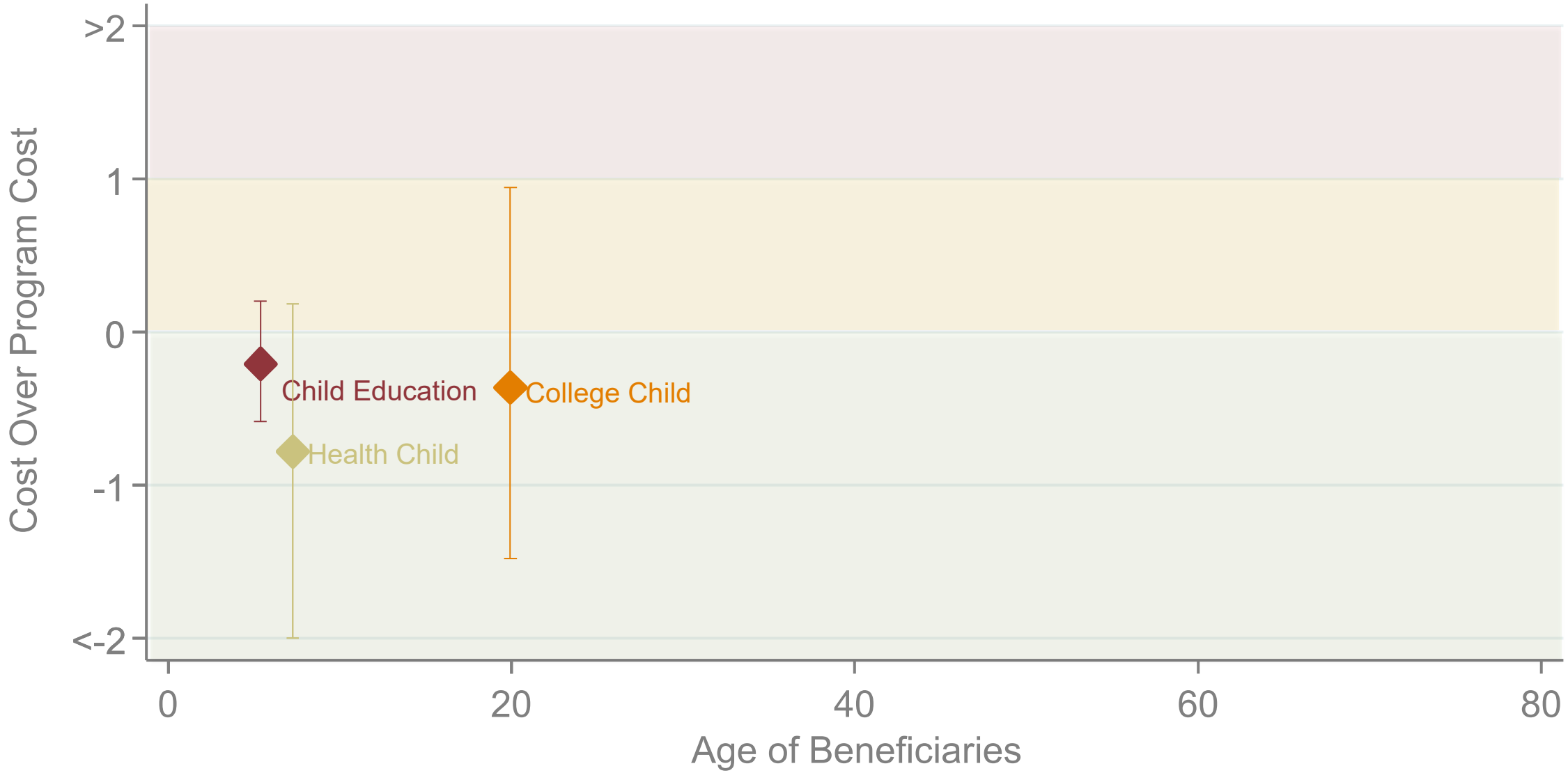
Direct Investments in Children Historically Had Highest MVPFs

Category Averages



Net Costs to Government per $1 of Initial Expenditure

Category Averages



Net Costs to Government per $1 of Initial Expenditure

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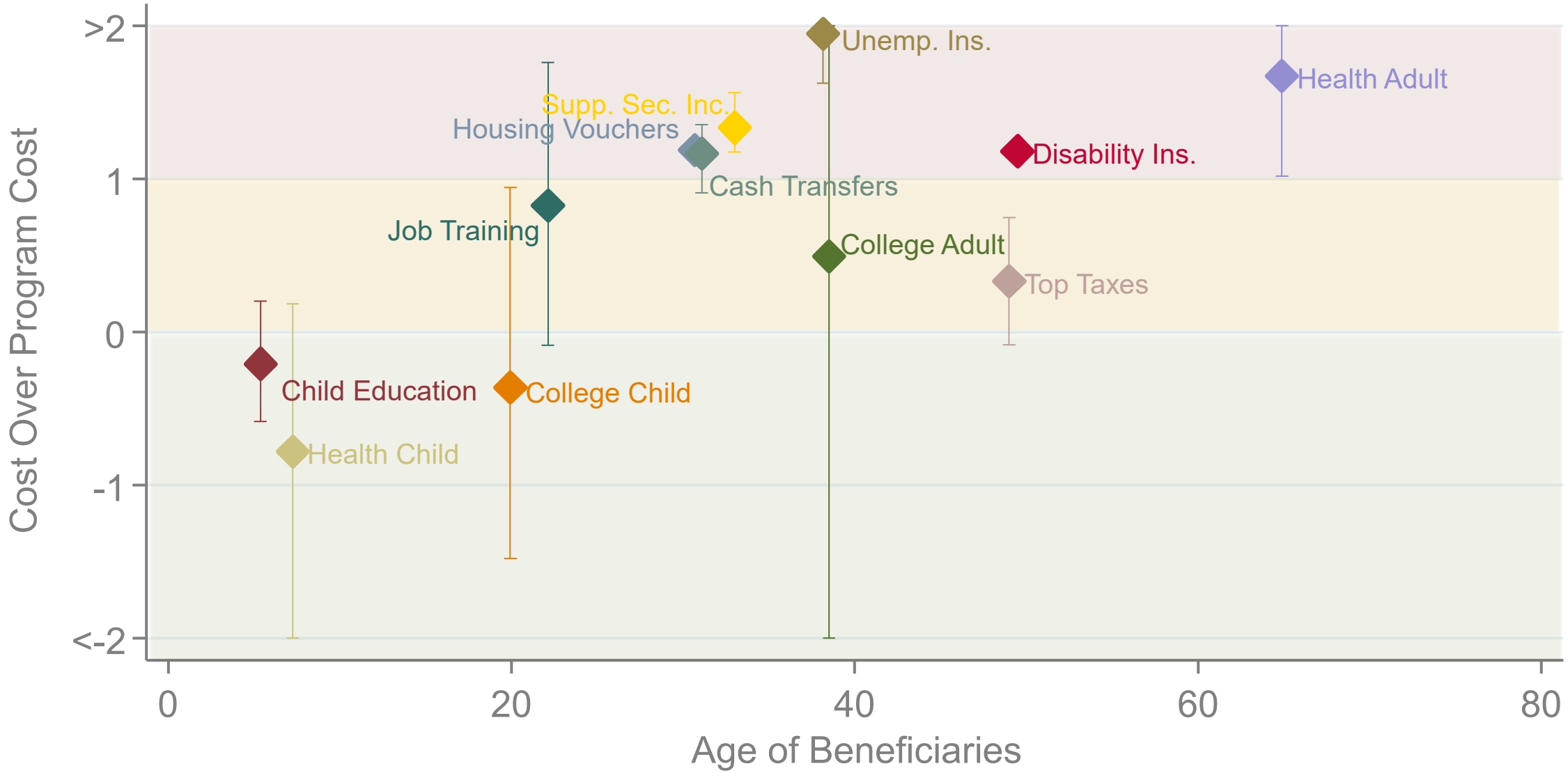
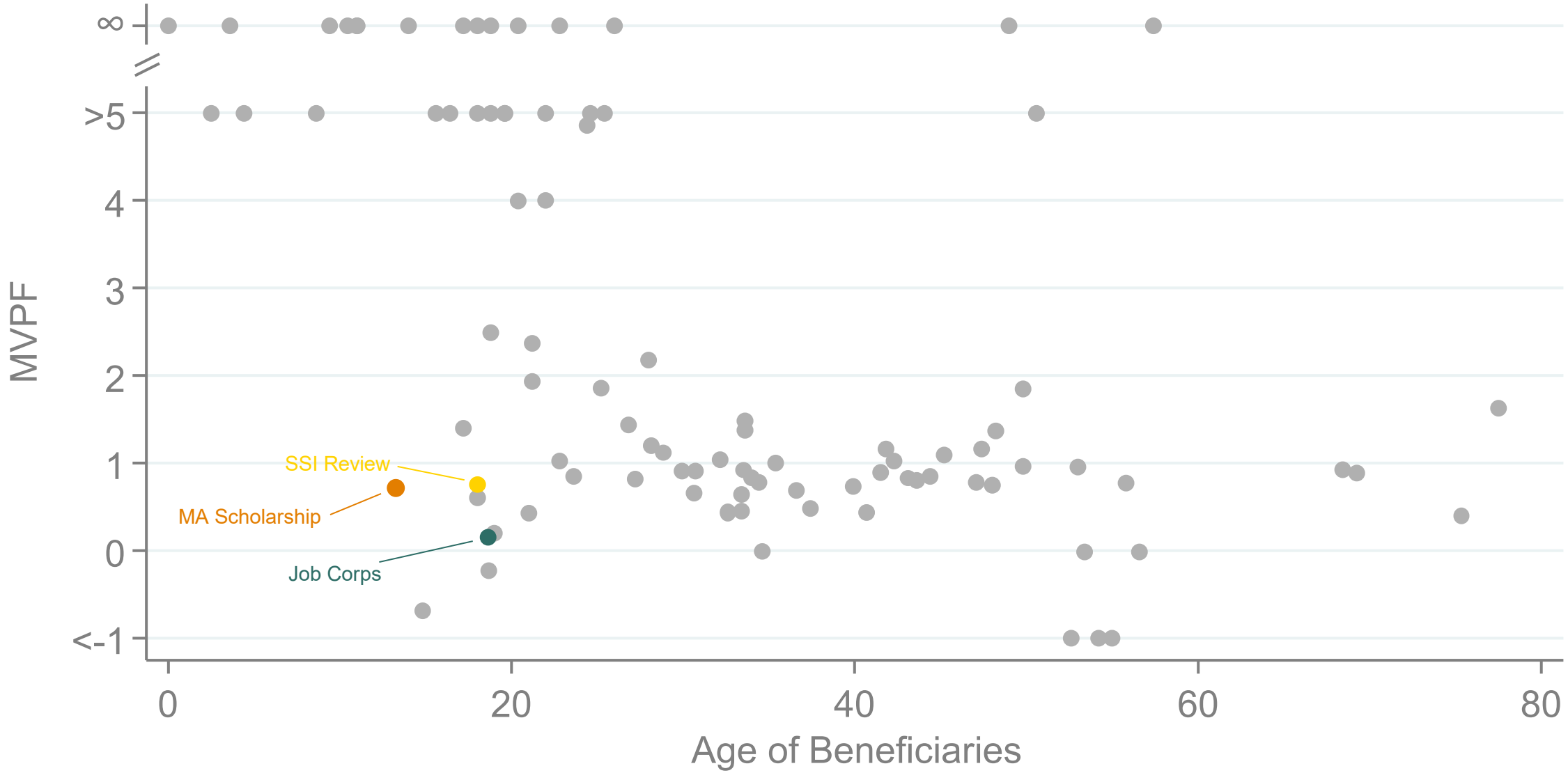
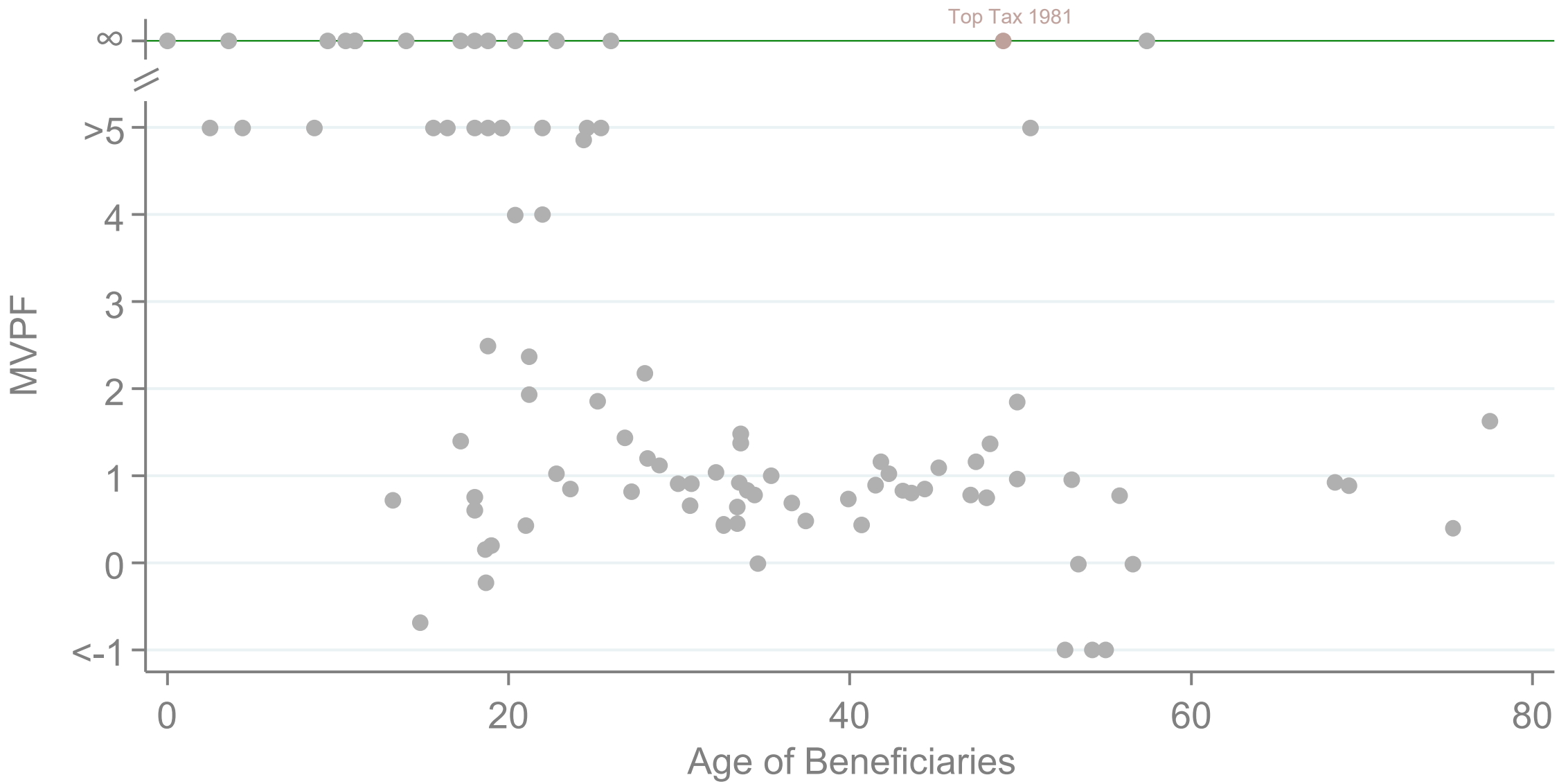


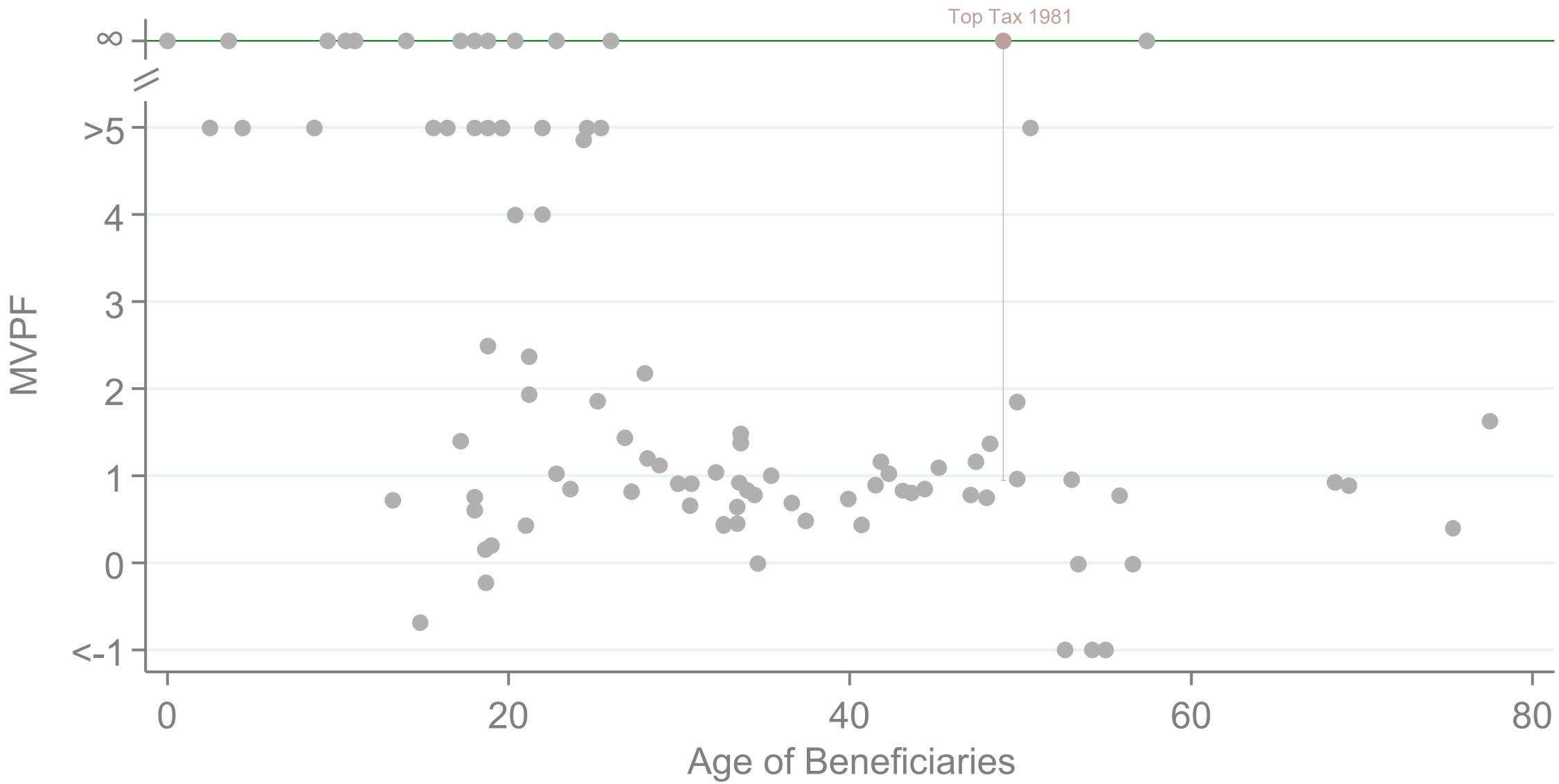
Not All Child-Targeted Policies Have High MVPFs



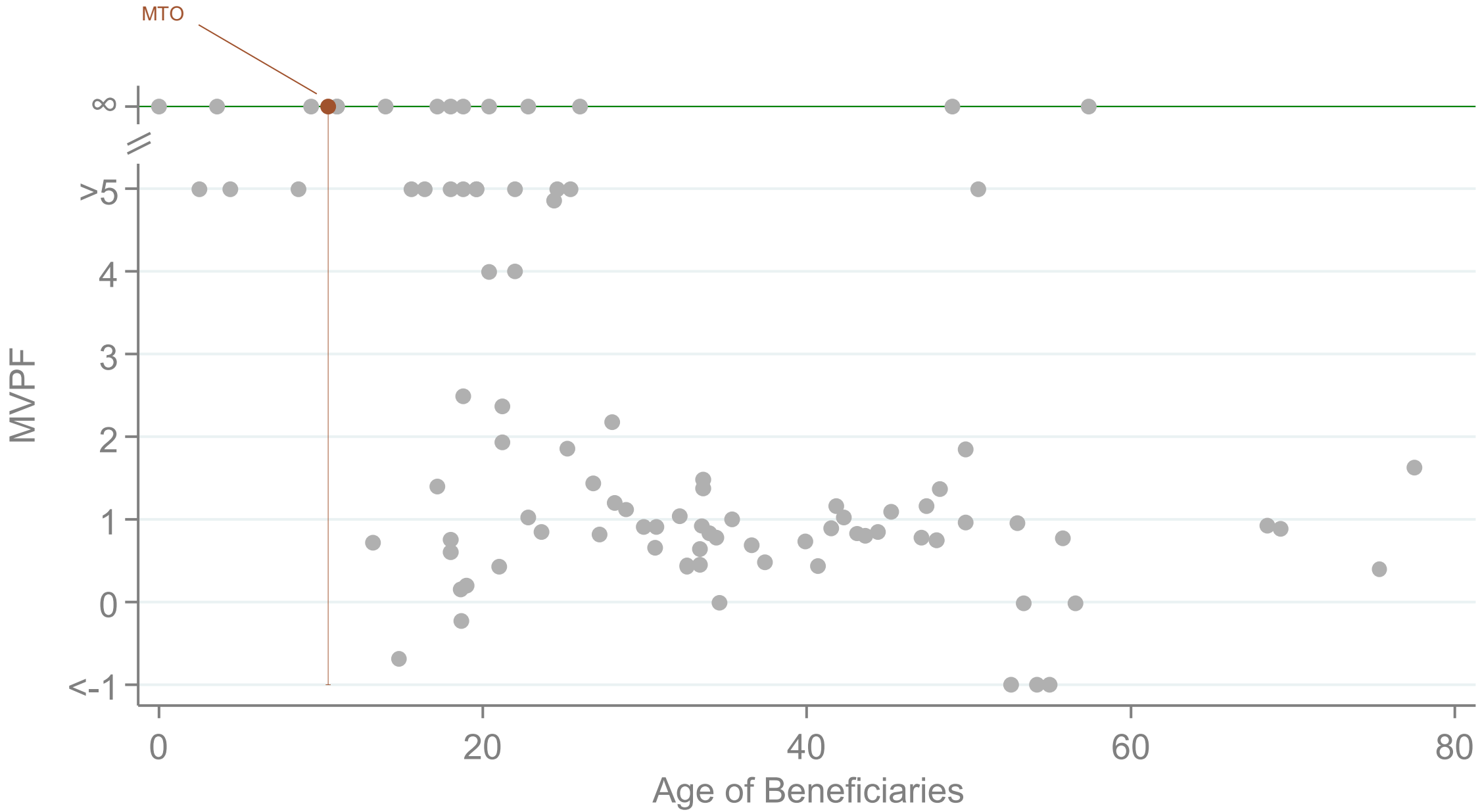
Infinite MVPF for 1981 Top Tax Rate…



Infinite MVPF for 1981 Top Tax Rate…

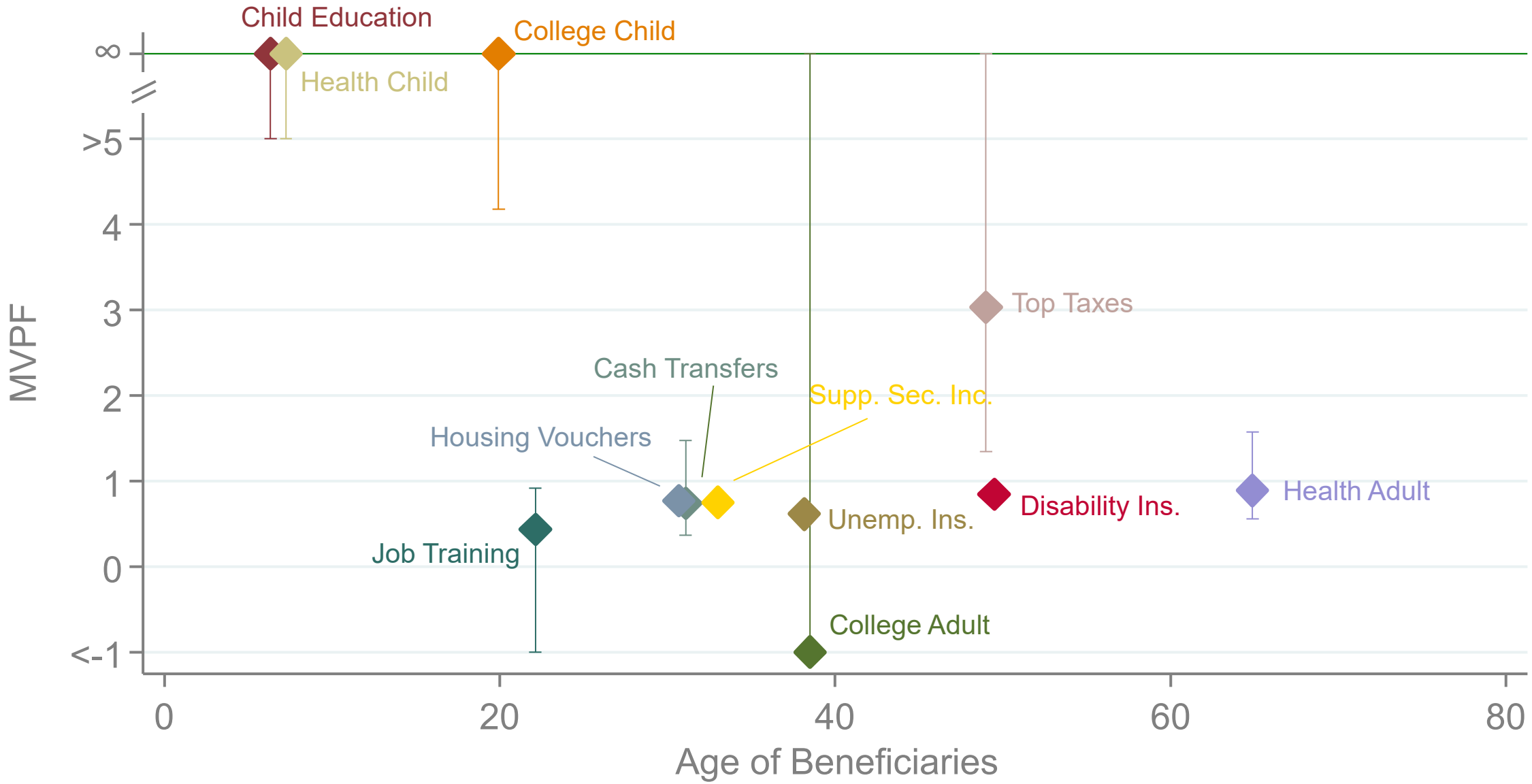


Policies with Spillovers onto Children Have High MVPFs (e.g. MTO)



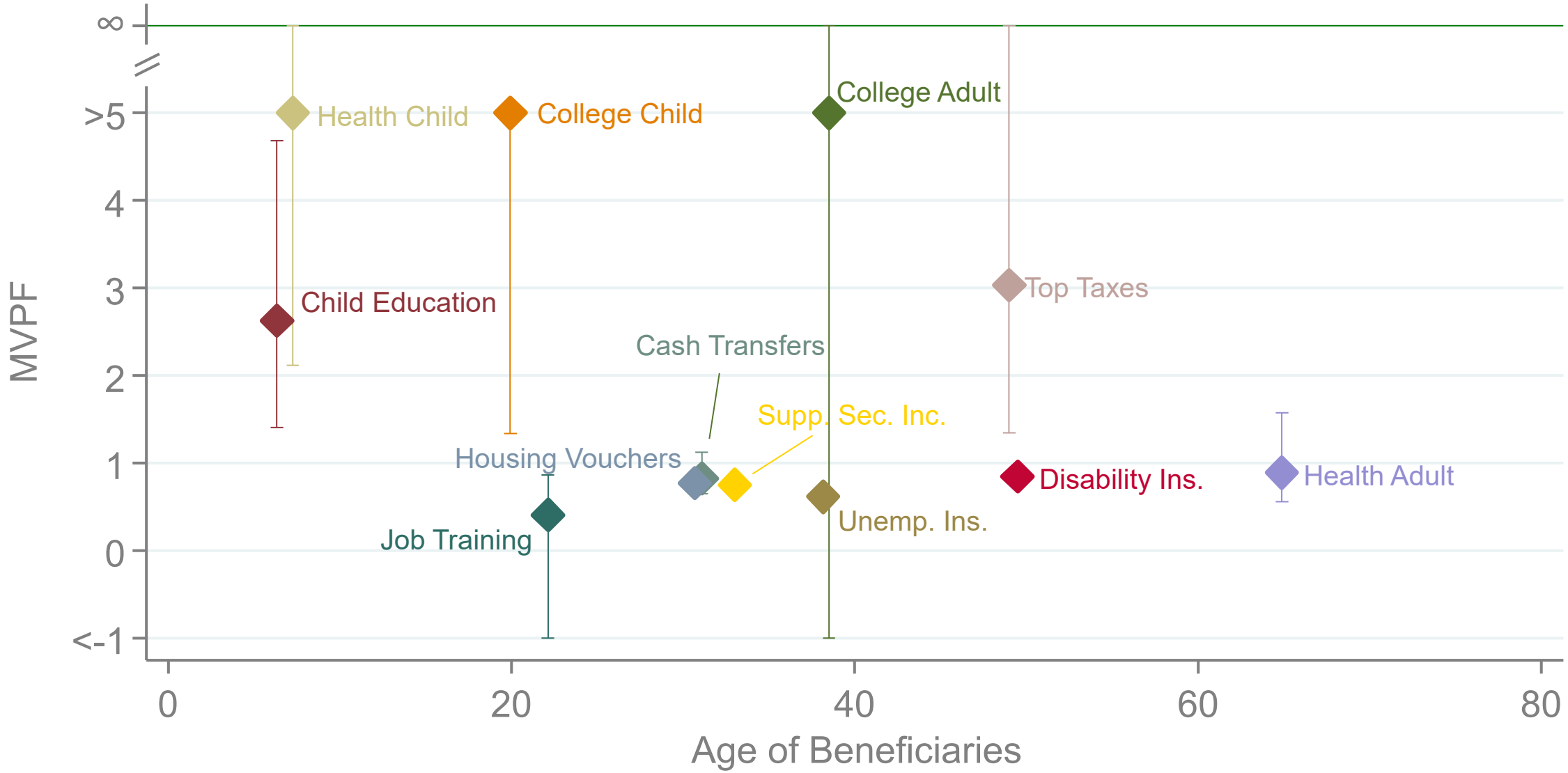
MVPF Robustness to Alternative Discount Rates

3% discount rate



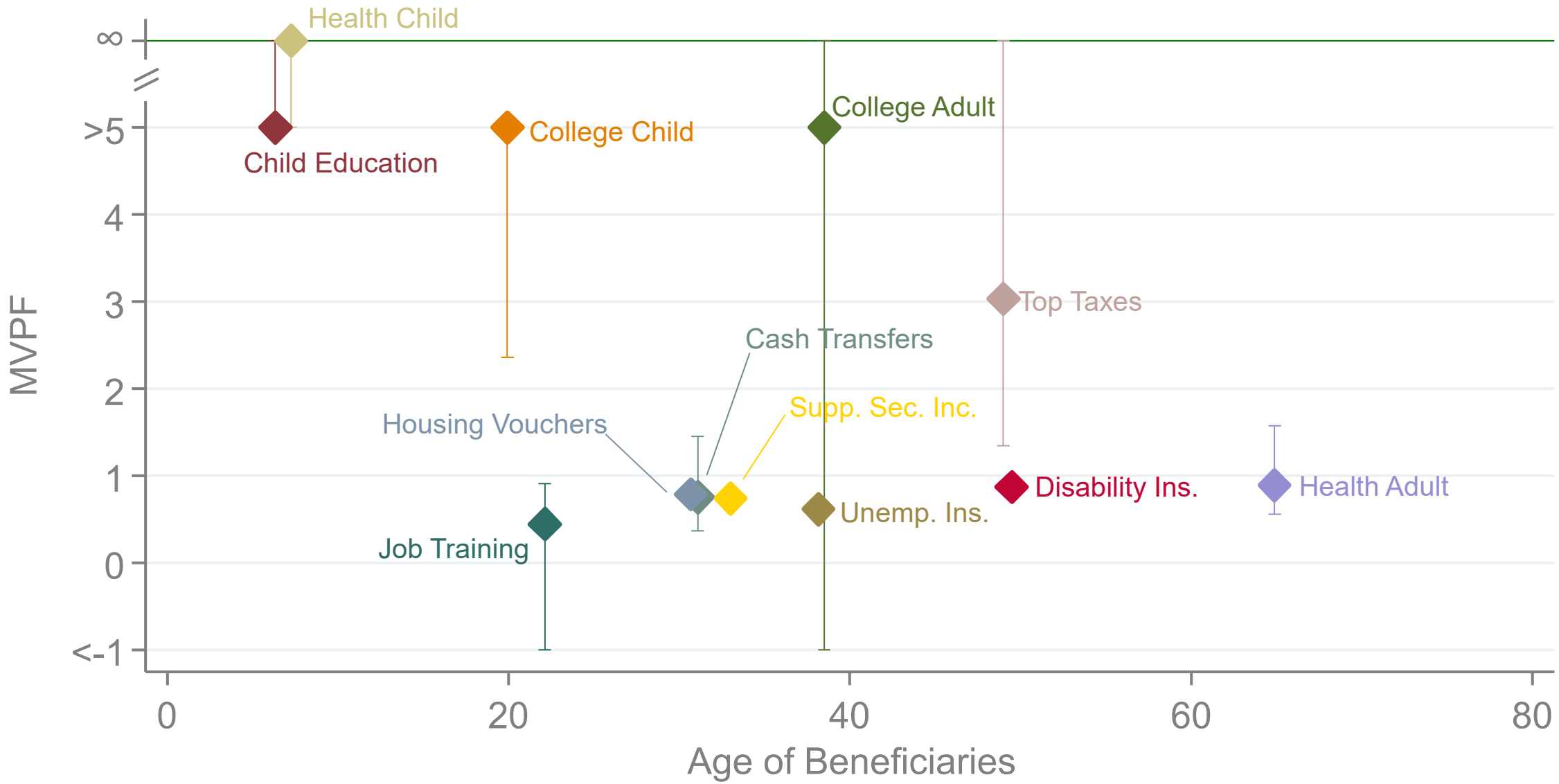
MVPF Robustness to Alternative Discount Rates

7% discount rate



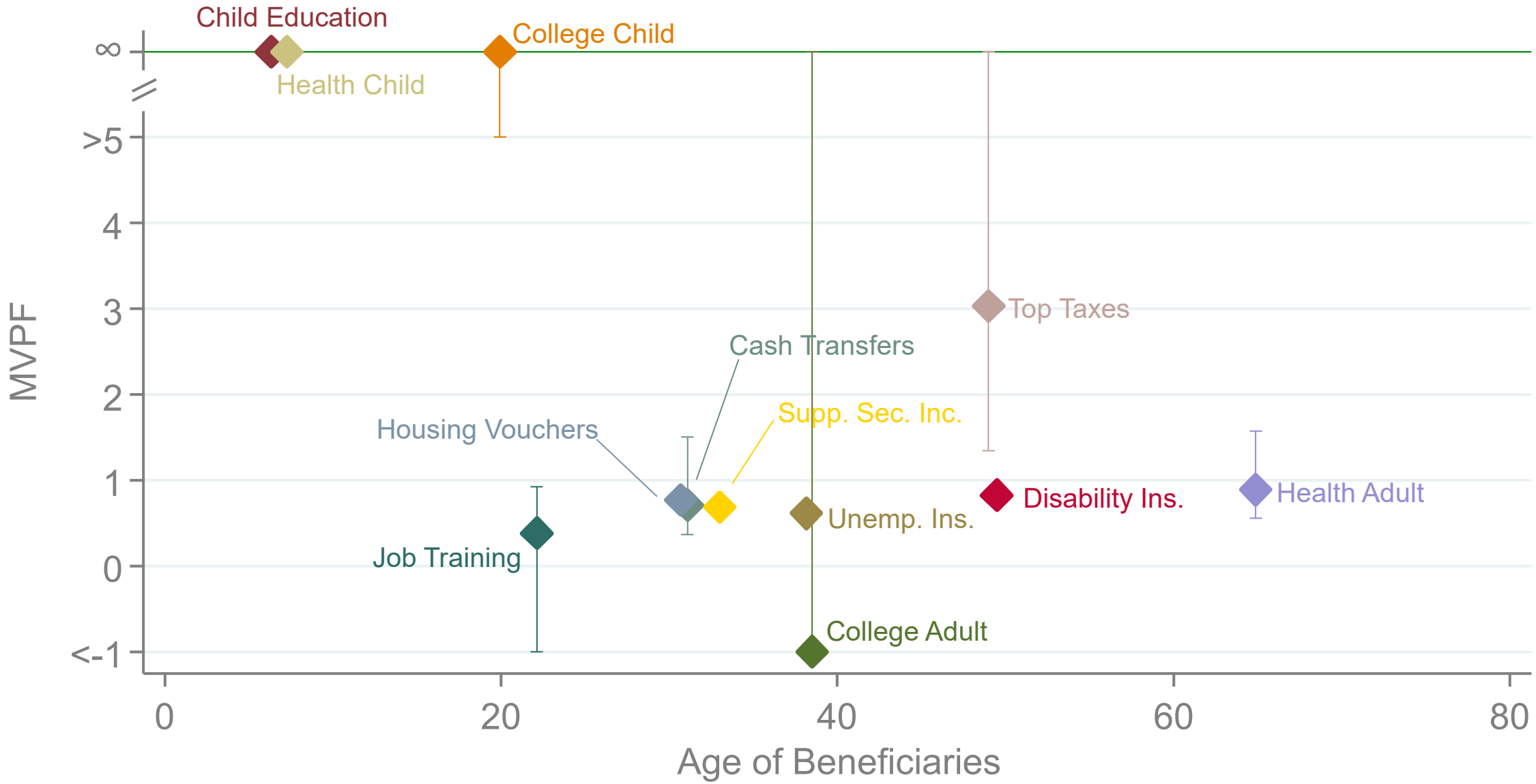
MVPF Robustness to Alternative Tax and Transfer Rates

10% Tax and Transfer Rate



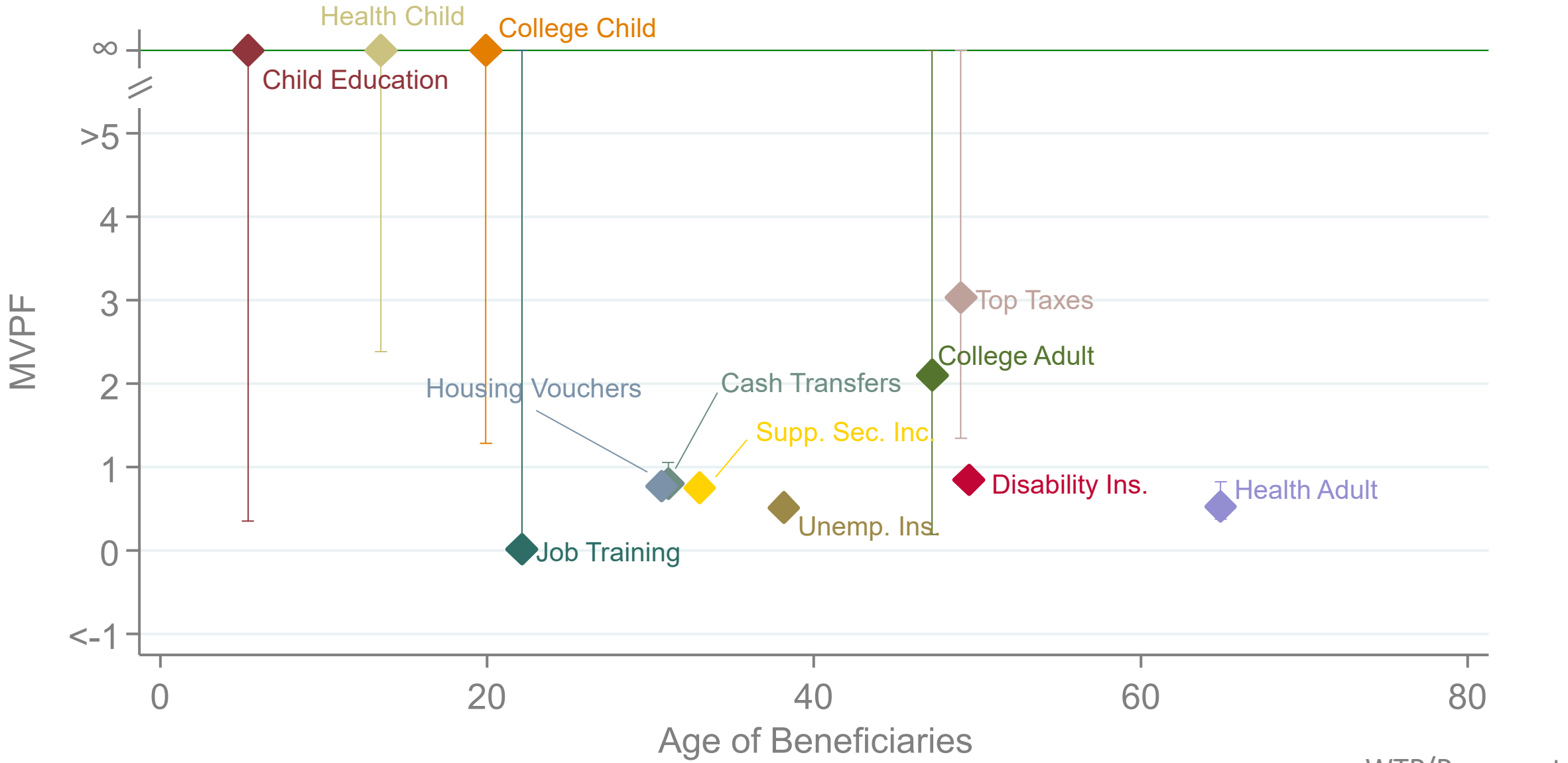
MVPF Robustness to Alternative Tax and Transfer Rates

30% Tax and Transfer Rate



MVPF Robustness to WTP

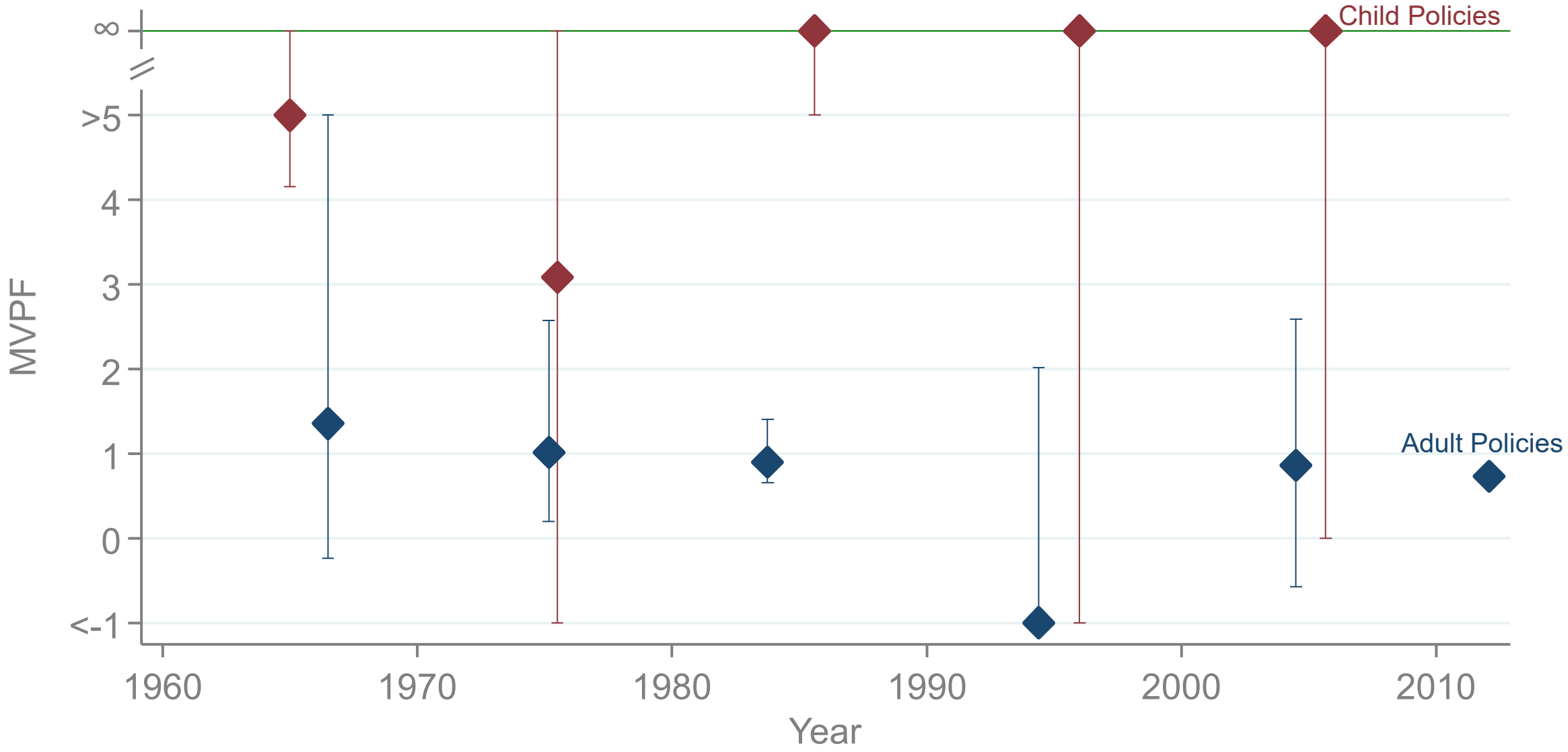
Conservative Willingness to Pay



WTP/Prog. cost

MVPF by Year of Policy

Averages by Decade



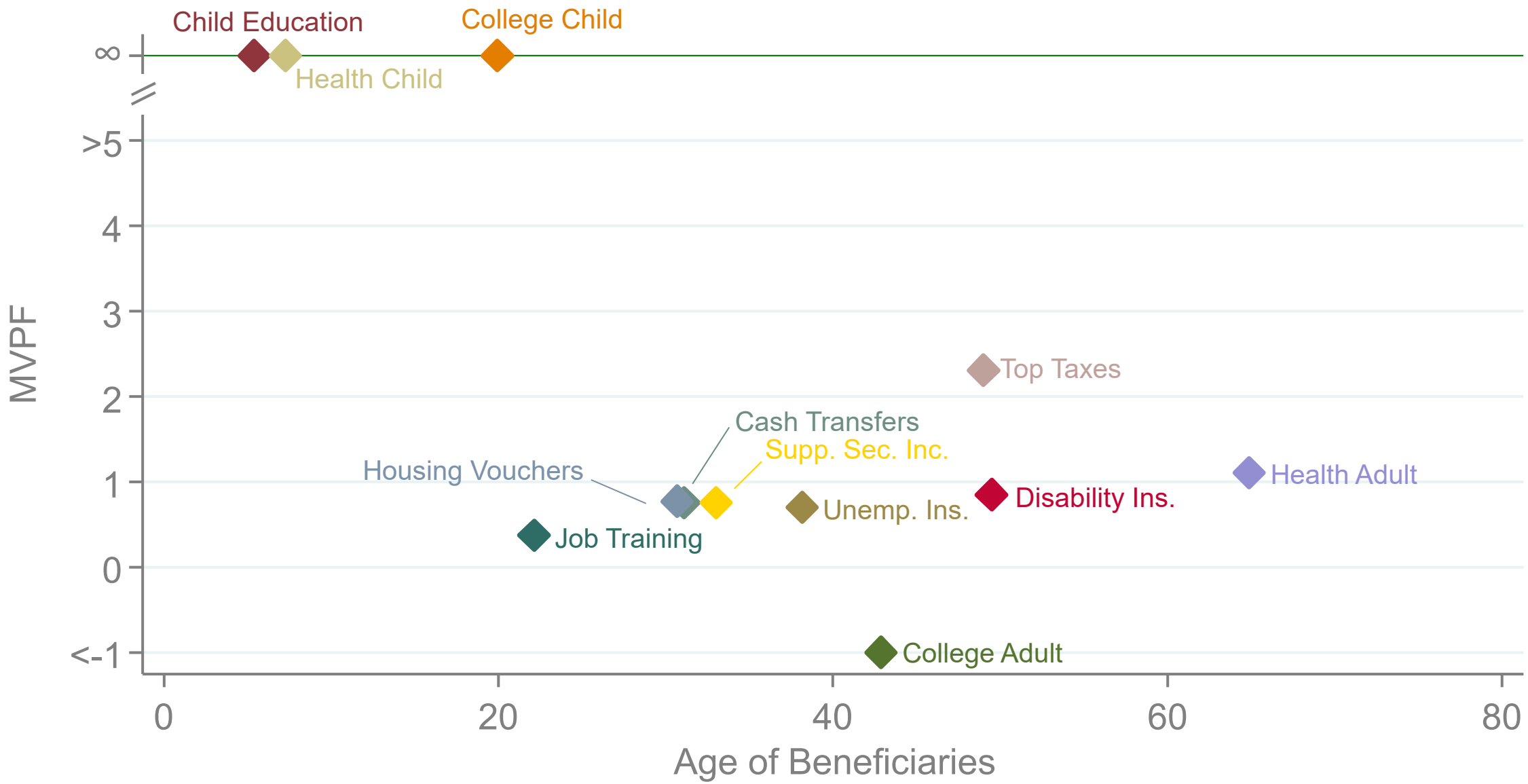
Publication Bias

- 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

Table

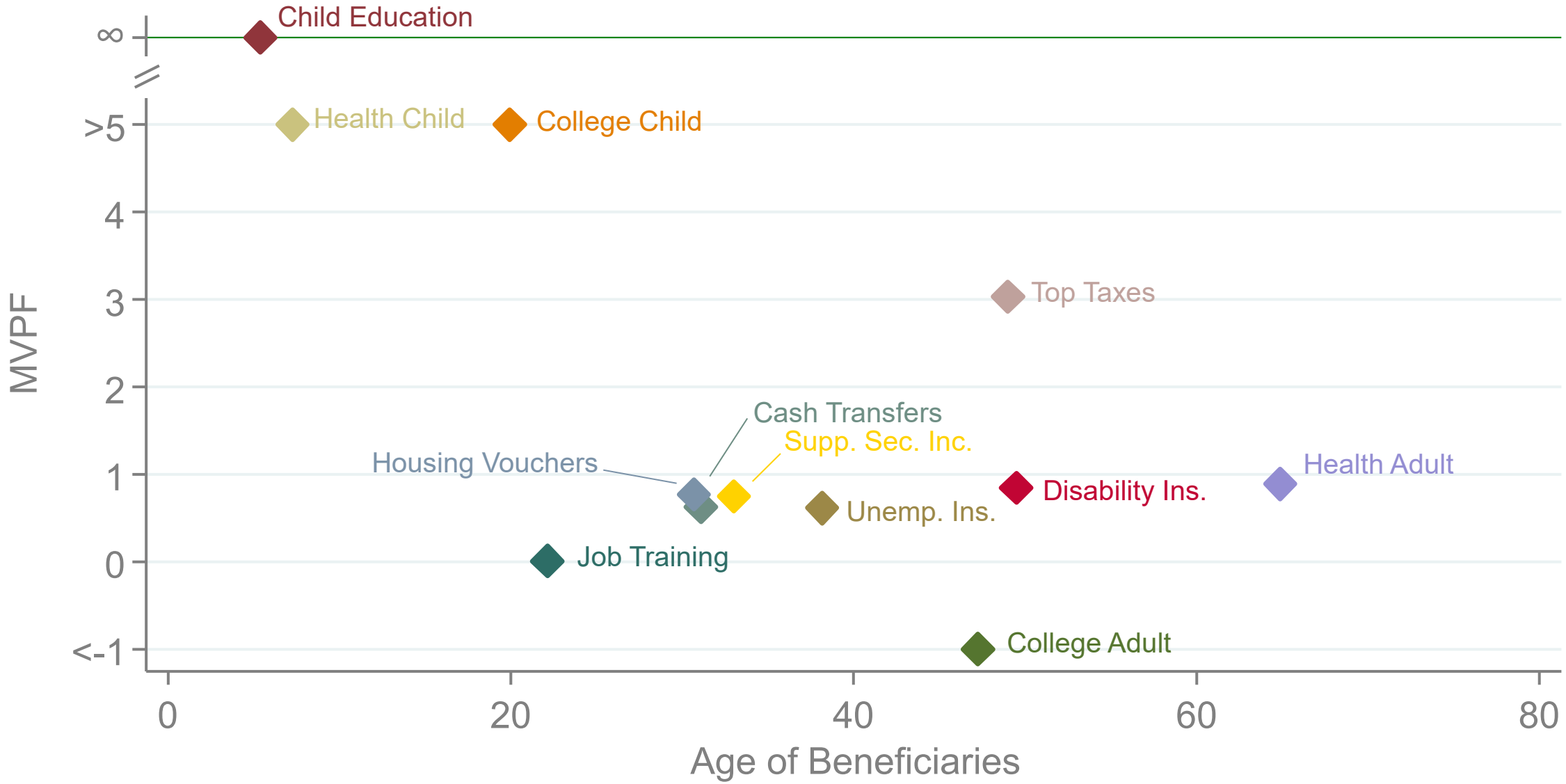
MVPF Robustness to Publication Bias

Adjusting for Observed Publication Bias



MVPF Robustness to Publication Bias

Adjusting for 35X Bias in Experimental Economics Studies [Camerer (2016)]



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

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:
- Or

$$\frac{dR}{d\tau^c} = \underbrace{E[y] + \tau \frac{dE[y]}{d\tau}}_{\text{Tax Cut}} \underbrace{- E[y] - \tau \frac{dE[y]}{dt}}_{\text{Lump-Sum}}$$

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

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

$$MEB = \epsilon^c$$

  - Where ϵ^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
  - (Washington State Institute for Public Policy, Boardman et al. (2018), Garcia, Heckman, et al (2017), Heckman et al. (2010))
  - 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

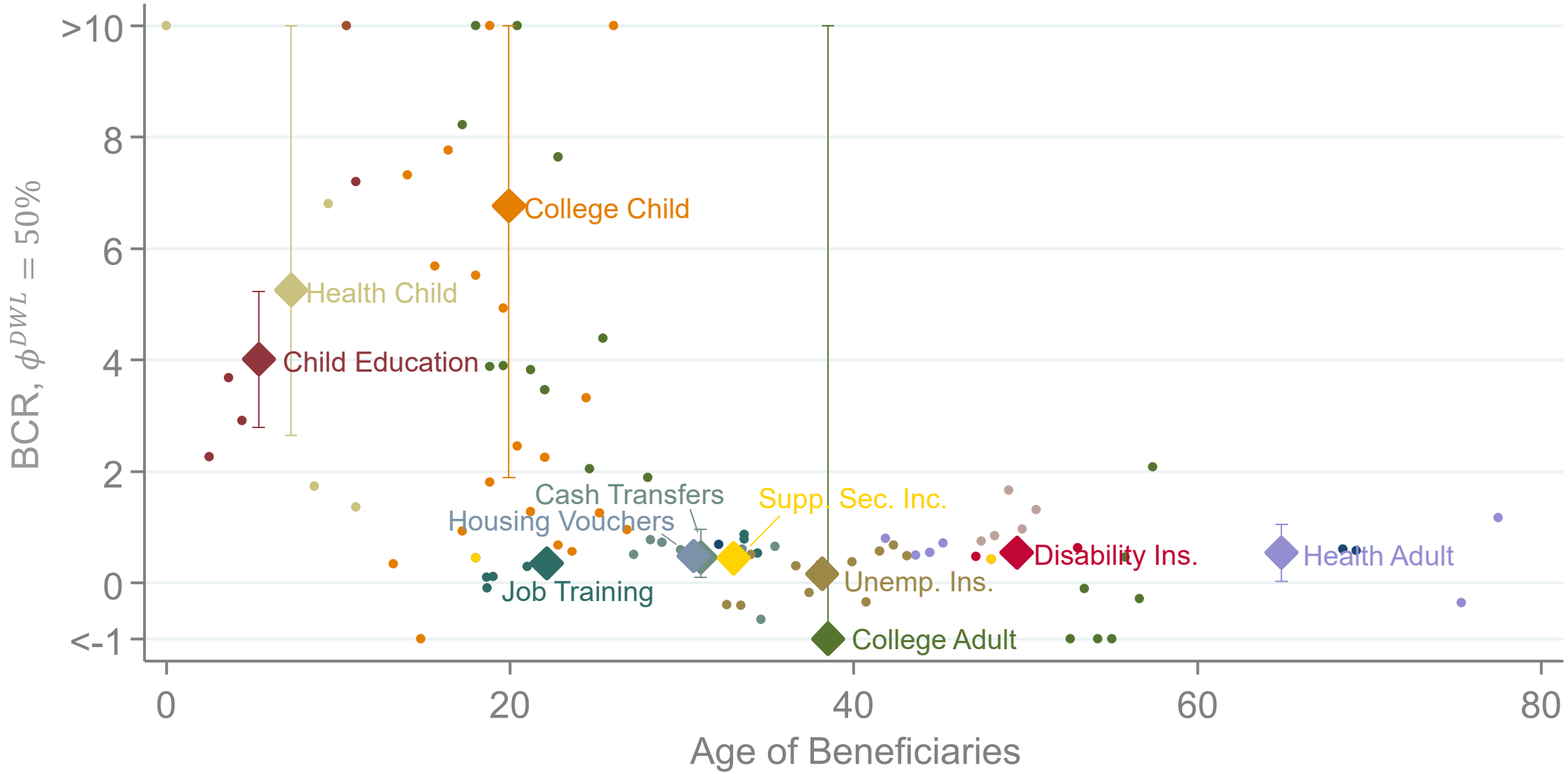
$$BCR = \frac{Social\ Benefits\ - Social\ Costs}{Programmatic\ Cost(1 + \phi^{DWL})}$$

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

- Benefits accruing to the government are included as social costs

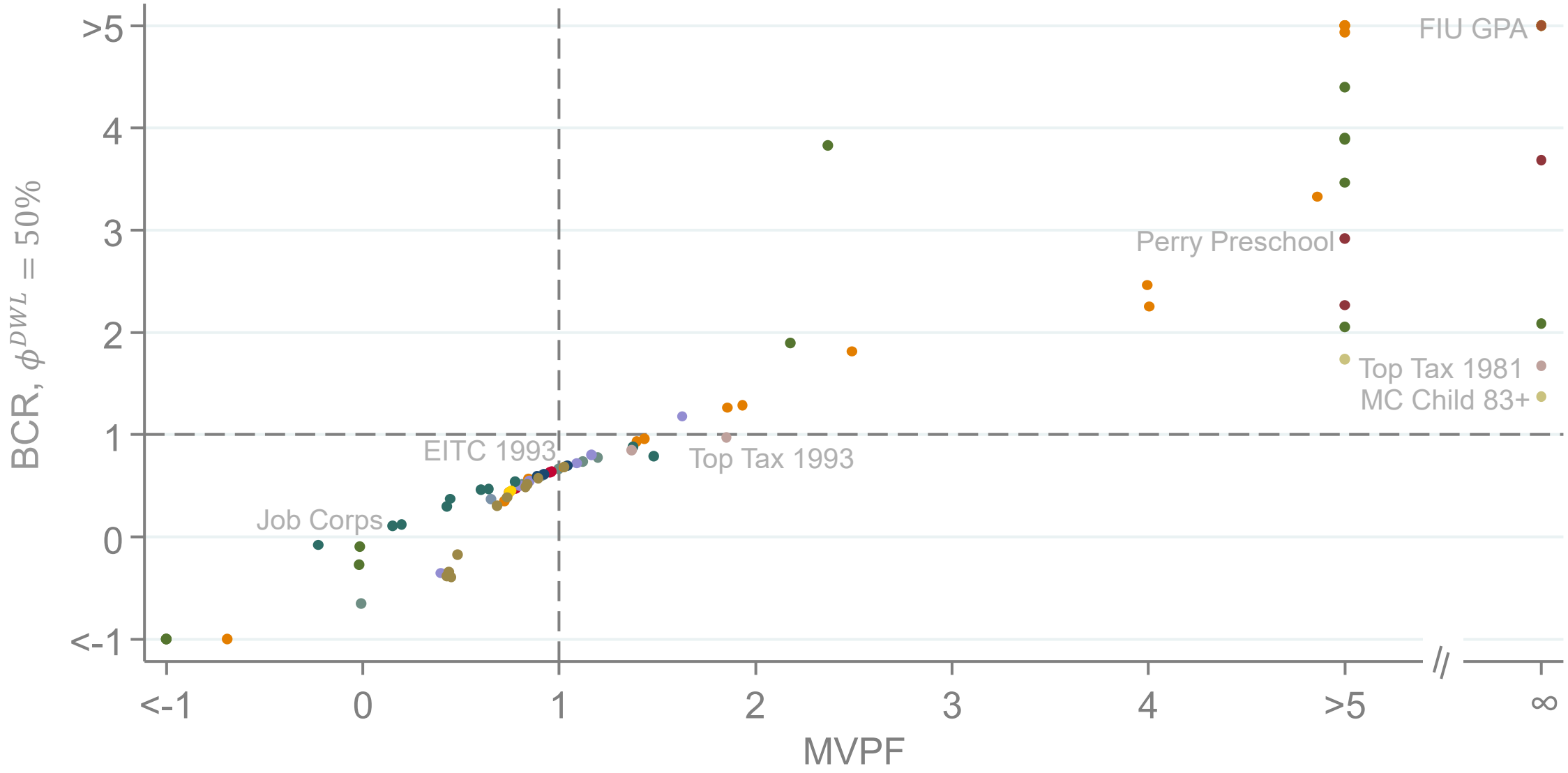
MVPF vs Benefit/Cost Ratio [Heckman et al., 2010; Zimmerman 2014]

Benefit Cost Ratio by Age of Beneficiaries



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

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



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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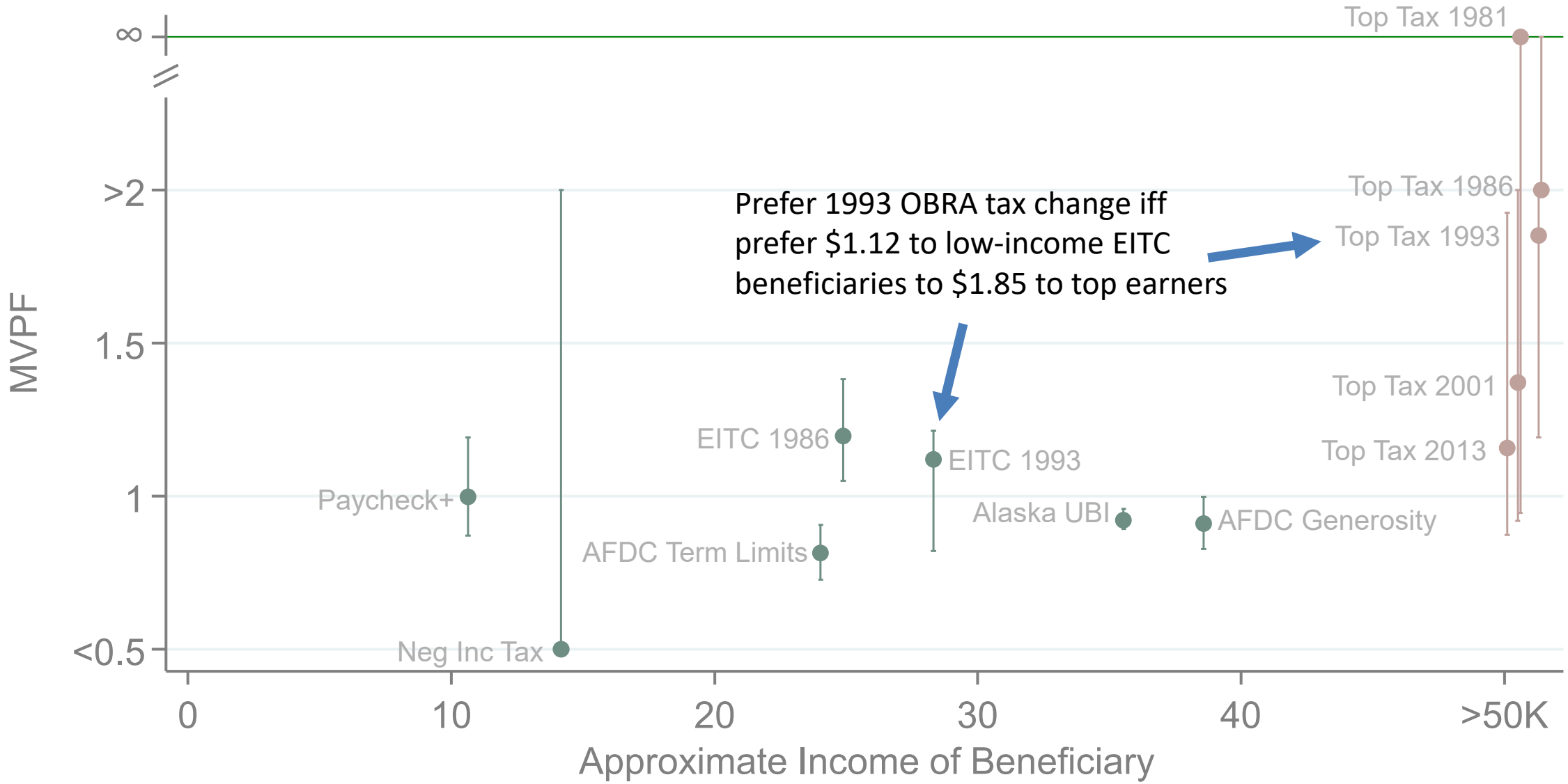
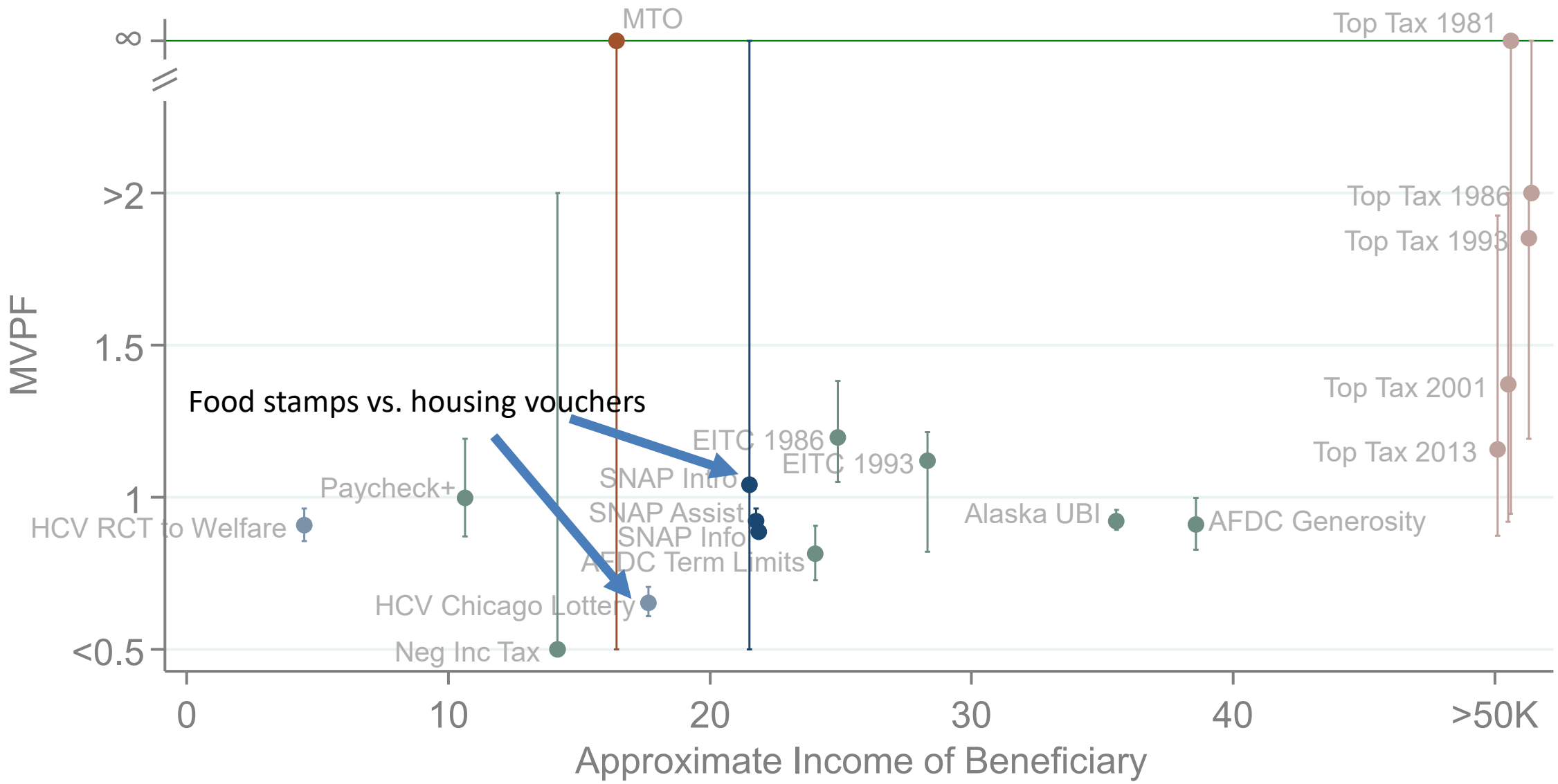
Quantifying the Tradeoffs of Redistribution through the Tax Schedule (Mirrlees 1976)

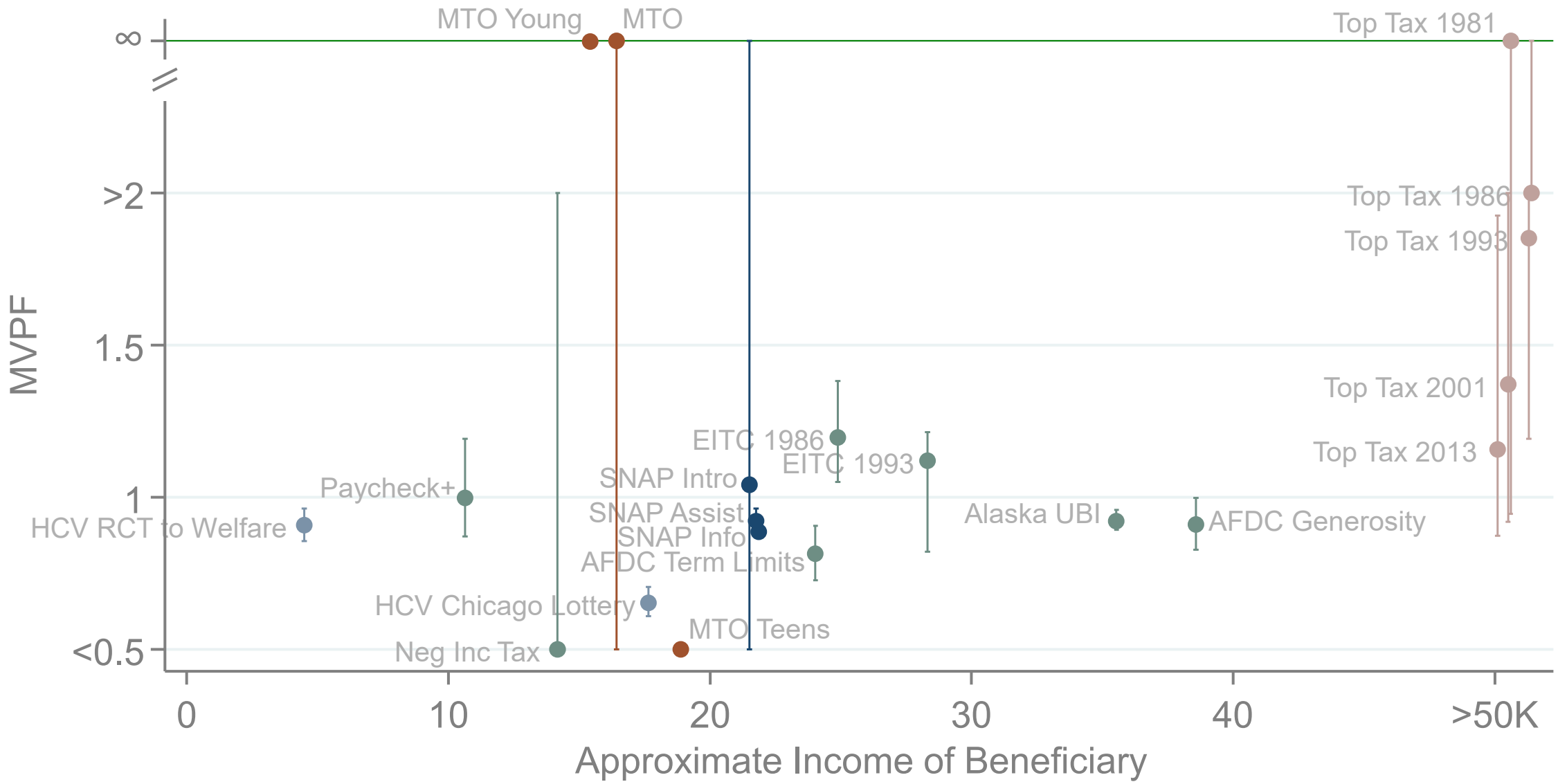


Spillovers on Children

In-Kind versus Cash Transfers ("Atkinson-Stiglitz" Theorem)

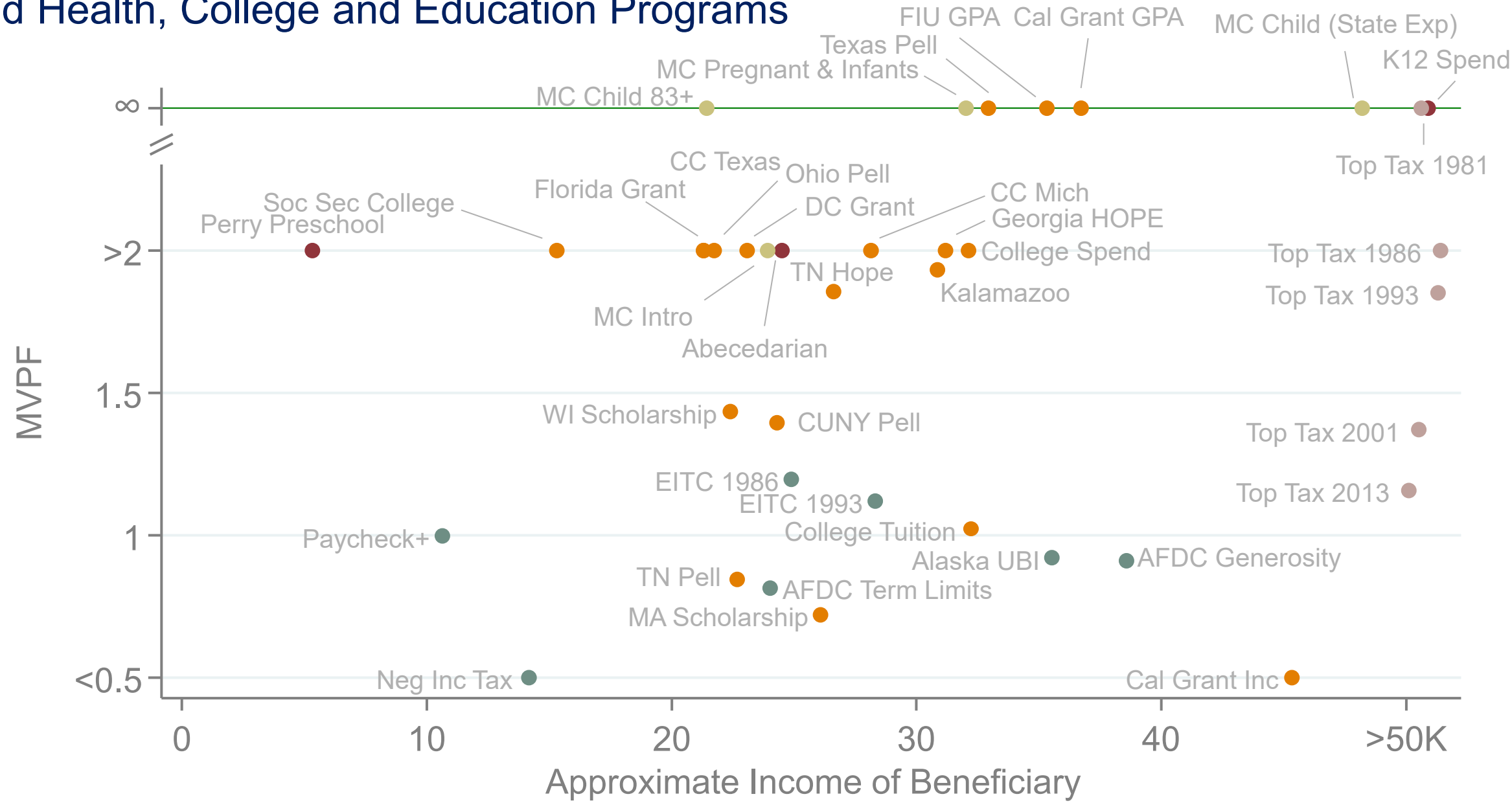


“Tagging” Based on Age in MTO



Efficient Redistribution through Investments in Low-Income Children

Child Health, College and Education Programs



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

$$\bar{\eta}_1 MVPF_1 > \bar{\eta}_2 MVPF_2$$

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

- At an optimum, $\bar{\eta}_1 MVPF_1 = \bar{\eta}_2 MVPF_2$

  - Can derive many (all?) optimal tax results through this equation

Summary

- 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 η_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?