Online Appendix

Household Labor Supply and the Value of Social Security Survivors Benefits
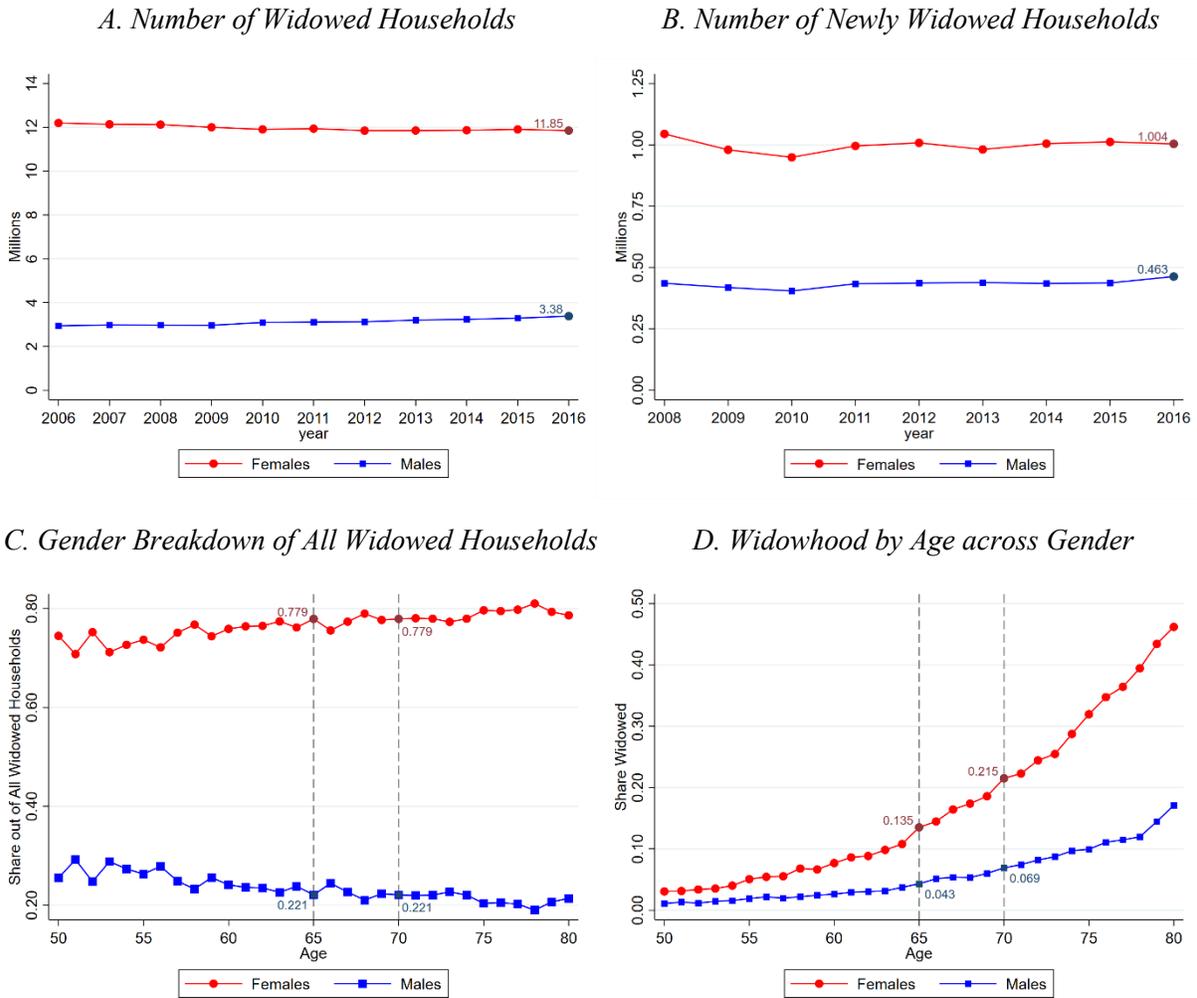
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Appendix A: Background Facts and Summary Statistics

Appendix Figure A.1: Facts on Widowhood in the U.S.

A. Number of Widowed Households

B. Number of Newly Widowed Households

C. Gender Breakdown of All Widowed Households

D. Widowhood by Age across Gender

Notes: These figures use annual data from the American Community Survey (ACS) to provide basic facts on widowhood in the U.S. The ACS is a representative survey conducted by the U.S. Census Bureau that contains information on households' demographics and economic characteristics. Panels C and D use data from 2016.

Appendix Table A.1: Labor Supply Statistics for American Women near Retirement Age

	ACS	Newly Widowed Households
	(1)	(2)
Age:		
55		
Wage Earnings	25,086	25,153
Labor Force Participation	0.681	0.721
Share with Wages Below Earnings Test	0.443	0.421
56		
Wage Earnings	24,205	23,857
Labor Force Participation	0.667	0.705
Share with Wages Below Earnings Test	0.457	0.440
57		
Wage Earnings	23,251	22,919
Labor Force Participation	0.646	0.686
Share with Wages Below Earnings Test	0.478	0.461
58		
Wage Earnings	22,208	21,828
Labor Force Participation	0.627	0.665
Share with Wages Below Earnings Test	0.500	0.486
59		
Wage Earnings	20,425	20,360
Labor Force Participation	0.597	0.641
Share with Wages Below Earnings Test	0.535	0.510
Average 55-59		
Wage Earnings	23,049	22,685
Labor Force Participation	0.644	0.681
Share with Wages Below Earnings Test	0.482	0.466

Notes: This table reports summary statistics for the labor supply of women near retirement age in the U.S. Column 1 uses annual data from the American Community Survey (ACS) among all American women for the year 2006; column 2 includes our sample of newly widowed women.

Appendix A.1: Additional Program Details—Cash-on-Hand Versus Wealth

In the analysis of the effects of eligibility for survivors benefits on newly widowed households, declines in labor supply would imply that the responses are driven by the sharp change in cash-on-hand and would point to the value of immediate (unanticipated) liquidity upon the adverse household event. To see this, we need to consider the degree to which benefit eligibility at the transition to widowhood induces a cash-on-hand (or liquidity) effect in contrast to an income (or wealth) effect, which we now discuss.

When we study the effect of benefit eligibility, we compare the behaviors of women at the initial stage of widowhood as a function of their age in months. As such, per the exact structure of Social Security's survivors benefits, there is a sharp discontinuity in cash-on-hand among newly widowed women at the precise age 60 eligibility cutoff. If liquidity matters, this sharp increase in liquidity through government transfers would induce a discontinuous decline in labor supply at the age cutoff. On the other hand, there is no discontinuity in newly widowed households' present discounted value of benefits at the eligibility cutoff for the following reasons. First, among widows older than 60 but younger than the full retirement age, the program is designed to provide an entitlement for the same benefit PDV for a given history of a husband's earnings, whereby claiming benefits at different ages involves actuarial adjustments, as we mention in the institutional details in Section 2. Second, widows younger than 60 are entitled to the same PDV of benefits (for a given history of a husband's earnings) as those who are older, which they can collect starting at age 60. Thus, the entitlement formula for benefit PDV is approximately flat around our threshold. Since the PDV of survivors benefits weakly increases in the husband's earnings history, which is weakly increasing the older the household transitions to widowhood, the PDV of survivors benefits at widowhood may display moderate increases in the widow's monthly age—but such potential increases are smooth as per the benefit calculation formula. Specifically, potential increases in benefit PDV over a newly widowed wife's monthly age from an additional month of a husband's earnings are smoothed and muted by the averaging of the husband's Average Income Monthly Earnings (AIME) over 35 years.

Appendix B: Construction of Rate of Change in Earnings

In our high-frequency study of the effects of benefit eligibility, we also provide complementary analysis for the rate of change in earnings, as an overall measure of changes in 'work intensity.' The benefit from this measure of changes in earnings, on top of earnings levels, is that it provides clear visual illustration of the promptness of responses right at eligibility. We construct this measure in the following way. To avoid division by zeros in analyzing how earnings change from one period to the next, we instead look at earnings today, $z_i(t)$, relative to the sum of earnings today and in the previous period, that is: $\frac{z_i(t)}{z_i(t)+z_i(t-1)}$. With this measure, the benchmark of no change in labor supply is $\frac{1}{2}$, so we study the deviation from this benchmark, that is: $\frac{z_i(t)}{z_i(t)+z_i(t-1)} - \frac{1}{2}$, to get at changes in work intensity. Finally, for ease of interpretation, we normalize this measure by dividing it by $\frac{1}{2}$. This has the appealing properties that it equals 0 if there are no changes in earnings and that it equals -1 if a person stops working altogether. Put together, our work intensity measure is $2 \times \frac{z_i(t)}{z_i(t)+z_i(t-1)} - 1$, where we assign the value zero if an individual does not work in both periods ($z_i(t) = z_i(t-1) = 0$).

Appendix C: Effects of Eligibility for Social Security's Survivors Benefits

Appendix Table C.1: Effects of Eligibility for Social Security's Survivors Benefits on Newly Widowed Households

| | Widows' Labor Supply | | Overall Net | Social Security Benefits | |
| | Wage Earnings | Participation | Household Income | Claiming Rate | Benefit Amount |
	(1)	(2)	(3)	(4)	(5)
Full-Exposure Effect	-1,751	-0.02866	4,799	0.51351	5,605
	(301)	(0.00349)	(345)	(0.00336)	(39)
Counterfactual	18,787	0.61215	42,127	0.11636	1,009
	(203)	(0.00213)	(212)	(0.00142)	(16)
Percent Change	-9.32	-4.7	11.4		
Number of Obs.	504,104	504,104	504,104	504,104	504,104
Number of Clusters	293,857	293,857	293,857	293,857	293,857

Notes: This table reports estimates for the impact of eligibility for Social Security's survivors benefits based on specification (1). It provides the effect of full exposure to eligibility for the program, which is captured by $\beta_2 + \beta_3 \times (11/12)$. The estimation includes observations from the immediate post-shock years (years 1 and 2 after the spousal death). We also report the counterfactual levels using equation (1), which is estimated by $\beta_0 + \beta_1 \times (11/12)$. We report robust standard errors clustered at the household level.

Appendix Table C.2: Effects of Eligibility for Social Security's Survivors Benefits on Newly Widowed Households—Additional Analysis

| | Widows' Labor Supply | | Overall Net | Social Security Benefits | |
	Wage Earnings	Participation	Household Income	Claiming Rate	Benefit Amount
	(1)	(2)	(3)	(4)	(5)
Panel A: Post-Shock Year 1					
Full-Exposure Effect	-1,784	-0.03514	4,931	0.54086	5,959
	(448)	(0.00504)	(504)	(0.00461)	(53)
Number of Obs.	259,407	259,407	259,407	259,407	259,407
Number of Clusters	259,407	259,407	259,407	259,407	259,407
Panel B: Labor Income below Earnings Test					
Full-Exposure Effect	-1,065	-0.02424	7,085	0.60301	7,258
	(214)	(0.00482)	(525)	(0.00461)	(60)
Counterfactual	3,978	0.29694	34,061	0.20312	1,921
	(196)	(0.00320)	(329)	(0.00278)	(32)
Percent Change	-26.8	-8.2	20.8		
Number of Obs.	216,167	216,167	216,167	216,167	216,167
Number of Clusters	126,635	126,635	126,635	126,635	126,635
Panel C: Augmented Design—Control Group					
Full-Exposure Effect	-1,363	-0.02866	5,425	0.53745	5,759
	(465)	(0.00696)	(771)	(0.00489)	(56)
Number of Obs.	547,279	547,279	547,279	547,279	547,279
Number of Clusters	317,332	317,332	317,332	317,332	317,332

Notes: This table reports various estimations of the impact of eligibility for Social Security's survivors benefits on newly widowed households. Panels A and B estimate equation (1) and report the full-exposure effect based on the estimate for $\beta_2 + \beta_3 \times (11/12)$. Panel A uses observations from the immediate post-shock year (year 1 after the spousal death). Panel B includes the sample of widows whose pre-shock earnings were below the earnings test thresholds and uses observations from the post-shock years 1-2. Panel C augments our main design with a control group of future widows. We include in the treatment group observations of widowed households from periods 1 and 2, and we include in the control group observations of future-widowed households from periods -2 and -1. To guarantee the comparability of calendar years across the treatment and control groups' observations and due to the horizon of our data, the control group is based on households that experience a spousal death in the years 2005-2007, and the treatment group is based on households that experience a spousal death in the years 2002-2004, such that all included observations are from the years 2003-2006. We estimate a specification that fully interacts the terms in equation (1) with an indicator for whether a household belongs to the treatment group, denoted by $treat_i$; that is, we estimate: $y_{i,t} = \alpha_0 + \alpha_1(age_{i,t} - 60) + \alpha_2 \mathbb{I}\{age_{i,t} > 60\} + \alpha_3 \mathbb{I}\{age_{i,t} > 60\} \times (age_{i,t} - 60) + treat_i \times [\gamma_0 + \gamma_1(age_{i,t} - 60) + \gamma_2 \mathbb{I}\{age_{i,t} > 60\} + \gamma_3 \mathbb{I}\{age_{i,t} > 60\} \times (age_{i,t} - 60)] + \varepsilon_{i,t}$. The full-exposure effect is then assessed in this specification by $\gamma_2 + \gamma_3 \times (11/12)$. We report robust standard errors clustered at the household level.

Appendix Table C.3: Effects of Eligibility for Social Security's Survivors Benefits—
No Pre-Period Contributions to Retirement Accounts

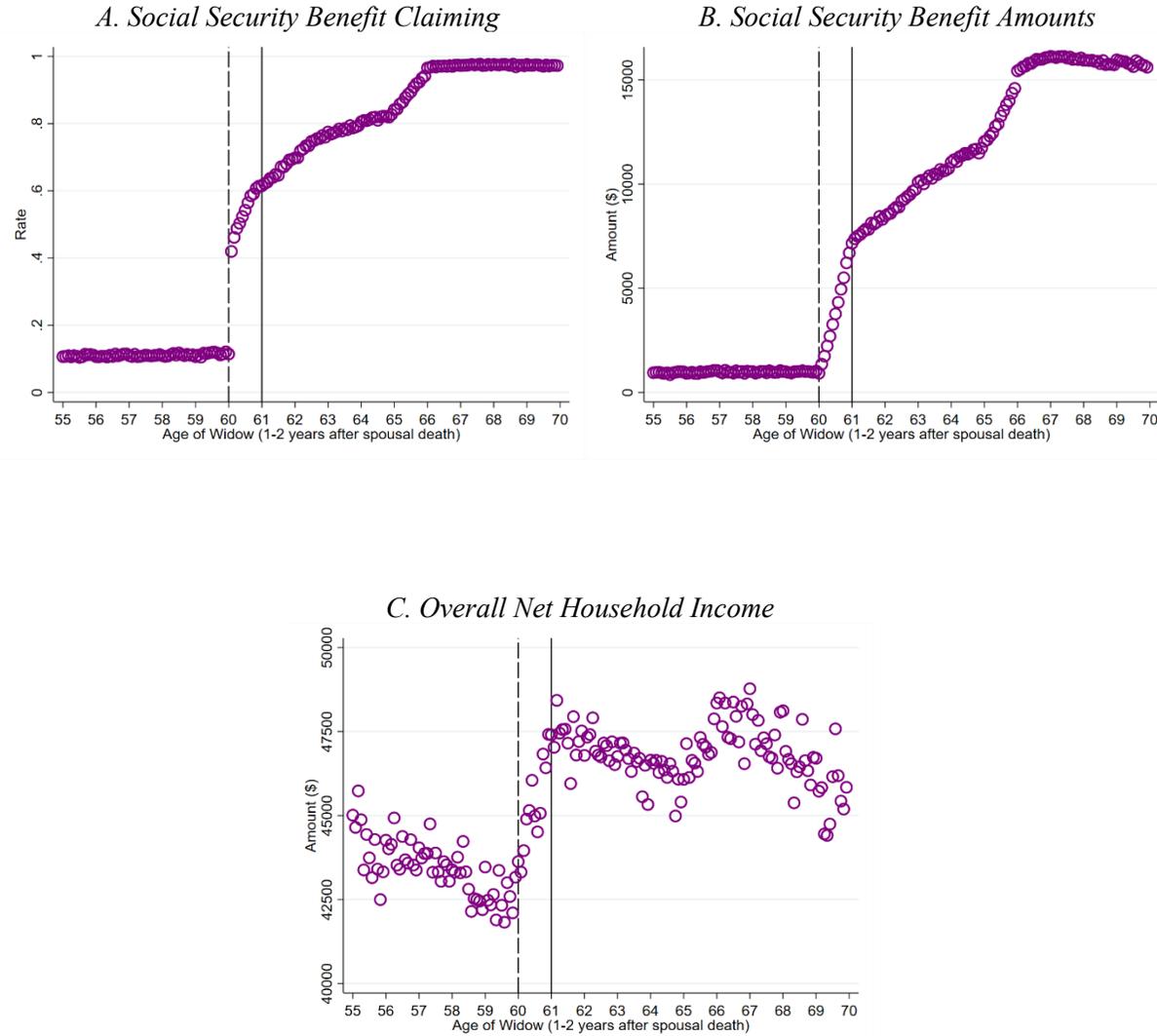| | Widows' Labor Supply | | Overall Net | Social Security Benefits | |
| | Wage Earnings | Participation | Household Income | Claiming Rate | Benefit Amount |
	(1)	(2)	(3)	(4)	(5)
Full-Exposure Effect	-1,597	-0.02447	5,100	0.55553	5,905
	(272)	(0.00496)	(435)	(0.00458)	(54)
Counterfactual	12,556	0.51545	34,269	0.15626	1,419
	(181)	(0.00314)	(270)	(0.00227)	(26)
Percent Change	-12.7	-4.75	14.9		
Number of Obs.	252,192	252,192	252,192	252,192	252,192
Number of Clusters	147,400	147,400	147,400	147,400	147,400

Notes: This table reports various estimations of the impact of eligibility for Social Security's survivors benefits. The analysis of newly widowed households includes observations from the immediate post-shock years (years 1 and 2 after the spousal death). Using specification (1), the table provides the effect of full exposure to eligibility for the program, which is captured by $\beta_2 + \beta_3 \times (11/12)$. The estimation includes all households who did not make contributions to savings accounts in previous periods (specifically, the pre-shock periods for newly widowed households and the lagged period for already widowed households). We report robust standard errors clustered at the household level.

Appendix Table C.4: Effects of Eligibility for Social Security's Survivors Benefits by Household Specialization
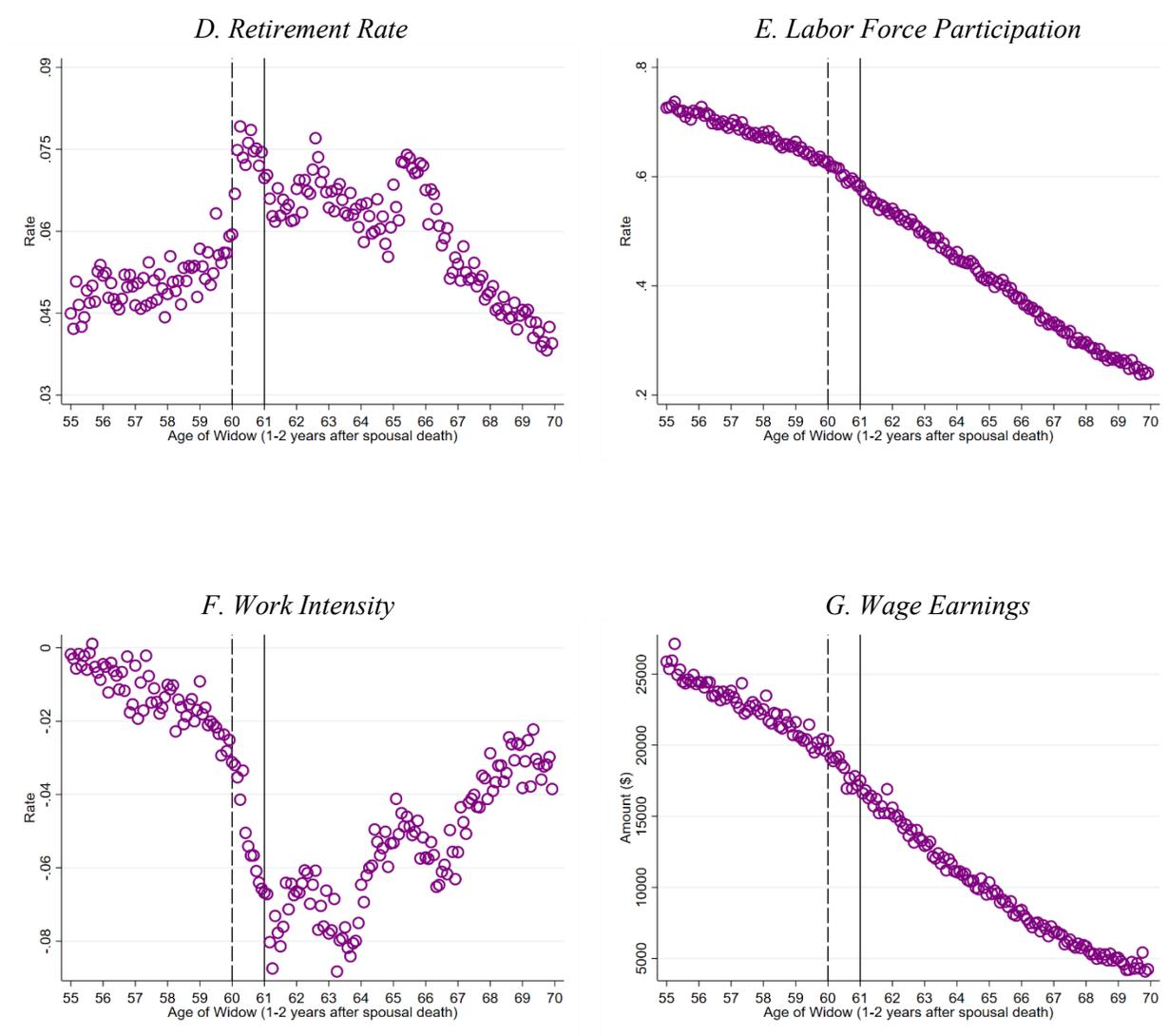
Panel A: Husband's Share of Household Earnings prior to Death < 25%

	Widows' Labor Supply		Overall Net Household Income	Social Security Benefits	
	Wage Earnings	Participation		Claiming Rate	Benefit Amount
Full-Exposure Effect	2,100	-0.007	5,041	0.424	4,446
	(1,687)	(0.0097)	(1,283)	(0.0127)	(138)
Counterfactual	32,911	0.855	52,464	0.052	252
Number of Obs.	34,250	34,250	34,250	34,250	34,250
Number of Clusters	19,992	19,992	19,992	19,992	19,992

Panel B: Husband's Share of Household Earnings prior to Death > 75%

	Labor Supply		Overall Net Household Income	Social Security Benefits	
	Wage Earnings	Participation		Claiming Rate	Benefit Amount
Full-Exposure Effect	-1,683	-0.023	7,920	0.596	7,784
	(457)	(0.0067)	(813)	(0.0065)	(89)
Counterfactual	6,660	0.320	38,024	0.217	2,218
Number of Obs.	122,650	122,650	122,650	122,650	122,650
Number of Clusters	71,392	71,392	71,392	71,392	71,392

Notes: This table reports estimates for the impact of eligibility for Social Security's survivors benefits on newly widowed households, where we split the sample by the relative shares of the spouses' pre-death labor earnings. Specifically, we calculate, for each household, the husband's share of household earnings in year -2 (to avoid changes that may occur just before death). Panel A includes the subsample of households in which the husband's share of household earnings prior to death was 0.25 or lower, and panel B includes the subsample of households in which the husband's share of household earnings prior to death was 0.75 or higher. Based on specification (1), the table provides the effect of full exposure to eligibility for the program, which is captured by $\beta_2 + \beta_3 \times (11/12)$. The estimation includes observations from the immediate post-shock years (years 1 and 2 after the spousal death). We also report the counterfactual levels using equation (1), which is estimated by $\beta_0 + \beta_1 \times (11/12)$. We report robust standard errors clustered at the household level.

Appendix Figure C.1: Effects of Eligibility for Social Security's Survivors Benefits—
Extended Age Range

A. Social Security Benefit Claiming

B. Social Security Benefit Amounts

C. Overall Net Household Income

Appendix Figure C.1: Effects of Eligibility for Social Security's Survivors Benefits—
Extended Age Range (*continued*)

Notes: These figures plot various household outcomes in the years just after a husband's death event (years 1 and 2 after the event) as a function of the surviving spouse's age in months. The purple circles represent means of raw data for each "monthly age" bin. Eligibility for benefits begins at exactly age 60 (which is marked by the vertical dashed black line), where full exposure is reached at age 61 (which is marked by the vertical solid black line).

Appendix Table C.5: Effects of Eligibility for Social Security's Survivors Benefits on Already Widowed Households

| | Widows' Labor Supply | | Overall Net | Social Security Benefits | |
| | Wage Earnings | Participation | Household Income | Claiming Rate | Benefit Amount |
	(1)	(2)	(3)	(4)	(5)
Full-Exposure Effect	-1,890	-0.02799	2,960	0.33232	3,614
	(201)	(0.00272)	(228)	(0.00281)	(33)
Counterfactual	20,616	0.62245	40,435	0.12076	1,116
	(167)	(0.00194)	(166)	(0.00131)	(15)
Percent Change	-9.2	-4.5	7.32		
Number of Obs.	643,380	643,380	643,380	643,380	643,380
Number of Clusters	237,359	237,359	237,359	237,359	237,359

Notes: This table reports estimates for the impact of eligibility for Social Security's survivors benefits based on specification (1). It provides the effect of full exposure to eligibility for the program, which is captured by $\beta_2 + \beta_3 \times (11/12)$. The estimation includes observations of already widowed households using observations from periods 6-10 following the spousal death. We also report the counterfactual levels using equation (1), which is estimated by $\beta_0 + \beta_1 \times (11/12)$. We report robust standard errors clustered at the household level.

Appendix C.1: Responses to Anticipated Benefit Eligibility by Widowed Households—Model of Household Behavior

1) Frictionless Benchmark

We offer here an extension to the model analyzed in the text by studying the dynamics within the bad state based on a two-period model of households that had transitioned to widowhood in period $t = 0$. We use the notation that $x(t)$ denotes outcome x for the widows in period $t \in \{0,1\}$. For the frictionless benchmark, we analyze the case in which households are forward-looking and understand the Social Security benefit schedule and rules and there are no liquidity constraints. Since we focus on spouses who are already in the bad state, we suppress any indexes for the household member or the state of nature.

We analyze the planning problem where the deterministic benefit schedule can be fully anticipated at its beginning. The household maximizes its lifetime utility subject to the within-period budget constraints, where the choice of saving or borrowing is unconstrained beyond guaranteeing that consumption is non-negative. Formally, the household solves the problem: $\max u(c(0)) - v(l(0)) + u(c(1)) - v(l(1))$, subject to the within-period budget constraints: $c(0) = \bar{A} + wl(0) + b(0) - s$ and $c(1) = A(1) + wl(1) + b(1) + s$, where $\bar{A}$ is a baseline level of wealth and non-labor income, and the choice of saving or borrowing, s, is unconstrained beyond guaranteeing that $c(0), c(1) \geq 0$.

At the optimum, widows smooth consumption and leisure so that $c(0) = c(1)$ and $l(0) = l(1)$, and the whole planning problem can be rewritten in terms of the present discounted value of lifetime unearned income, $I \equiv \bar{A} + b(0) + b(1)$.[1] Hence, the main prediction of this familiar model, which constitutes a frictionless benchmark, is that of labor supply smoothing: there should be no discontinuity in labor market choices when the anticipated benefits become available. That is, for a given level of the present discounted value of benefits, the household's behavior should not depend on their timing. It is straightforward to also explicitly incorporate an earnings test similar to that of the Social Security survivors insurance, whereby later benefits increase permanently to account for the months in which benefits are withheld if widows' earned income crosses a given threshold. If households correctly perceive the earnings test, the qualitative results of our model remain the same.

2) Benchmark Calibration of Full Hand-to-Mouth

Assume the household transitioned to widowhood when ineligible in the first period, followed by eligibility in the second period, so that $b(0) = 0$ and $b(1) > 0$. To derive this calibration, we first employ the simple within-period first-order condition $u'(c(t)) = \frac{v'(l(t))}{w}$ in the absence of benefits $(t = 0)$ to calibrate parameters, and we then use the same equation at benefit eligibility $(t = 1)$ to impute the responses

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[1] The saving/borrowing decision follows $s = \frac{1}{2}(\bar{A} + b(0) - b(1))$, and the planning problem reduces to maximizing lifetime utility subject to $c(t) = wl(t) + \frac{1}{2}I$ for $t \in \{0,1\}$.

if households were to display complete hand-to-mouth (HtM) behavior (so that current income equals consumption). We make the following parametric assumptions and calibrations: $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, $\gamma = 2$; and $v(l) = a + bl^2$. The first-order condition is then: $c^{-\gamma} = \beta z$, where $\beta \equiv \frac{2b}{w^2}$ and $z \equiv wl$. At the imputed counterfactual in the absence of benefits, income equals \$40,435 and earnings equal \$20,616, which implies that $\beta = \frac{40{,}435^{-2}}{20{,}616}$. Among eligible households, income equals \$43,395. To satisfy the first-order condition under complete hand-to-mouth, their earnings should be: $z = \frac{43{,}395^{-2}}{\beta} = \$17{,}899$. To measure the degree to which households display hand-to-mouth behavior, we divide the gap between the actual earnings treatment effect and the treatment effect under no liquidity constraints (our benchmark of zero) by the treatment effect under complete credit constraints (that is, \$17,899−\$20,616 = -\$2,717). This measure has the properties that it equals zero under the permanent income hypothesis (PIH) and that it equals 1 under HtM. In practice, the measure equals $\frac{-1{,}890-0}{-2{,}717} = 0.70$, so that the representative widowed household displays behavior that is 70% away from PIH and 30% away from HtM.

Appendix Figure C.2: Effects of Eligibility for Social Security's Survivors Benefits on Already Widowed Households

A. Labor Supply Responses by Household Liquidity Quartile

Labor Force Participation

Wage Earnings

B. Timing of Remarriage

Treatment Effect: 0.00858 (0.00081)

Counterfactual: 0.00834

Age of Widow (6-10 years after spousal death)

Rate

○ Raw Data ━━━ Regression ━━━ Counterfactual

Notes: The analysis sample includes already widowed households using observations from periods 6-10 following the spousal death. Panel A provides estimates for household labor supply responses by the degree of liquidity as proxied by lagged unearned income. We split households by quartiles, and we analyze labor supply outcomes for each subsample. The figures plot full-exposure effects for both participation and wage earnings by liquidity quartiles, along with the corresponding 95-percent confidence intervals. Panel B studies widows' remarriage rate as a function of age among widows who were single in the lagged period. The purple circles represent the means of the raw data for each "monthly age" bin. The solid gray lines plot the piecewise linear fit using equation (1). The dashed gray line in the age range 60-61 represents the counterfactual behavior in the absence of eligibility for survivors benefits based on specification (1), which extrapolates the linear relationship estimated on observations prior to age 60. Eligibility for benefits begins at exactly age 60 (which is marked by the vertical dashed black line). The full-exposure effect of benefit eligibility is represented by the vertical gap between the solid and the dashed gray regression lines at age 61 (which is marked by the vertical solid black line). We report the full-exposure effect (with standard errors in parentheses) as well as the counterfactual level.

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Appendix Table C.6: Effects of Eligibility for Social Security's Survivors Benefits on Already Widowed Households—Different Subsamples

	Social Security Benefit Amounts	Labor Supply	
		Participation	Wage Earnings
	(1)	(2)	(3)
Panel A: Low Liquidity			
Full-Exposure Effect	3,797	-0.03646	-2,930
	(42)	(0.00354)	(359)
Number of Obs.	322,950	322,950	322,950
Number of Clusters	138,615	138,615	138,615
Panel B: High Liquidity			
Full-Exposure Effect	3,392	-0.00648	-430
	(29)	(0.00392)	(206)
Number of Obs.	320,430	320,430	320,430
Number of Clusters	140,832	140,832	140,832
Difference Low-High	404	-0.02997	-2,500
	(64)	(0.00540)	(424)
Panel C: Highest Liquidity			
Full-Exposure Effect	3,369	-0.00461	273
	(68)	(0.00562)	(317)
Number of Obs.	159,452	159,452	159,452
Number of Clusters	77,072	77,072	77,072
Panel D: Remarried at or just after 60			
Full-Exposure Effect	5,772	-0.04584	-7,309
	(303)	(0.02650)	(2,191)
Number of Obs.	8,349	8,349	8,349
Number of Clusters	8,262	8,262	8,262

Notes: This table reports estimates for the impact of eligibility for Social Security's survivors benefits based on specification (1). It provides the effect of full exposure to eligibility for the program, which is captured by $\beta_2 + \beta_3 \times (11/12)$. The estimation includes observations of already widowed households using observations from periods 6-10 following the spousal death. We also report the counterfactual levels using equation (1), which is estimated by $\beta_0 + \beta_1 \times (11/12)$. We report robust standard errors clustered at the household level. Panels A-C report estimates for subsamples with varying degrees of liquidity. We proxy for the degree of liquidity using lagged unearned income. Panel A and panel B split the observations into high liquidity and low liquidity based on the sample median, and panel C includes observations from the top quartile of liquidity. Panel D reports estimates for the sample of widows who remarry at or just after the year they turn 60.

Appendix D: Spousal Death Event

Appendix Table D.1: Effects of Spousal Death on Household Outcomes

	Widows' Labor Supply		Overall Net Household Income	Social Security Benefits	
	Wage Earnings	Participation		Claiming Rate	Benefit Amount
	(1)	(2)	(3)	(4)	(5)
Time to Event:					
-3	113	0.00575	424	-0.00116	-19
	(124)	(0.00184)	(233)	(0.00145)	(15)
-2	171	0.00410	59	-0.00074	-11
	(128)	(0.00148)	(198)	(0.00110)	(11)
-1	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)
0	-45	0.00124	-9,904	0.13782	2,187
	(136)	(0.00152)	(207)	(0.00162)	(17)
1	379	0.00675	-25,073	0.15103	4,657
	(142)	(0.00192)	(239)	(0.00177)	(25)
2	283	0.00565	-25,580	0.13470	4,701
	(135)	(0.00212)	(252)	(0.00182)	(25)
3	412	0.01046	-24,616	0.12196	4,759
	(149)	(0.00228)	(263)	(0.00183)	(26)
Counterfactual	11,583	0.42768	70,803	0.53053	4,795
Number of Observations	965,447	965,447	965,447	965,447	965,447
Number of Clusters	137,921	137,921	137,921	137,921	137,921

Notes: This table reports the dynamic difference-in-differences estimates for the evolution of different household outcomes in response to spousal death using specification (2). It displays estimates for the δ_n parameter vector on the interaction between the treatment indicator and the indicators for time with respect to the assigned event year from period -3 to period +3, where the baseline period is -1. Counterfactuals are calculated based on this specification for the average behavior over the post-event years. We include as controls age fixed effects and calendar year fixed effects, and we report robust standard errors clustered at the household level.

Appendix Table D.2: Heterogeneity in Effects of Spousal Death

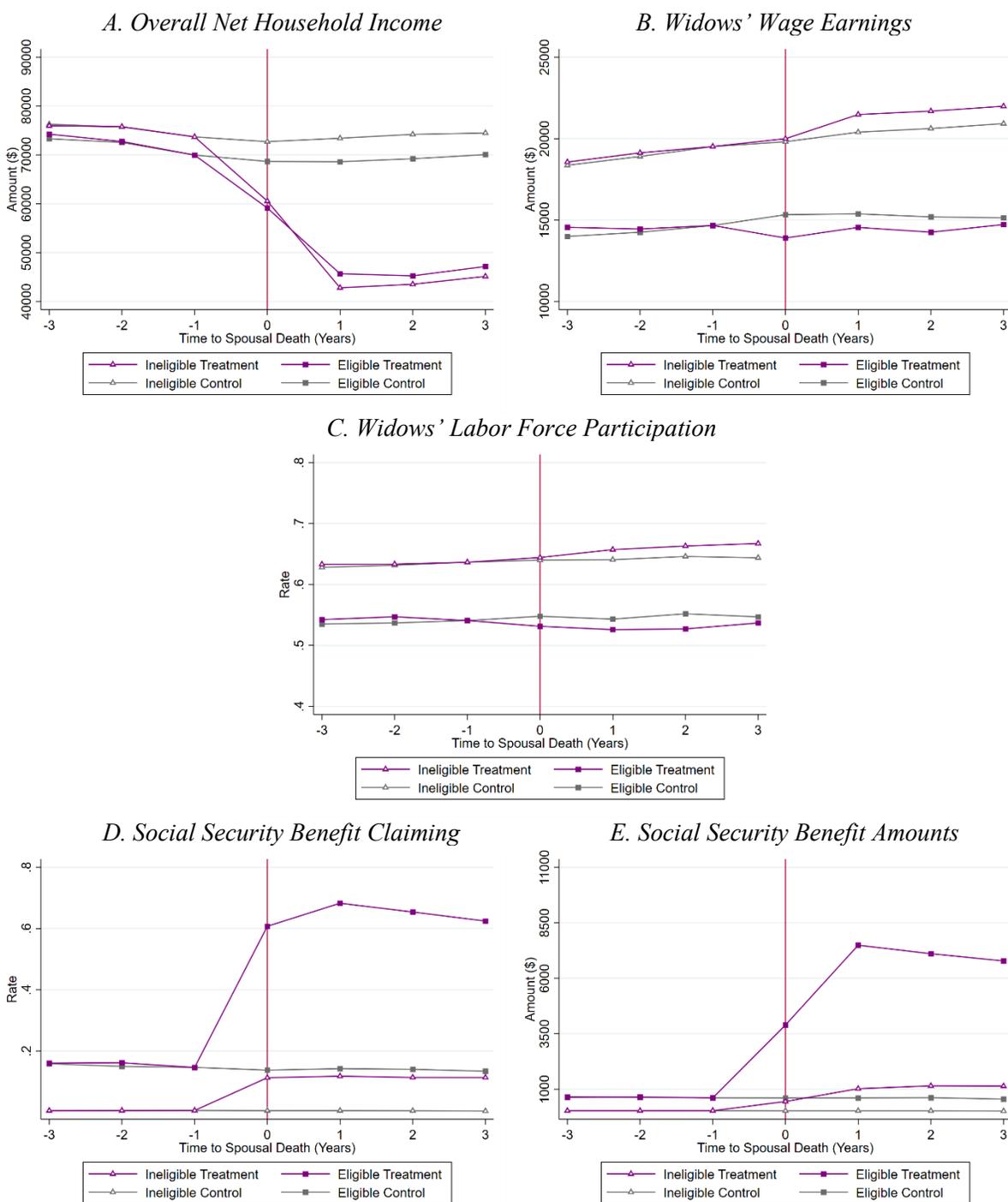*Panel A: Effects by Benefit Receipt Instrumented with Eligibility*

	Wage Earnings	Participation	Overall Net Household Income	Benefit Amount	Wage Earnings	Participation	Overall Net Household Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treat x Post	1,790	0.03033	-30,950	-64	1,772	0.02998	-30,896
	(680)	(0.01080)	(1,378)	(32)	(675)	(0.01071)	(1,368)
Treat x Post x	-4,007	-0.07900	12,334	10,010			
Benefit Receipt Indicator	(1,389)	(0.02337)	(2,939)	(83)			
Treat x Post x					-0.39804	0.000008	1.22524
Benefit Amounts					(0.13791)	(0.000002)	(0.29147)
Number of Obs.	161,073	161,073	161,073	161,073	161,073	161,073	161,073
Number of Clusters	67,140	67,140	67,140	67,140	67,140	67,140	67,140

Panel B: Effects by Widow's Employment History

	Widow Did Not Work				
	Wage Earnings	Participation	Overall Net Household Income	Benefit Claiming Rate	Benefit Amount
	(1)	(2)	(3)	(4)	(5)
Treat x Post	2,247	0.0881	-35,137	0.2500	2,742
	(322)	(0.0066)	(1,137)	(0.0065)	(80)
Number of Obs.	78,527	78,527	78,527	78,527	78,527
Number of Clusters	19,868	19,868	19,868	19,868	19,868

	Widow Did Work				
	Wage Earnings	Participation	Overall Net Household Income	Benefit Claiming Rate	Benefit Amount
	(1)	(2)	(3)	(4)	(5)
Treat x Post	563	-0.0031	-30,493	0.0729	619
	(329)	(0.0035)	(462)	(0.0020)	(21)
Number of Obs.	244,464	244,464	244,464	244,464	244,464
Number of Clusters	54,784	54,784	54,784	54,784	54,784

Notes: These tables study heterogeneity in the effects of spousal death. Panel A studies heterogeneity by survivors benefits. We estimate a specification of equation (3), where we let the average treatment effect vary by benefits received, which we define in a first specification as an indicator for benefit receipt (columns 1-4) and in a second specification as the dollar amount of benefits received (columns 5-7). We instrument for this right-hand side variable with a dummy variable for age-based eligibility, defined as the widow being 60 or older, which we interact with the main term $treat_i \times post_{i,t}$ as the instrument. We estimate this equation on a narrow age band around the eligibility cutoff (ages 58-61). We add flexible age controls in the regression by including age dummies and their interactions with $post_{i,t}$ and with $treat_i$ separately, and we also include calendar year fixed effects. In panel B, we study effects by ineligible widows' employment prior to the spousal death event. We split the sample by whether the widow worked in at least one of the pre-event years -3 to -1, and we estimate equation (3) on each subsample separately. In all specifications, we report robust standard errors clustered at the household level.

Appendix Figure D.1: Dynamic Effects of Spousal Death around Benefit Age-Eligibility

A. Overall Net Household Income

B. Widows' Wage Earnings

C. Widows' Labor Force Participation

D. Social Security Benefit Claiming

E. Social Security Benefit Amounts

Notes: These figures plot the evolution of different household outcomes in response to spousal death split by age-eligibility for Social Security's survivors benefits. Observations from ages 60 or older are included in the age-eligible plots and observations from younger ages are included in the age-ineligible plots. The x-axis denotes time with respect to the event year, normalized to period 0. For the treatment group, period 0 is when the actual event occurs; for the control group, period 0 is when a placebo event occurs (while their actual event occurs in period 4). To ease the comparison of trends, from which the effect is identified, we normalize the level of the control group's outcome to the pre-event level of the treatment group's outcome (in period −1). This normalized counterfactual is displayed by the gray line. The purple line plots the behavior of the treatment group.

Appendix E: Effects on Self-Employment

Appendix Table E.1: Effects of Eligibility for Social Security's Survivors Benefit

	Self-Employment Income	
	Indicator (1)	Amount (2)
Full-Exposure Effect	-0.00609	72
	(0.00184)	(122)
Counterfactual	0.07159	1,277
	(0.00114)	(75)
Number of Obs.	504,104	504,104
Number of Clusters	293,857	293,857

Notes: This table reports estimates for the impact of eligibility for Social Security's survivors benefits on self-employment based on Schedule SE. Using specification (1), it provides the effect of full exposure to eligibility for the program, which is captured by $\beta_2 + \beta_3 \times (11/12)$. The estimation includes observations of newly widowed households from the immediate post-shock years (years 1 and 2 after the spousal death). We also report the counterfactual levels using equation (1), which is estimated by $\beta_0 + \beta_1 \times (11/12)$. We report robust standard errors clustered at the household level.

Appendix Table E.2: Effects of Spousal Death

| | Self-Employment Income | |
| | Indicator | Amount |
	(1)	(2)
Time to Event:		
-3	-0.00022	22
	(0.00114)	(46)
-2	-0.00009	-36
	(0.00098)	(36)
-1	0	0
	(0)	(0)
0	0.00176	175
	(0.00103)	(60)
1	0.00600	193
	(0.00120)	(61)
2	0.00479	60
	(0.00126)	(76)
3	0.00287	145
	(0.00130)	(63)
Average Treatment Effect	0.00456	133
	(0.00111)	(57)
Counterfactual	0.05237	803
Number of Observations	965,447	965,447
Number of Clusters	137,921	137,921

Notes: This table reports the dynamic difference-in-differences estimates for the evolution of self-employment based on Schedule SE in response to spousal death using specification (2). It displays estimates for the δ_n parameter vector on the interaction between the treatment indicator and the indicators for time with respect to the assigned event year from period -3 to period +3, where the baseline period is -1. Counterfactuals are calculated based on this specification for the average behavior over the post-event years. We include as controls age fixed effects and calendar year fixed effects, and we report robust standard errors clustered at the household level.

Appendix F: Constructing Counterfactual Outcomes for Compliers

In this appendix, we describe how we calculate counterfactuals for the sample of compliers. It follows the classical Local Average Treatment Effect (LATE) framework and assumptions as applied to our setting.

Let Y_d be the potential outcome as a function of potential benefit take-up, $d \in \{0,1\}$, and let d_z be the potential take-up for each possible value of the eligibility instrument, $z \in \{0,1\}$. Denote the share of never-takers (for whom $d_z = 0$) by π_n, the share of always-takers (for whom $d_z = 1$) by π_a, and the share of compliers (for whom $d_0 = 0$ and $d_1 = 1$) by π_c. Additionally, we let $D \in \{0,1\}$ and $Z \in \{0,1\}$ denote the actual benefit take-up and benefit eligibility status, respectively.

We recover counterfactual outcomes for compliers, $E[Y_0|complier]$, using the following relationships:

$$E[D|Z = 0] = \pi_a; E[D|Z = 1] = \pi_a + \pi_c; \pi_n = 1 - E[D|Z = 1]$$

$$E[Y|D = 0, Z = 0] = \frac{\pi_n}{\pi_n + \pi_c} E[Y_0|never\text{-}taker] + \frac{\pi_c}{\pi_n + \pi_c} E[Y_0|complier]$$

$$E[Y|D = 0, Z = 1] = E[Y_0|never\text{-}taker]$$

Lastly, we estimate the observable moments as follows. First, for moments that pertain to ineligible households ($Z = 0$), we use predictions from a linear specification estimated based on households below the eligibility age (younger than 60): $y_{i,t} = \beta_0 + \beta_1(age_{i,t} - 60) + \varepsilon_{i,t}$. The estimator for the counterfactual is then $\beta_0 + \beta_1 \times (11/12)$. Second, for moments that pertain to eligible households ($Z = 1$), we calculate average outcomes based on households that are fully exposed, specifically using widows of the monthly ages $60\frac{11}{12}$ and 61. When the moments are conditional on takeup (D), we add that as a restriction to the estimation sample.

We calculate that $\pi_a = 0.11643$; $\pi_c = 0.49792$; $\pi_n = 0.38565$. For household income: $E[Y_0|never\text{-}taker] = 59,315$ and $E[Y_0|complier] = 31,318$. Since the treatment effect for compliers is 9,345, it represents an increase of 30%. For earnings: $E[Y_0|never\text{-}taker] = 34,696$ and $E[Y_0|complier] = 10,050$. Since the treatment effect for compliers is -3,410, it represents a decrease of 34%. These calculations are also summarized in Appendix Table F.1.

Appendix Table F.1: Analysis of Compliers

	Wage Earnings	Overall Net Household Income
	(1)	(2)
Treatment Effect	-3,410	9,345
Counterfactual	10,050	31,318
Percent Change	-33.93	29.84

Notes: This table reports estimates for the impact of Social Security's survivors benefits among compliers. The details of the calculations of these estimates are provided in Appendix F.

Appendix G: Welfare Implications

Appendix G.1: Fiscal Externality

In this appendix, we derive the fiscal externality in the simple illustrative example we provide in Section 6.3. Let the subpopulation of widows be indexed by w, and let the subpopulation of workers in the labor force whose earnings are subject to SSA payroll taxes be indexed by l. Additionally, let N^j denote the size of subpopulation j, E^j denote mean earnings for individuals in subpopulation j, and τ^j denote the corresponding tax rates with $j \in (w, l)$. We consider marginal increases in the generosity of survivors benefits to widows, and we assume it is financed via an increase in SSA payroll taxes, $d\tau^l$, with $d\tau^l \times E^l \times N^l = B$, where B is the additional dollar amount of benefits to be collected. The fiscal externality involves two components: the behavioral responses to the increased generosity among widows and the behavioral responses to the increased tax liability among workers. The marginal fiscal externality per widow can be therefore expressed as:

$$(dE^w \times \tau^w) + \frac{N^l}{N^w} \times \left(dE^l \times \tau^l\right).$$

Recalling that $d\tau^l \times E^l \times N^l = B$, we can further develop the term $\left(dE^l \times \tau^l\right)$ as:

$$\left(dE^l \times \tau^l\right) = \left(\frac{dE^l}{d\tau^l} \times d\tau^l \times \tau^l\right) = \left(\frac{dE^l}{d\tau^l} \times \frac{B}{E^l \times N^l} \times \tau^l\right) = \left(-\varepsilon \times \frac{\tau^l}{1 - \tau^l} \times \frac{B}{N^l}\right),$$

where $\varepsilon = \frac{dE^l}{d(1-\tau^l)} \frac{(1-\tau^l)}{E^l}$ is the standard net-of-tax elasticity.

With current tax rates as of 2021, $\tau^w = 0.12$ (with $E^w = \$22,685$ from Appendix Table A.1), and $\tau^l = 0.22$ (with $E^l = \$43,444$ which is calculated as total earnings subject to payroll taxes divided by total taxpayers as reported in https://www.ssa.gov/policy/docs/statcomps/eedata_sc/2019/index.html, Table 1). The term dE^w consists of the change in wage earnings among widows, and it is therefore a product of the share of widow beneficiaries (the takeup rate of 0.47168 from Table 1) and earnings response per dollar of benefits among them ($-\$0.39804$ from Appendix Table D.2), so that $dE^w \times \tau^w = (-\$0.39804 \times 0.47168) \times 0.12 = -\$0.0225$. Finally, we have $\frac{N^l}{N^w} \times \left(dE^l \times \tau^l\right) = -\varepsilon \times \frac{0.22}{1-0.22} \times 0.47168 = -\varepsilon \times 0.133$. In total, the fiscal externality amounts to:

$$(dE^w \times \tau^w) + \frac{N^l}{N^w} \times \left(dE^l \times \tau^l\right) = -0.0225 - \varepsilon \times 0.133.$$

For example, with $\varepsilon = 0.20$, the fiscal externality per dollar of increased generosity would be $-\$0.049$.

<div align="center">Appendix Table G.1: Welfare Analysis—Sensitivity</div>

Panel A: Value of Survivors Benefits

Labor Supply Responses		0.5	0.75	1	1.25	1.5	1.75	2
				Curvature of Labor Disutility				
Overall Sample:	10.3%	0.052	0.077	0.103	0.129	0.155	0.180	0.206
Low Earning:	36.6%	0.183	0.275	0.366	0.458	0.549	0.641	0.732
Compliers:	51.0%	0.255	0.383	0.510	0.638	0.765	0.893	1.020

Panel B: Utility Gain from Transferring Resources across States of Nature

Labor Supply Responses		0.5	0.75	1	1.25	1.5	1.75	2
				Curvature of Labor Disutility				
Upper Bound:	5.3%	0.027	0.040	0.053	0.066	0.080	0.093	0.106
Point Estimate:	3.1%	0.015	0.023	0.031	0.039	0.046	0.054	0.062
Lower Bound:	0.9%	0.004	0.007	0.009	0.011	0.013	0.015	0.017

Panel C: Net Societal Returns from Transferring Resources across States of Nature

Net-of-Tax Elasticity	0.5	0.75	1	1.25	1.5	1.75	2
			Curvature of Labor Disutility				
0	-0.007	0.001	0.008	0.016	0.024	0.032	0.039
0.1	-0.020	-0.013	-0.005	0.003	0.011	0.018	0.026
0.2	-0.034	-0.026	-0.018	-0.010	-0.003	0.005	0.013
0.3	-0.047	-0.039	-0.031	-0.024	-0.016	-0.008	-0.001

Panel D: Imputed Labor Disutility State Dependence to Justify Current Insurance Levels

Net-of-Tax Elasticity	0.5	0.75	1	1.25	1.5	1.75	2
			Curvature of Labor Disutility				
0.3	1.046	1.038	1.031	1.023	1.015	1.008	1.001

Note: This table studies the sensitivity of our welfare analysis to different preference and behavioral parameter values. In all panels, we consider for values of the labor-disutility curvature parameter, φ, the range 0.5 to 2, where 1 corresponds to quadratic labor disutility. Panel A quantifies the value of survivors benefits based on our welfare measure ω_1, for the overall sample of widows, low-earning widows, and the sample of compliers. Panel B quantifies the potential utility gain to widowed households from a marginal transfer of resources across states of nature using our welfare measure ω_2. We look at our overall sample of widows using a range of their labor supply responses by taking the point estimate along with the upper and lower bounds of the corresponding 95-percent confidence interval. Panel C assesses the net societal return from marginal transfers across states of nature by combining the calibration of the potential utility gain to widowed households from panel B with their fiscal externality (from Appendix G.1). We consider the value range 0-0.30 for the net-of-tax elasticity. Finally, panel D imputes the level of labor disutility state dependence, θ^v, that would justify current levels of transfers to widows. We choose the highest value of the net-of-tax elasticity from panel C to provide a more conservative measure regarding the net social returns.