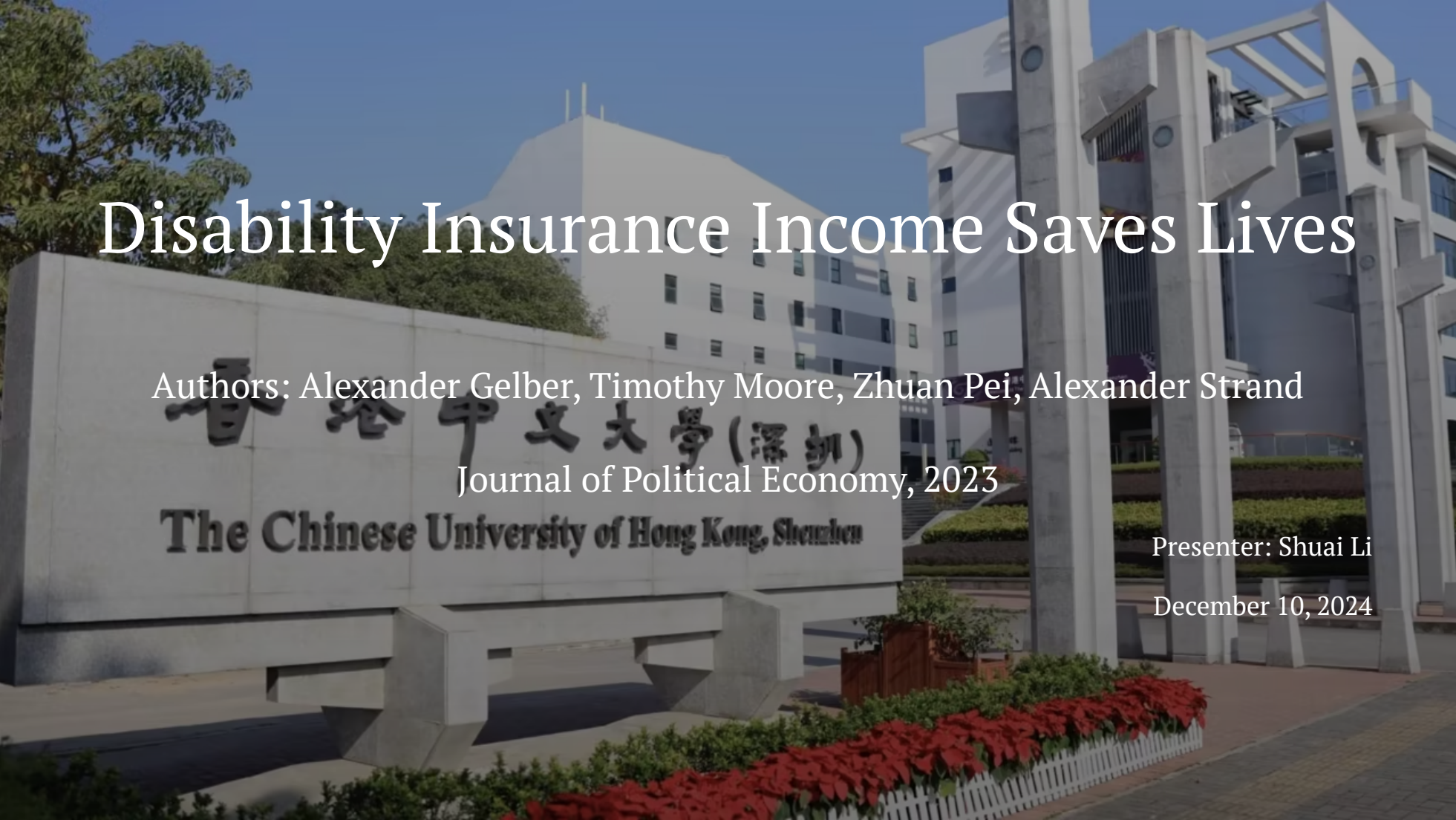

Disability Insurance Income Saves Lives

Authors: Alexander Gelber, Timothy Moore, Zhuan Pei, Alexander Strand

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Presenter: Shuai Li

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Introduction

Research Background

Disability Insurance (DI):

- A critical component of the social safety net.
- Insures against income loss due to disability, covering 175M Americans.
- In 2020, DI paid $144B to 10M beneficiaries (SSA 2021).

DI Beneficiaries: DI is vital not just for income support but potentially for health outcomes.

- High dependency: 82% rely on DI for over half of household income (Bailey and Hemmeter 2015).
- Severe health outcomes: 14% mortality within 4 years (Arias 2014; Zayatz 2015).

Motivation

Understanding Health Impacts of DI Income

- Does the income provided by DI directly improve health outcomes, such as mortality?
- Identifying this link is crucial for:
  - Assessing the true value of DI in cost-benefit analyses.
  - Designing optimal DI payment formulas.

Policy for Vulnerable Populations

- Policy discussions often focus on costs (e.g., reduced workforce participation). However, there exists limited attention to health benefits, like improved mortality.
- DI beneficiaries are distinct from general populations often studied in income-health literature.

Research Questions

Primary RQ: How does DI income affect beneficiaries' mortality rates?

Additional RQ (Heterogeneity Analysis):

- Are effects stronger for certain groups? Such as:
  - Low-income beneficiaries?
  - Those awarded DI by initial examiners?
  - Beneficiaries with specific disabilities (e.g., cancers, heart disease)?
- Are effects immediate or persistent over time?

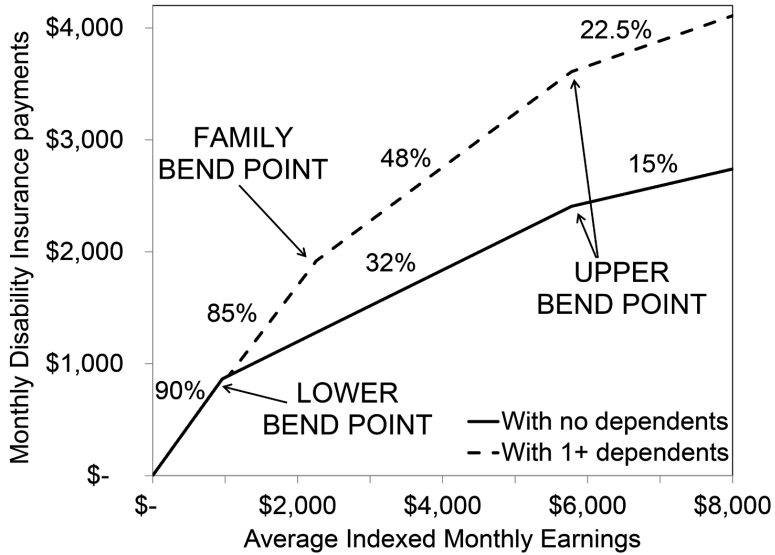

FIG. 1. Social Security DI payments to AIME.

Terms:

- **Primary Insurance Amount (PIA):** Base DI payment.
- **Dependent Payments:** Additional payments for dependents.
- **Monthly DI payment:** PIA + Dependent Payments
- **Average Indexed Monthly Earnings (AIME):** Average indexed monthly earnings.

Research Gaps

- **Causal Evidence is Sparse**
  - Previous studies on DI focus on: (a) Consumption smoothing and income volatility reduction. (b) Costs of reduced workforce participation [1].
  - Health effects of DI income largely unexamined.
- **Empirical evidence**
  - Scant evidence on the causal health effects of DI;
  - Large and growing literature quantifying the costs associated with the reduction in work due to DI [2].
  - Evidence on the overall impact of DI receipt on mortality is limited to a study by Black et al. (2021),

1. For example, see Bound et al. (2004), Chandra and Samwick (2005), Ball and Low (2014), Low and Pistaferri (2015), Autor et al. (2019), Meyer and Mok (2019), and Deshpande and Lockwood (2022).

2. For example, see Bound (1989), Gruber and Kubik (1997), Gruber (2000), Black, Daniel, and Sanders (2002), Autor and Duggan (2003), Chen and van der Klaauw (2008), von Wachter, Song, and Manchester (2011), Campolieti and Riddell (2012), Maestas, Mullen, and Strand (2013), Borghans, Gielen, and Luttmer (2014), French and Song (2014), Kostøl and Mogstad (2014), Autor et al. (2015), Moore (2015), Coile (2016), and Gelber, Moore, and Strand (2017). For a review of earlier work, see Bound and Burkhauser (1999).

Identification Strategy

Objective: Estimate the local treatment-on-the-treated parameter using a fuzzy RKD.

- **Treatment (B):** Size of DI payments (primary insurance amount (PIA) + dependent payments).
- **Assignment Variable (A):** AIME (average indexed monthly earnings) at the time of DI application.
- **Outcome (Y):** Mortality rate after DI receipt.

Key Equation

$$Fuzzy\ RKD\ Estimand = \frac{\lim_{a \to a_1^+} \frac{dE[Y|A=a]}{da} - \lim_{a \to a_1^-} \frac{dE[Y|A=a]}{da}}{\lim_{a \to a_1^+} \frac{dE[B|A=a]}{da} - \lim_{a \to a_1^-} \frac{dE[B|A=a]}{da}}$$

RKD Implementation

Estimation Steps

Step 1. Use **local polynomial regressions** to estimate outcome and first-stage kinks.
Step 2. Normalize BP to zero and solve for parameters via kernel-weighted regressions:

$$\hat{\beta}_1 = \arg\min_{\beta_1^+} \sum_{i=1}^{n^+} \left[Y_i^+ - \sum_{j=0}^{p} \beta_j^+ (A_i^+)^j \right]^2 K\left(\frac{A_i^+}{h}\right)$$

Step 3. Repeat for observations below BP.

Three key ingredients of equation:

- **Bandwidth (h):** Mean squared error (MSE)-optimal (Calonico et al., 2014).
- **Polynomial Order (p):** Local linear (p=1) (Card et al. 2017).
- **Kernel (K):** Uniform kernel.

Robustness Adjustments

- Bias correction and robust standard errors (Calonico et al., 2014).
- Covariate inclusion (e.g., locally controlling for covariates).

Key Assumptions for RKD

Continuity Assumption:

- No unobserved discontinuities in mortality at the bend points (BPs) except for the DI payment change.
- Beneficiaries around each BP are similar in terms of characteristics like health and income, except for the DI benefit.

No Manipulation of AIME:[1]

- Individuals cannot manipulate their AIME to influence which BP they fall under. This ensures that observed changes in mortality are due to the change in DI income.

Parallel Trends:

- The relationship between mortality and AIME should remain stable around the BPs, except for the kink introduced by DI payments. No underlying trend should break at the BPs.

Exogeneity of DI Payments:

- The DI payment rule is exogenous and does not depend on factors other than AIME (i.e., no eligibility-based sorting across the BPs that could bias the results).

1. This assumption may not hold if there is sorting in relation to the BPs. However, such sorting appears implausible in this context, given how AIME is calculated.

*Additional Interpretation

Outcome Measure

- Change in mortality rates per $1 increase in DI income.
- Report results for a $1,000 annual DI increase for clarity.

Important Notes

1. **Long-Term Effects:**
   - DI income changes are persistent over time due to lifetime income adjustments and low DI exit rates (<1% annually).
2. **Pretax Income:**
   - Results reflect changes in pretax DI income.
   - Tax adjustments minimal; estimates are likely lower bounds for after-tax effects.

Data and Variables

- **Data Source:** 3,648,988 DI beneficiaries from SSA administrative records (2002–2015).
- **Dependent Variable:**
  - Mortality rates (within 4 years after DI award).
- **Key Independent Variables:**
  - **AIME (Average Indexed Monthly Earnings):** Measures earnings prior to DI.
  - **DI Income:** Direct monthly benefit payments based on AIME.
  - **Other Covariates:** Age, sex, race, type of disability (e.g., mental or physical), pre-DI health conditions.
- **Treatment Thresholds:**
  - DI benefits are determined by three income thresholds (Lower BP, Family BP, Upper BP).
  - The lower, family, and upper BPs correspond to the 4th, 30th, and 84th percentiles of the AIME distribution, respectively.

Results

Main Results and Key Findings

1. **Lower and Family BPs:**
    - Increased DI income significantly reduces mortality rates.
    - **Lower BP:** Mortality reduction: **0.21–0.35 percentage points (pp)** per $1,000 increase in DI income.
    - **Family BP:** Mortality reduction: **0.18–0.26 pp** per $1,000 increase in DI income.
    - In another word, they find that DI payments reduce mortality among lower-income beneficiaries.
2. **Upper BP:** No statistically significant mortality effects.

Supporting Evidence

- **Graphical Analysis:** Visible changes in the slope of mortality rates at lower and family BPs but not at the upper BP.
- **Robust Estimates:** Consistent results with and without quadratic bias correction and covariate adjustments. Statistically significant at the 5% level.

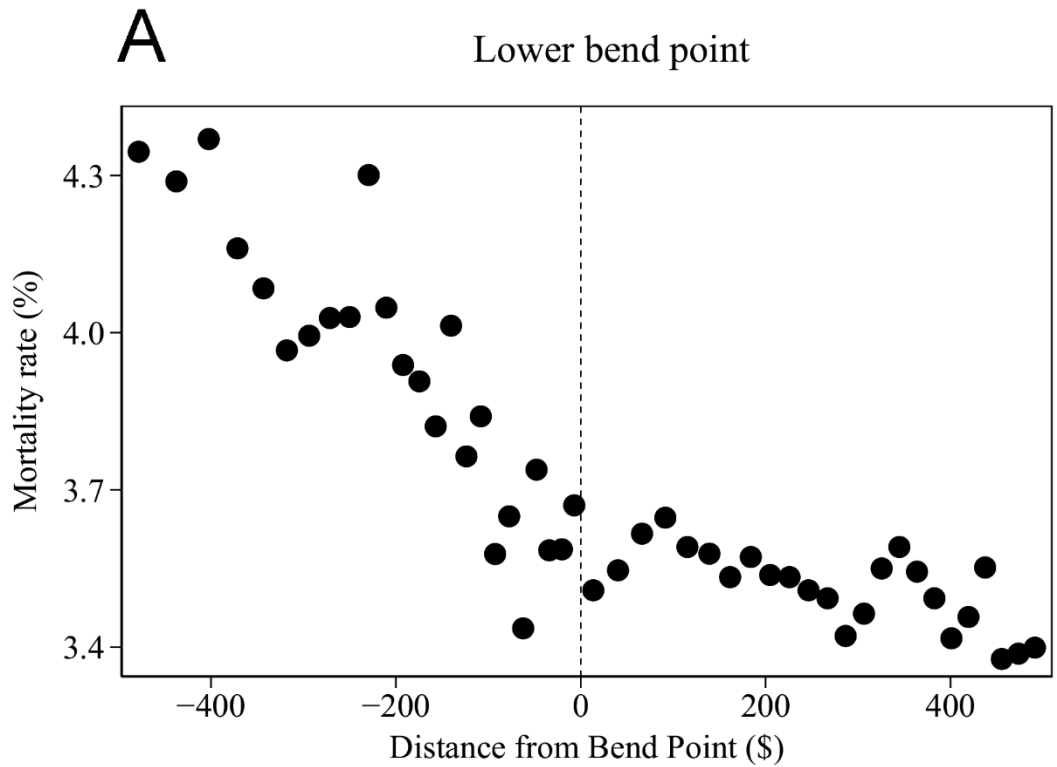

FIG. 2. Mortality rates around the BPs.(A)

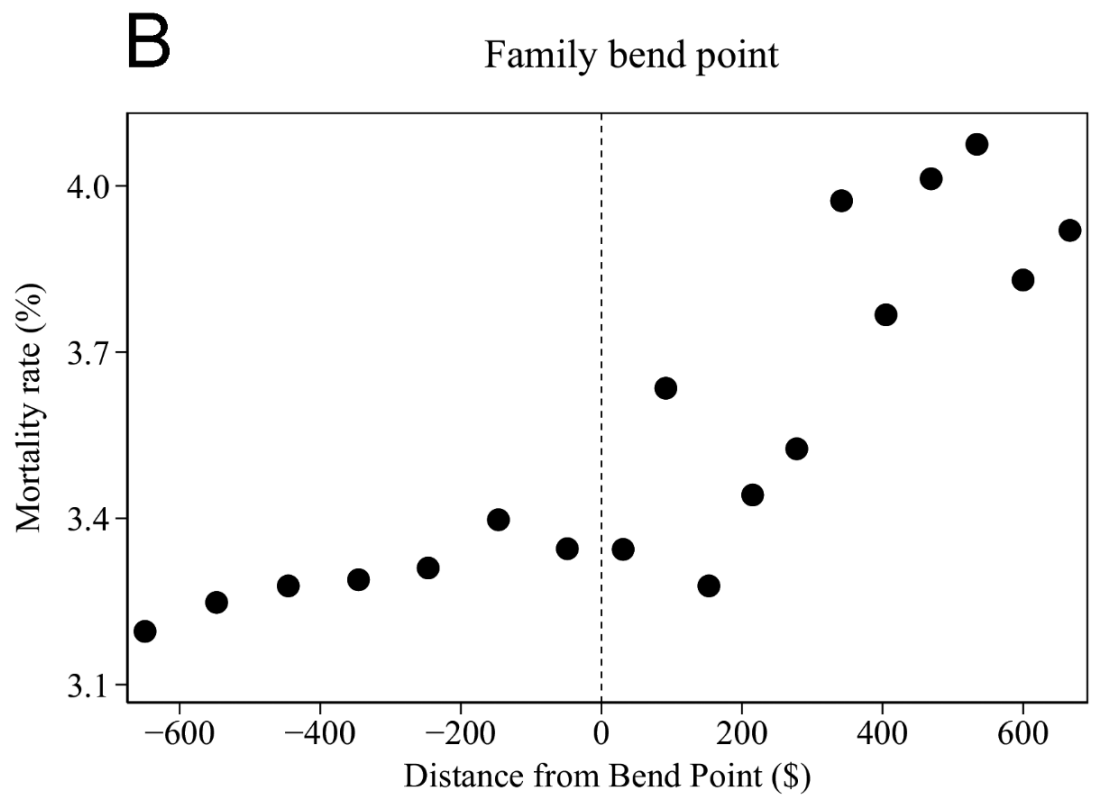

FIG. 2. Mortality rates around the BPs.(B)

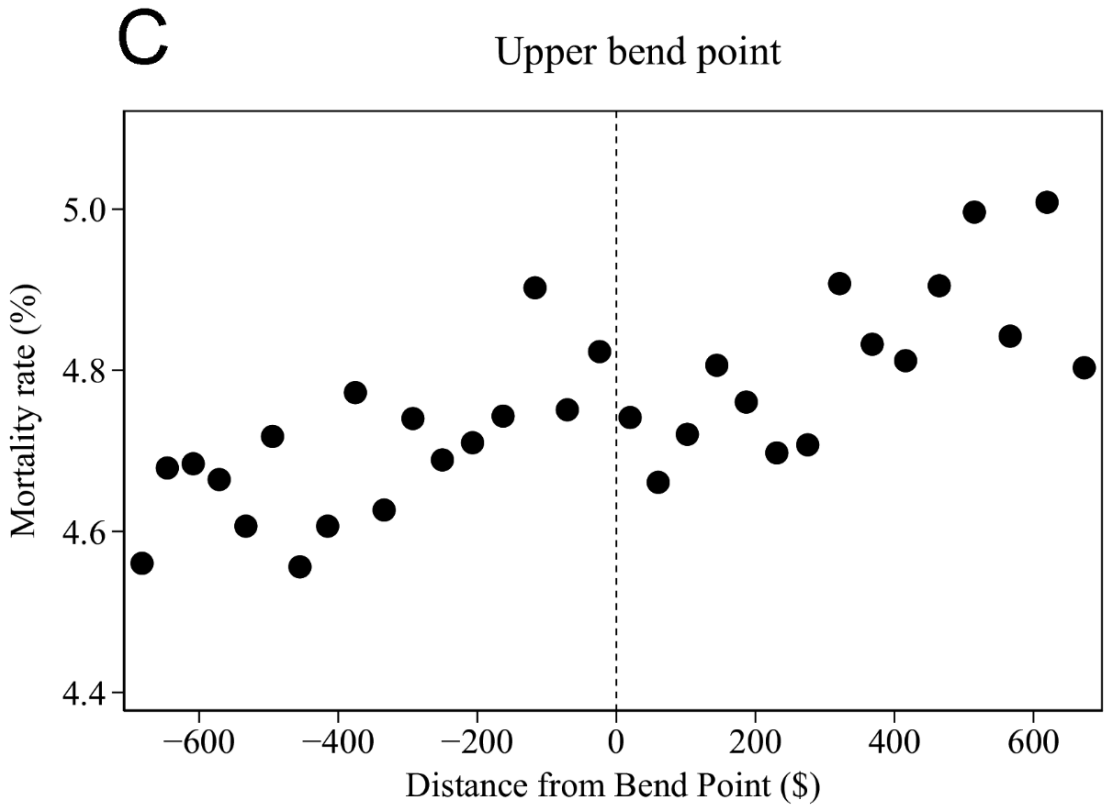

FIG. 2. Mortality rates around the BPs.(C)

Effect of Disability Insurance Payments on Mortality Rates

	Without covariates		With covariates		
	Local Linear (1)	+ Quadratic Bias Correction (2)	Local Linear (3)	+ Quadratic Bias Correction (4)	BP Mean (pp) (5)
	Lower BP				
First-stage estimates (DI pay change per $1 AIME)	−.517	−.506	−.532	−.527	
	(.003)	(.001)	(.003)	(.002)	
Mortality change per $1,000 DI (pp)	−.241	−.371	−.209	−.346	3.86
	(.077)	(.140)	(.096)	(.145)	
Implied change (%)	−6.2	−9.6	−5.4	−8.9	
Bandwidth	194.48	194.48	156.21	156.21	
Effective no. of observations	182,275	182,275	146,116	146,116	
	Family BP				
First-stage estimates (DI pay change per $1 AIME)	−.369	−.370	−.369	−.369	
	(.001)	(.001)	(.001)	(.001)	
Mortality change per $1,000 DI (pp)	−.254	−.319	−.184	−.255	3.65
	(.063)	(.100)	(.061)	(.094)	
Implied change (%)	−6.9	−8.7	−5.0	−7.0	
Bandwidth	599.57	599.57	586.91	586.91	
Observations	128,071	128,071	125,485	125,485	
	Upper BP				
First-stage estimates (DI pay change per $1 AIME)	−.169	−.165	−.169	−.161	
	(.010)	(.006)	(.024)	(.006)	
Mortality change per $1,000 DI (pp)	−.033	−.113	−.025	.097	4.92
	(.086)	(.139)	(.082)	(.327)	
Implied change (%)	−.7	−2.3	−.5	−2.0	
Bandwidth	588.94	588.94	579.44	579.44	
Observations	445,600	445,600	438,311	438,311	

TABLE. 1. Effect of Disability Insurance Payments on Mortality Rates

Robustness and Validity Checks

Bandwidth Sensitivity

- Estimates remain stable for bandwidths:
  - **Lower BP:** $150–$800.
  - **Family BP:** $390–$810.
- **Upper BP:** No significant effects across bandwidth choices.

Placebo Tests

- **No effects detected** in placebo groups:
  - DI beneficiaries without dependents near the family BP.
  - Non-DI beneficiaries with estimated AIME.
  - Predicted mortality based on covariates.

Permutation Test (Ganong and Jäger, 2018)

- **Lower and Family BPs:** T-statistic for the main estimates exceed placebo thresholds.
- **Upper BP:** T-statistic for the main estimates fall within placebo range.

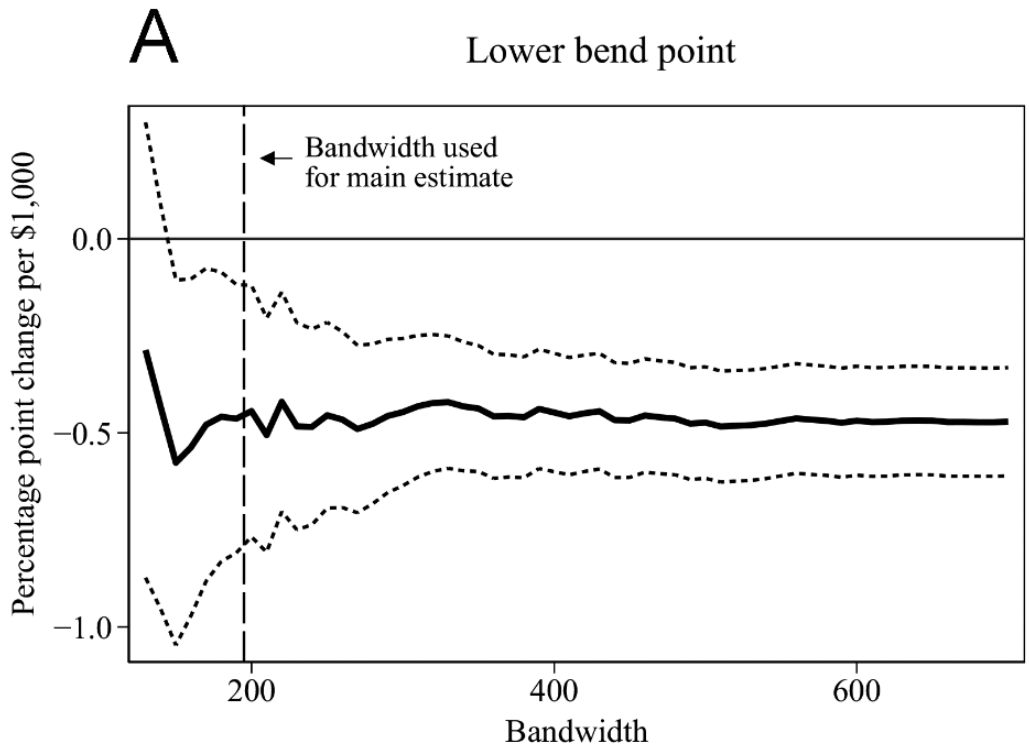

FIG. 3. Mortality estimates with varying bandwidths.(A)

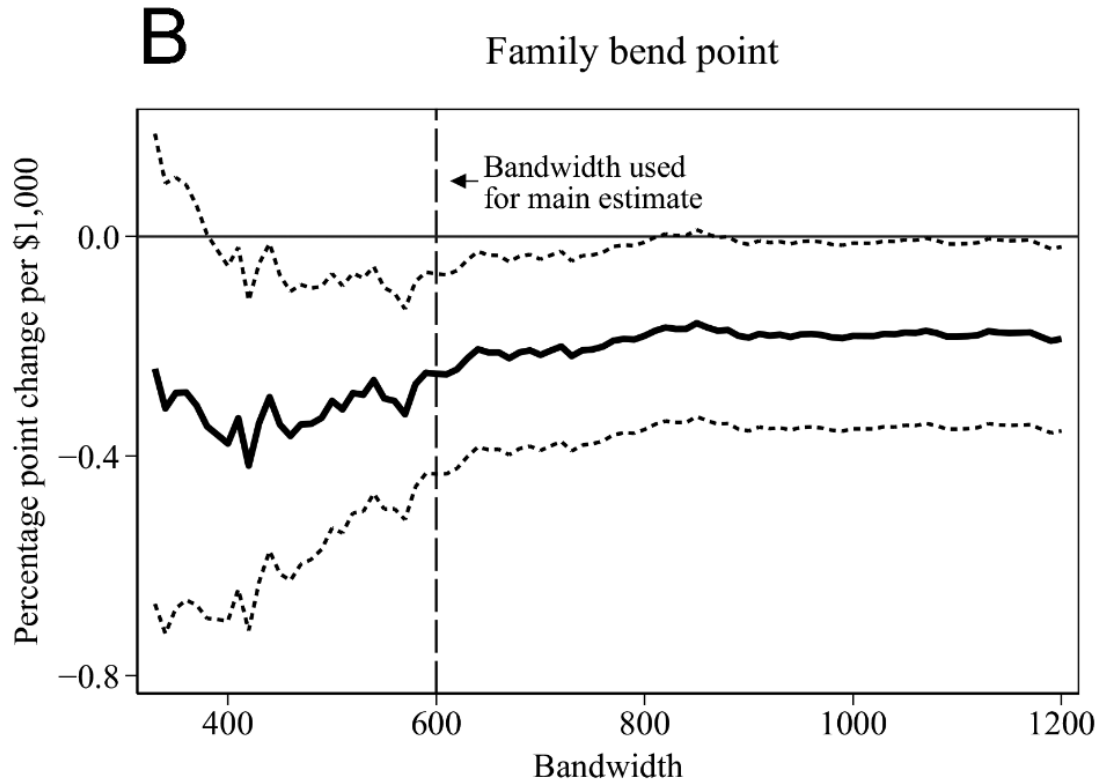

FIG. 3. Mortality estimates with varying bandwidths.(B)

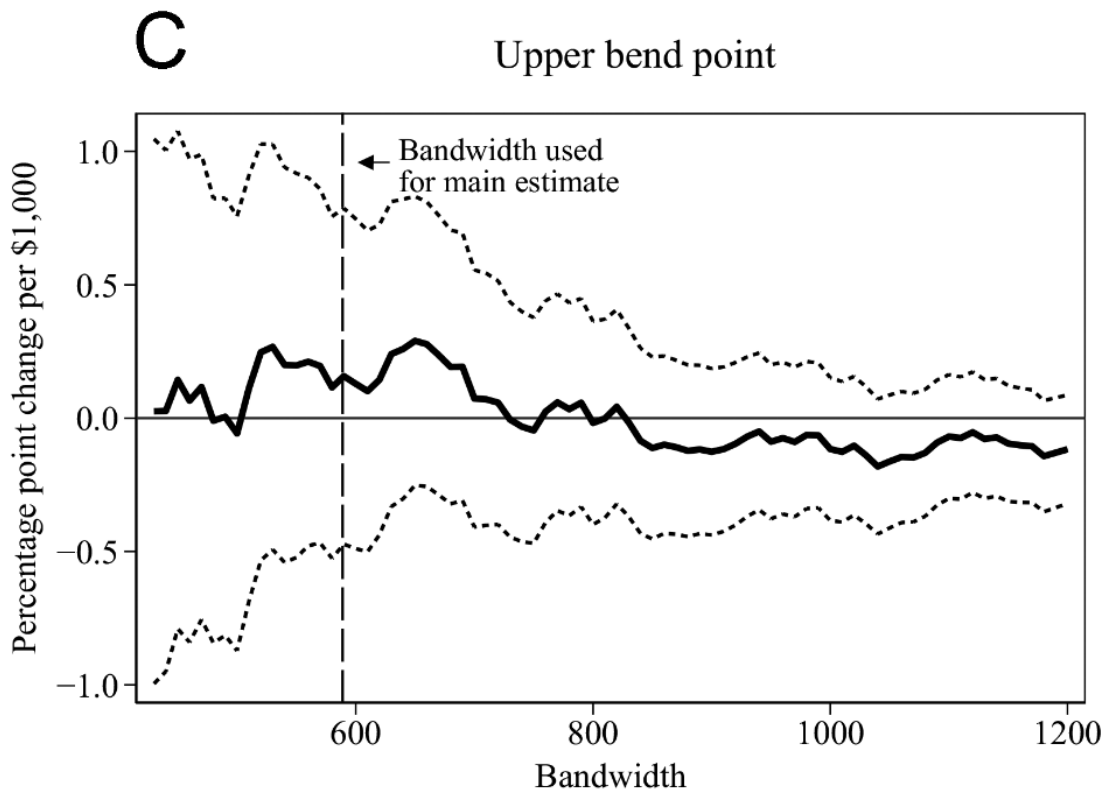

FIG. 3. Mortality estimates with varying bandwidths.(C)

Effect Heterogeneity
Key Subgroup Insights

- **By Award Method:**
  - **Initial awardees:** Significant reductions in mortality (higher baseline mortality).
  - **Hearing-level awardees:** No significant effects.
- **By Disability Type:**
  - Larger reductions for cancers and "other" disabilities (higher baseline mortality).
  - Smaller reductions for musculoskeletal and mental disorders.
- **By Time on DI:**
  - Mortality reductions decline over time, with effects lowest in the fourth year.
  - Consistent with declining baseline mortality.

HETEROGENEITY IN THE MORTALITY EFFECTS AT THE LOWER AND FAMILY BPS

	Lower BP				Family BP			
	Full Sample		DDS Examiner Awardees Only		Full Sample		DDS Examiner Awardees Only	
Category, Subgroup	Estimate (pp) (1)	Mean (pp) (2)	Estimate (pp) (3)	Mean (pp) (4)	Estimate (pp) (5)	Mean (pp) (6)	Estimate (pp) (7)	Mean (pp) (8)
				How DI Awarded				
a. DDS examiner awardees	−.373	5.00	. . .		−.227	4.29	. . .	
	(.138)				(.075)			
b. Hearings level awardees	.294	1.36	. . .		.062	1.04	. . .	
	(.364)				(.071)			
p-value: a = b	.09				.01			
				Sex				
c. Females	−.422	3.86	−.475	5.22	−.142	3.94	−.230	4.87
	(.184)		(.170)		(.082)		(.104)	
d. Males	.348	3.83	−.137	4.21	−.148	3.40	−.190	3.78
	(1.017)		(.272)		(.083)		(.101)	
p-value: c = d	.46		.29		.95		.78	
				Race				
e. Non-Black	−.321	3.81	−.424	4.96	−.181	3.53	−.207	4.14
	(.123)		(.149)		(.066)		(.082)	
f. Black	.201	4.20	.410	5.19	−.047	4.28	−.082	5.07
	(.358)		(1.54)		(.140)		(.170)	
p-value: e = f	.17		.59		.39		.51	
				Age at Filing				
g. <45 years	−.031	2.16	−.358	2.85	−.206	2.83	−.332	3.42
	(.900)		(.495)		(.070)		(.094)	
h. ≥45 years	−.212	4.74	−.280	5.94	−.021	5.32	−.001	5.93
	(.211)		(.14)		(.107)		(.125)	
p-value: g = h	.84		.88		.15		.13	

TABLE 2. Heterogeneity in the Mortality Effects at the Lower and Family BPs(1)

	Year Started on DI							
i. 1997–2005	−.351	4.74	−.771	6.08	−.213	3.86	−.274	4.48
	(.494)		(.344)		(.084)		(.101)	
j. 2006–9	−.398	2.82	−.411	3.59	−.044	3.35	−.069	3.98
	(.169)		(.152)		(.084)		(.110)	
p-value: i = j	.93		.34		.15		.17	
	Primary Disability							
k. Mental	.649	1.10	.144	1.16	−.117	.65	−.137	.67
	(.487)		(.466)		(.057)		(.064)	
l. Musculoskeletal	.047	.83	−.247	1.04	.002	.72	−.061	.66
	(.250)		(.186)		(.063)		(.095)	
m. Cancers	−1.505	18.05	−.428	18.97	−.171	18.99	−.281	19.40
	(1.055)		(.226)		(.224)		(.231)	
n. Cardiovascular	−.077	4.18	−.557	5.18	−.020	1.79	−.035	2.00
	(.870)		(.946)		(.201)		(.232)	
o. All other disabilities	−.541	7.80	−.589	9.41	−.211	6.93	−.236	8.55
	(.370)		(.245)		(.117)		(.135)	
p-value: k = l = m = n = o	.34		.70		.71		.72	
	Time on DI							
p. Years 1–2	−.503	5.15	−.819	6.86	−.107	5.16	−.142	4.48
	(.254)		(.319)		(.096)		(.120)	
q. Years 3–4	−.116	2.56	−.183	3.12	−.145	2.15	−.193	3.98
	(.064)		(.195)		(.077)		(.095)	
p-value: p = q	.14		.09		.76		.74	

TABLE 2. Heterogeneity in the Mortality Effects at the Lower and Family BPs(2)

Potential Mechanisms

Labor Supply Channel

- No significant changes in labor supply at lower and family BPs.
- Contrasts with findings that DI receipt may reduce labor participation and increase mortality (e.g., Fitzpatrick and Moore 2018; Kuhn et al. 2020; Black et al. 2021).

Spending That Protects Health

- Higher DI income may improve access to health care, food, and housing.
- **Evidence:**
  - Cheaper heating reduces mortality (Chirakijja et al., 2019).
  - Increased food expenditure lowers cardiovascular conditions (Cutler et al., 2003).
- **Medicaid and In-Kind Benefits:**
  - DI/SSI beneficiaries with Medicaid access show smaller mortality effects (e.g., Borgschulte and Vogler 2020; Miller, Johnson, and Wherry 2021).
  - Results suggest in-kind benefits reduce dependence on DI payments for health improvements.

	MSE-optimal bandwidths			Bandwidths used in Gelber,Moore & Strand (2017)		
	Local linear (1)	+ Bias correction (2)	+ Covariate adjustment (3)	Local linear (4)	+ Bias correction (5)	+ Covariate adjustment (6)
Lower bend point						
Change per $1 of DI	0.051	-0.049	-1.126	-0.012	0.046	0.030
	(0.106)	(0.363)	(0.820)	(0.158)	(0.219)	(0.219)
Bandwidth	117.45	117.45	199.71	600	600	600
Effective no. of observations	109,681	109,681	187419	548,218	548,218	548,218
Family bend point						
Change per $1 of DI	0.081	0.144	0.164			
	(0.055)	(0.100)	(0.099)			
Bandwidth	512.84	512.84	509.82			
Observations	110,088	110,088	109,435			
Upper bend point						
Change per $1 of DI	-0.223	-0.173	-0.390	-0.242	-0.261	-0.374
	(0.113)	(0.221)	(0.203)	(0.028)	(0.068)	(0.099)
Bandwidth	550.05	550.05	682.41	1500	1500	1500
Observations	323,314	323,314	402,044	918,598	918,598	918,598

TABLE 3. Effect of DI payments on earnings (Appendix Table B6)

	Lower bend point (1)	Family bend point (2)	Upper bend point (3)
DI beneficiaries who received SSI			
First-stage estimates (DI/SSI pay change per $1 AIME)	0.0010 (0.0015)	-0.367 (0.001)	-0.161 (0.006)
Mortality change per $1,000 DI (p.p.)	-0.415 (1.913)	-0.054 (0.106)	0.140 (0.320)
Bandwidth	165.29	600.32	1199.96
Observations	194,826	134,288	166,435
Mean at bend point (p.p.)	3.96	3.62	5.29
p-value: coefficient (a) equals estimate for main sample [from Table 1, column (3)]	0.97	0.12	0.60
All DI beneficiaries – Main sample + DI beneficiaries who received SSI			
First-stage estimates (DI/SSI pay change per $1 AIME)	-0.118 (0.016)	-0.368 (0.001)	-0.161 (0.007)
Mortality change per $1,000 DI (p.p.)	-0.457 (0.221)	-0.169 (0.082)	0.135 (0.331)
Bandwidth	151.47	571.78	470.85
Observations	498,781	247,423	409,022
Mean at bend point (p.p.)	3.94	3.64	4.96

TABLE 4. Estimates using DI/SSI beneficiaries after the DI waiting period (Appendix Table B8)

Unexplored Channels

- Limited self-insurance (e.g., low assets, being single) may contribute to mortality effects (Coe et al. 2014; Autor et al. 2019; Meyer and Mok 2019).
- Future research needed to link wealth or asset data to mortality outcomes.

Implications and Conclusion

Key Findings:

- **Large Mortality Reductions for Lower-Income DI Beneficiaries**
  - -0.21 pp (conventional) | -0.35 pp (bias-corrected) per $1,000 DI income (covariates are included).
  - Mortality elasticity: -0.56 to -0.94 (DI income) | -0.63 to -1.0 (DI income + earnings).
- **Household Income**: Elasticity of -0.76 to -1.3

Comparisons to Other Studies:

- Similar effects to rural pensions in China (-1.2) and US Union Army pensions (-0.6) (Cheng et al. 2018, Salm 2011).
- Comparable to cash transfers in vulnerable populations (e.g., Russian pensions, Mexican seniors)

Implications for Policy:

- **Cost of Saving a Life Year (VSLY)**:
  - $33,000–$55,000 (**Lower BP**) | $45,000–$65,000 (**Family BP**).
  - Lower than VSLY benchmarks used by Department of Health and Human Services ($116,000–$369,000).
- **Quality-Adjusted Life Year (QALY)**:
  - Life expectancy gains for DI beneficiaries align with QALY estimates ($50,000–$150,000; e.g., Neumann, Cohen, and Weinstein 2014; Neumann et al. 2016; Kim and Basu 2021; Vanness, Lomas, and Ahn 2021)

Broader Context:

- Mortality reductions in DI beneficiaries comparable to low-income taxpayers in the bottom 5% (Chetty et al., 2016)
- Potential for significant societal impact, especially among low-income or vulnerable groups

Future Research: Investigating mortality effects in other social insurance programs could yield valuable insights.

Thank You !