

# The Liquidity Sensitivity of Healthcare Consumption: Evidence from Social Security Payments

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## Online Appendix

### **A Appendix: Additional Results Related to the Overall Effect of Social Security Checks**

Section 2 studies how prescription drug fills vary around recipients' Social Security paydays. This appendix presents additional results. First, we present an unadjusted time series that describes prescription fills over time. To highlight the effects of Social Security checks, we calculate the difference between the logarithm of total prescriptions filled among recipients in the first payday group (who receive their checks on the second Wednesday of the month) and prescriptions filled among recipients in the third payday group (who receive their checks on the fourth Wednesday of the month). The first panel of Appendix Figure [A1](#) plots this difference for 10 days before and 10 days after the second Wednesday of the month ("day zero") for the subsidized-copayment group and the no-copayment group. There is a clear increase on day zero for the subsidized-copayment group while fills for the no-copayment group remain unchanged. The second panel presents the same exercise for the full-copayment group, and suggests a smaller increase in fills when checks are distributed.

Appendix Figure [A2](#) presents a similar plot, but also plots the difference in "expected" fills. Expected fills are the number of prescriptions we would expect to be filled on each day if all recipients re-filled their prescription on the day their prior prescription ran out. We code expected fills to occur on the day of the prior prescription plus the days' supply of the prescription. The figure suggests that the increase in prescription fills on Social Security payday cannot be explained by expected fills.

Appendix Figure A3 explores the heterogeneous effects of Social Security checks. The figure presents  $\beta_0$  from equation (1) separately by race and medical condition. Non-White recipients exhibit larger check effects than White recipients. Recipients with cancer, chronic obstructive pulmonary disease, depression, diabetes, and heart disease all exhibit significant payday spikes, indicating that the overall result is not only driven by healthy recipients. Recipients with Alzheimer’s disease exhibit smaller, though still statistically significant, increases on Social Security paydays. (For those with Alzheimer’s disease, prescriptions may be managed by a caregiver rather than the recipient herself.) The second panel of Appendix Figure A4 presents similar results for the full-copayment group. Among this group, the disparity in the payday effect between White and non-White recipients is much larger, likely reflecting a much larger income disparity between these groups among the full-copayment group relative to the subsidized-copayment group, where income-based eligibility rules limit heterogeneity in income.

### A.1 The Two Subsidized-Copayment Groups

For simplicity, this paper describes Medicare Part D recipients as being comprised of three groups: those who face no copayments, those who face subsidized copayments, and those who face full copayments. There are two complications. First, there exists an additional group of recipients who pay zero copayments and zero premiums. This group consists of Medicaid-Medicare-enrolled individuals who are institutionalized. For this group, copayments are fully paid by the Medicare program rather than the Medicaid program. We exclude those recipients from the analysis sample, since they are institutionalized and thus have limited discretion over the timing of their prescription-drug fills.

A second complication is that the subsidized-copayment group actually consists of two sub-categories. First there are the lowest-income recipients, who face extremely low copayments. In 2015, those recipients were charged \$2.65 copayments for generic drugs and \$6.60 copayments for branded drugs. Second, there are slightly higher-income recipients who face smaller subsidies. In 2015, those recipients faced an average out-of-pocket price of scripts of roughly \$7.31, compared to an average of \$2.74 for recipients in the lowest-income subsidized-copayment group.

For the sake of simplicity, the main text combines these two sub-groups into one. Nevertheless, we can estimate the effect of Social Security checks for both of these sub-groups separately. Appendix Table A1 presents summary statistics for

these two sub-groups. Appendix Figure A5 presents estimates of  $\beta_0$  from equation (1) estimated separately for these two groups. Both sub-groups exhibit statistically significant effects of Social Security checks. The effects are largest for the higher-income sub-group: total prescriptions purchased increases by over 13 percent on Social Security check days for that group. That pattern is unsurprising for two reasons. First, despite having higher income, that sub-group still has very low income relative to the general population. Second, that sub-group faces higher copayments than the other subgroup.

## A.2 Share of Wednesday Fills on Paydays as a Signal of Liquidity Sensitivity

Appendix B, below, leverages one particular proxy for liquidity sensitivity: the share of each recipient’s Wednesday fills that occur on their Social Security payday. This appendix provides evidence that that proxy is indeed correlated with liquidity sensitivity.

Appendix Figure A6 plots estimated effects of Social Security checks by deciles of this proxy. We calculate the proxy for all years *other* than the year that we calculate the effect of Social Security checks. That approach prevents this exercise from falling into a circular logic, testing for an effect of Social Security checks by decile of the effect of those checks.

The figure suggests a clear relationship between the share of Wednesday fills that occur on payday and liquidity sensitivity. There is a positive association between payday filling and the share of Wednesday fills that occur on payday. For the subsidized-copay group, recipients in the tenth decile exhibit an increase in scripts on Social Security paydays that is greater than 100 percent. For the full-copay group, those in the tenth decile exhibit a nearly 50-percent increase in fills. That pattern motivates our focus in Appendix B on this top decile of recipients as the “constrained” group. Importantly, because the measure is constructed from prescription fills from *other* years, these results also provide evidence that payday-filling is a persistent behavior.

There also exists a positive association for the no-copay group, but the association is much smaller than for the other groups. Moreover, the positive association for the no-copay group may be somewhat spurious in that it reflects underlying auto-correlation in the tendency for a recipient to fill their scripts on a given Wednesday of the month over time.

Finally, Appendix Figure A7 offers a placebo test: we plot payday effects by

decile of the share of Wednesday fills that occur on the *Wednesday before payday*. Reassuringly, unlike Appendix Figure A6, this false proxy is not associated with payday effects.

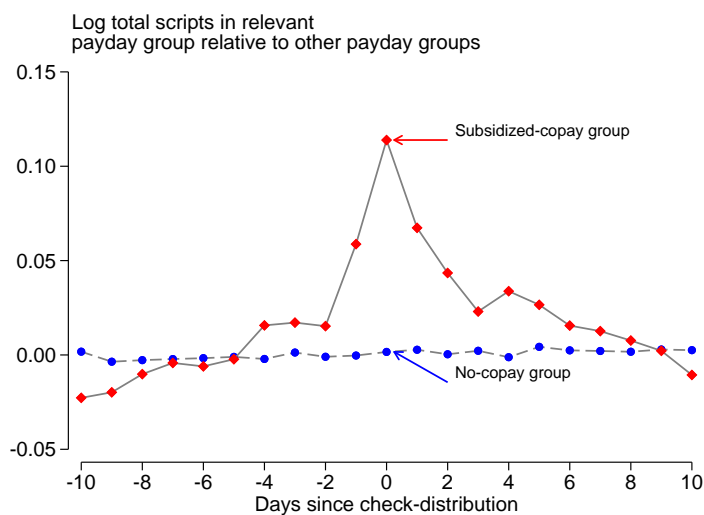
Appendix Table A1. Summary Statistics for the Two Subsidized-Copayment Sub-Groups

	Lowest-income, Subsidized copay	Higher-income, Subsidized copay
Number of beneficiaries in 20% sample in 2006	14,006	6,299
Number of beneficiaries in 20% sample in 2015	102,406	41,373
Mean total scripts per year	43.23	46.06
Mean out-of-pocket spending per year	\$124.49	\$320.24
Mean out-of-pocket spending per script	\$3.04	\$7.71
Mean share filling a script each day	0.056	0.063
Share male	0.400	0.373
Average age	70.21	70.58
Average number of chronic conditions	3.93	4.14
Share white	0.661	0.775

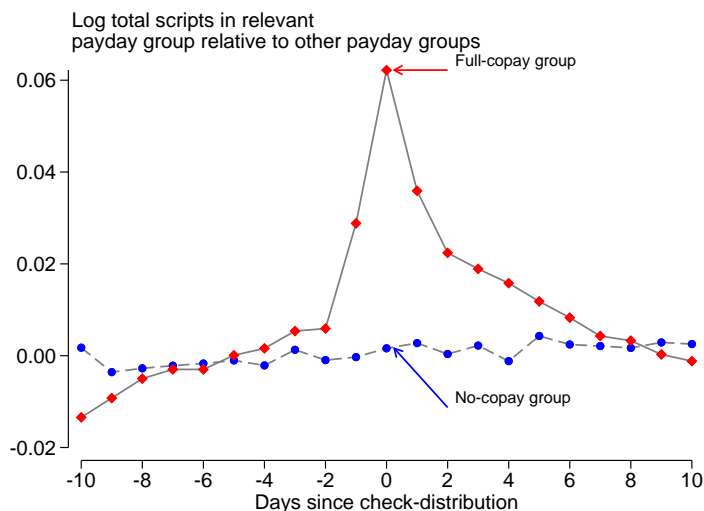
*Note:* This table presents summary statistics for the two sub-groups that receive subsidized copayments.

Appendix Figure A1. Re-Centered Time Series of Prescription Fills around Payday

(a) Logarithm of Total Scripts, Subsidized Copayment Group



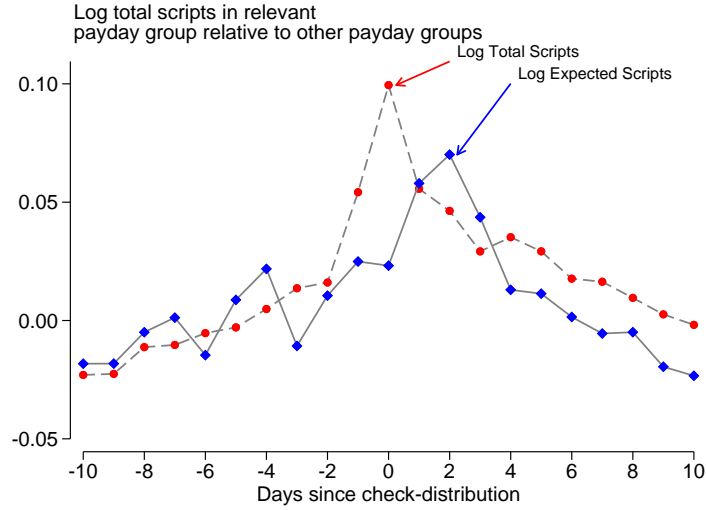
(b) Logarithm of Total Scripts, Full Copayment Group



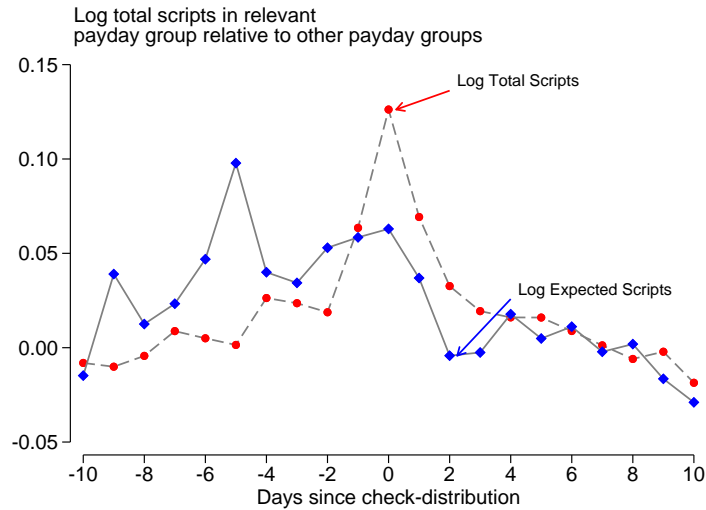
*Note:* These figures plot measures of prescription drug consumption for each event-time day relative to check receipt for the no-copay group and the full-copay group. Panel (a) plots the share of beneficiaries who fill a script. Panel (b) plots the logarithm of total scripts filled. For each copay group and event day, we calculate the difference in these outcomes across recipients who are nearest to receiving a check and those who are two weeks from their check.

Appendix Figure A2. Re-Centered Time Series for the Subsidized-Copay Group, Total Scripts and Expected Refills Based on Prior Fills

(a) Logarithm of Total Scripts: 28-Day Wait

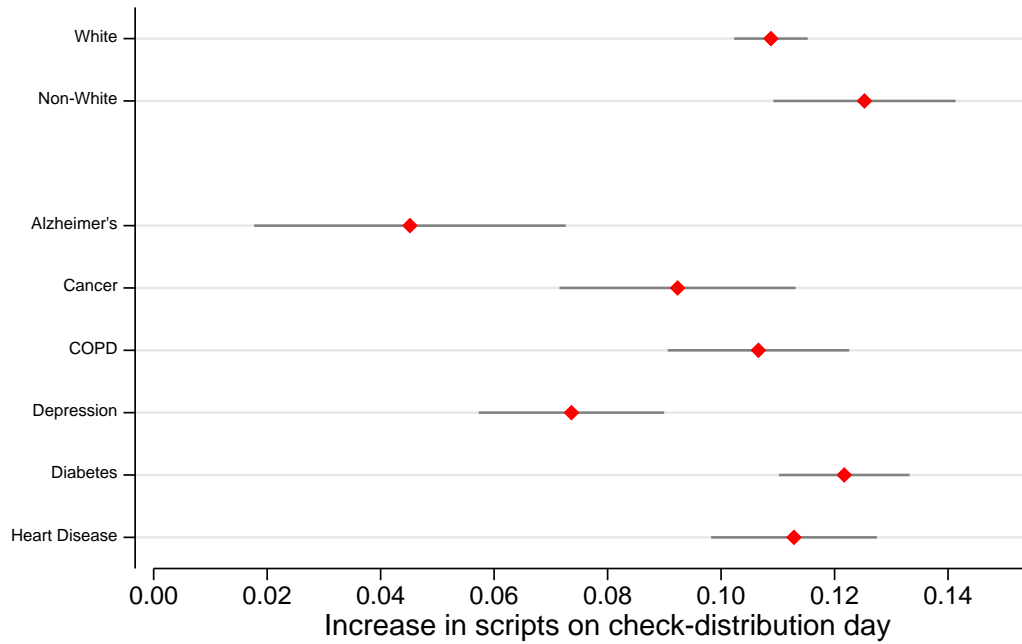


(b) Logarithm of Total Scripts: 35-Day Wait



*Note:* These figures plot measures of prescription drug consumption for each event-time day relative to check receipt for the subsidized-copay group. Panel (a) plots the logarithm of total scripts and expected scripts filled for 28-day waits. Panel (b) plots the logarithm of total scripts and expected scripts filled for 35-day waits. For each copay group and event day, we calculate the difference in these outcomes across recipients who are nearest to receiving a check and those who are two weeks from their check.

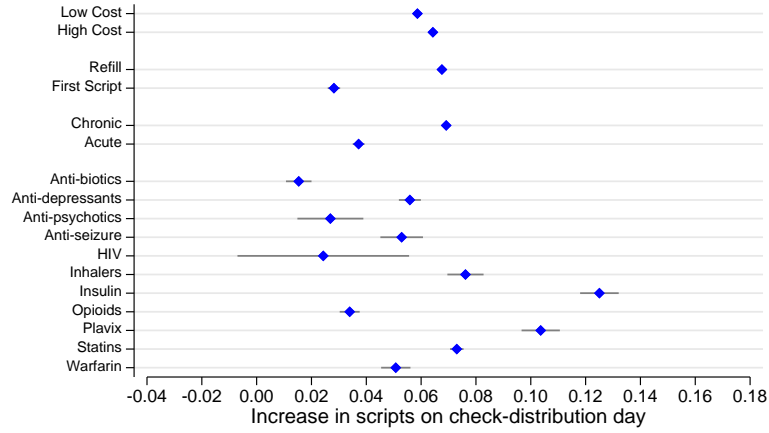
Appendix Figure A3. Heterogeneous Effects Across Recipient Characteristics



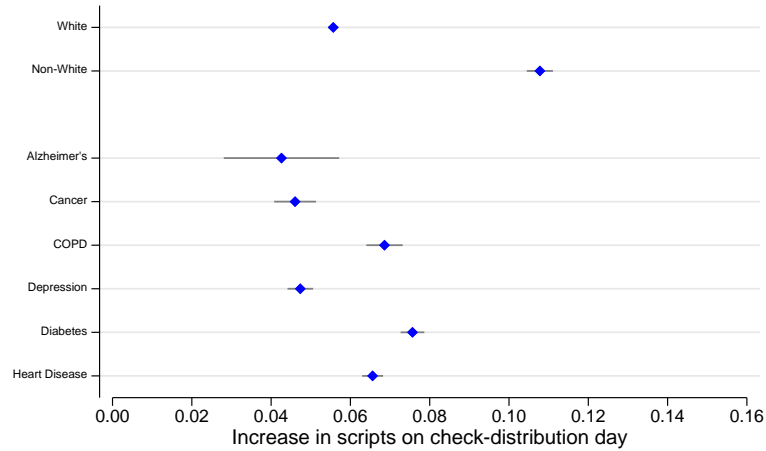
*Note:* These figures plot estimates of  $\beta_0$  from equation (1): the event-study coefficient for check-distribution day when the outcome is the logarithm of scripts filled for groups of particular beneficiaries. We divide beneficiaries by race (white or non-white), and the chronic conditions of COPD, Heart Disease, Diabetes, Depression, Alzheimer's, and Cancer. The sample is restricted to the subsidized-copay group. The horizontal lines across each marker plot 95-percent confidence intervals based on standard errors that are clustered at the level of the birthday group.

Appendix Figure A4. Heterogeneous Effects for the Full-Copay Group

(a) Across Types of Drugs



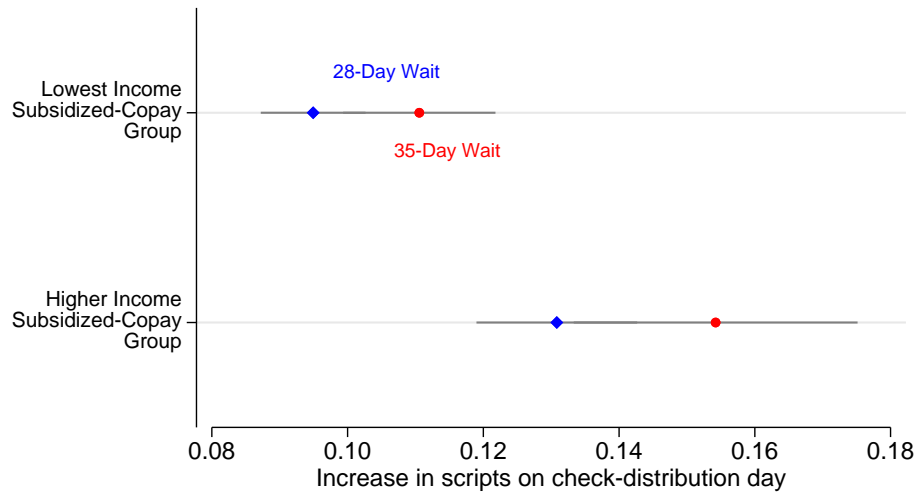
(b) Across Beneficiary Characteristics



*Note:* Both panels plot estimated event-study coefficients on check-distribution day for the logarithm of total scripts filled by subgroup. All samples are restricted to the full-copay group. All coefficients come from estimating equation (1). “Expected scripts filled” is the number of prescriptions that would occur on that day if all recipients with a prior prescription consumed one pill per day and then filled the script as soon as they were out of pills. The horizontal lines through each marker plot 95-percent confidence intervals based on standard errors that are clustered at the level of the birthday group.



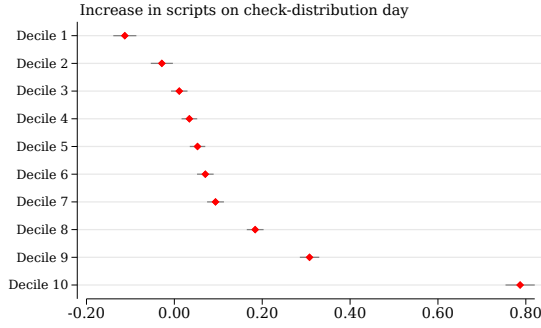
Appendix Figure A5. Changes in Scripts Filled by Group and Wait



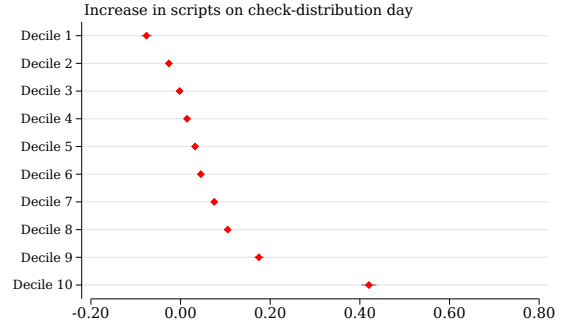
*Note:* This figure presents the estimated event-study coefficient for check-distribution day when the outcome is the logarithm of the total scripts filled by the subsidized-copay group and by length of wait (28-day wait or 35-day wait). The horizontal lines along each marker plot 95-percent confidence intervals based on standard errors that are clustered at the level of the birthday group. These coefficients come from estimating equation (1).

Appendix Figure A6. Heterogeneous Effects Across Share Filling Deciles

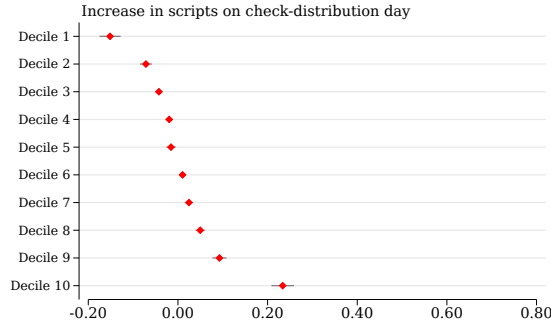
(a) Subsidized-Copay Group



(b) Full-Copay Group



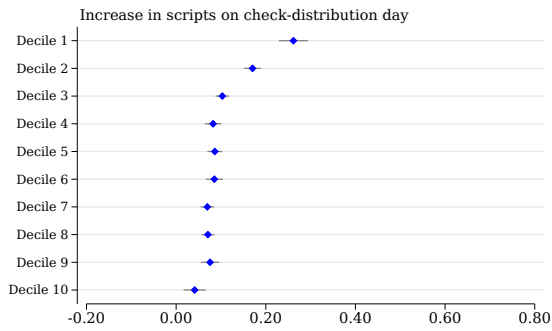
(c) No-Copay Group



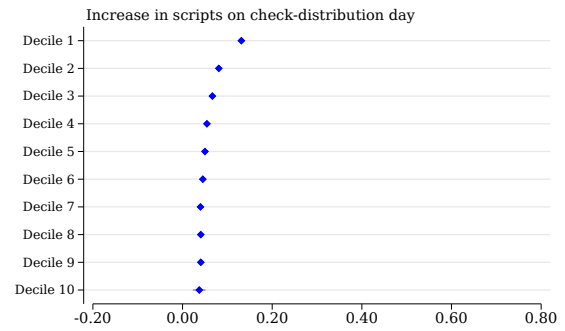
*Note:* All panels plot estimated event-study coefficients on check-distribution day for the logarithm of total scripts filled by share of Wednesday fills that fall on payday. Panel (a) restricts to the subsidized-copay group. Panel (b) restricts to the full-copay group. Panel (c) restricts to the no-copay group. All coefficients come from estimating equation (1). The horizontal lines through each marker plot 95-percent confidence intervals based on standard errors that are clustered at the level of the birthday group.

Appendix Figure A7. Falsification Test: Effects Across Psuedo-Share Filling Deciles

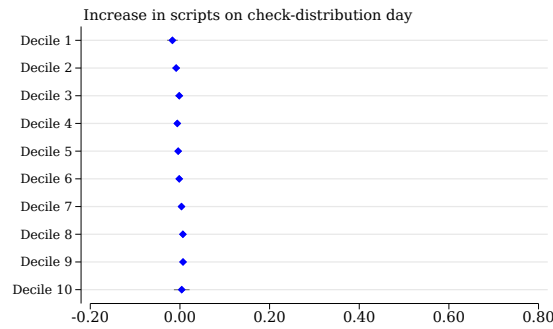
(a) Subsidized-Copay Group



(b) Full-Copay Group

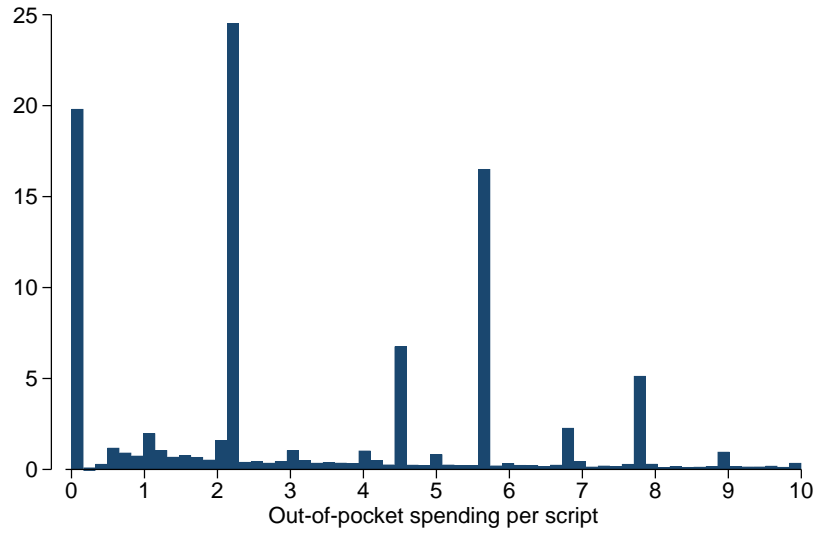


(c) No-Copay Group



*Note:* All panels plot estimated event-study coefficients on check-distribution day for the logarithm of total scripts filled by share of Wednesday fills that fall on Wednesday before payday. Panel (a) restricts to the subsidized-copay group. Panel (b) restricts to the full-copay group. Panel (c) restricts to the no-copay group. All coefficients come from estimating equation (1). The horizontal lines through each marker plot 95-percent confidence intervals based on standard errors that are clustered at the level of the birthday group.

Appendix Figure A8. Histogram of Copayments



*Note:* This figure plots the distribution in percentages of copayments for the subsidized-copay group in 2008. The histogram is censored at \$10 copayments.

## B Appendix: The Effect of More-Generous Coverage on Liquidity Sensitivity

Section 2 suggests an increase in prescription drug fills when consumers who face copayments receive their Social Security checks. This appendix studies what occurs when those consumers experience a change in the copayments they face, transitioning from a group that faces copayments to the no-copayment group or vice-versa. We leverage these transitions as a way to assess how liquidity sensitivity relates to the generosity of health insurance.<sup>1</sup>

To do so, we identify all recipients who switch from a copayment group (subsidized or full) to the no-copayment group or vice-versa between 2007 and 2015. We restrict the sample to recipients continuously enrolled in Medicare Part D for at least one year before the transition and at least one year after. This restriction allows us to observe pre- and post-transition consumption patterns. We also remove from the sample those recipients who were in the no-copayment group at some point during the 24 months prior to the transition, and we limit the sample to those who were continuously enrolled in the no-copayment group for 24 months after the transition. The first panel of Appendix Figure B1 describes the effects of these transitions on the out-of-pocket price for prescriptions paid by recipients. Out-of-pocket costs drop sharply at the time of the transition from an average of \$7 to zero.

One concern with studying transitions across copayment groups is that the transitions may be endogenous. Some recipients may apply for the LIS program because they anticipate needing more prescription drugs. In addition, the transitions can sometimes be triggered by health events, such as a hospitalization. Hospital staff may help a recipient enroll in the LIS program. The health event would then confound our analysis. We discuss these endogeneity concerns in depth in [Gross, Layton and Prinz \(2020\)](#).

We study transitions in coverage in two steps. First, we study how changes in generosity affect liquidity sensitivity. Second, we study how changes in the generosity of insurance affect utilization levels, estimating an overall price elasticity of demand and separate price elasticities for recipients who are and are not liquidity sensitive.

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<sup>1</sup>Many recipients transitioning between copayment groups also experience a change in their premium subsidy. Such a change in the subsidy could affect drug utilization via an income effect. In [Gross, Layton and Prinz \(2020\)](#) we show that these changes in the premium subsidy do not explain the results.

## B.1 The Effect of Lower Copayments on Payday Filling

We first test how changes in the generosity of insurance affect the likelihood that recipients fill their prescriptions when their Social Security checks arrive. To do so, we calculate the share of each recipient’s Wednesday fills that occur on their Social Security payday.<sup>2</sup> We calculate the share of Wednesday fills occurring on Social Security paydays for each time period and each cohort of recipients who transition from a group that faces copayments to the no-copay group; we define a cohort as including all recipients who switch groups in a given time period. If recipients fill prescriptions on a schedule unrelated to their Social Security paydays, then roughly 23 percent of their Wednesday fills should occur on their payday. That number comes from a simple calculation: there are 12 checks sent each year, and either 52 or 53 Wednesdays in the year. If, however, some recipients delay filling scripts until their paychecks arrive, then the share of their Wednesday fills that occur on their payday would rise above 23 percent.

The first panel of Appendix Figure B1 plots the average out-of-pocket price for prescriptions before and after recipients transition to the no-copayment group. The average out-of-pocket price drops from roughly \$7 to zero. The second panel of Appendix Figure B1 plots the measure of payday filling described above: the share of Wednesday fills that occur on recipients’ Social Security paydays. Prior to the transition into the no-copay group, recipients fill roughly 24–25 percent of their Wednesday fills on their Social Security payday. In the months immediately following their transition to near-full insurance, however, the share drops sharply to roughly 22–23 percent. More-generous insurance, it seems, reduces the propensity for recipients to fill their scripts on their Social Security payday. Appendix Table B1 presents estimates of a regression in which the share of Wednesday fills on payday is the outcome of interest. The estimates suggest that that measure decreases by 2.6 percentage points (10.3 percent) when recipients transition into the no-copay group. Further, those numbers suggest that once on the no-copayment group, recipients fill prescriptions on a schedule entirely unrelated to their Social Security checks: full insurance eliminates “payday filling.”

These results are consistent with those presented in Section 2: they suggest no effect of Social Security checks on prescription fills for those in the no-copayment group. But these results go further in that they show that a given recipient *changes*

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<sup>2</sup>We focus on the share of *Wednesday* fills that occur on payday, because there are day-of-the-week effects in prescription-filling behavior.

how she fills prescriptions in response to more-generous coverage. It appears that when liquidity-sensitive recipients are given full insurance, they start filling their prescriptions when they want or need the medicine rather than when they receive their Social Security checks.

## B.2 The Interaction Between Price Sensitivity and Liquidity Sensitivity

The results above establish that more-generous insurance causes drug consumption to become less sensitive to liquidity. A remaining question regards how liquidity sensitivity relates to *price* sensitivity. If the most liquidity-sensitive beneficiaries increase drug consumption the most in response to the reduction in the out-of-pocket price, this may suggest that liquidity-related frictions were not only affecting the timing of consumption but also the quantity of drugs consumed in a year. That said, it could also be the case that these liquidity-sensitive beneficiaries just have different preferences from other beneficiaries and a stronger demand-response reflects those preferences rather than the relaxation of liquidity-related frictions.

To explore that relationship, we stratify recipients by the share of their Wednesday fills that occurred on their Social Security paydays before the transition. Appendix A.2 demonstrates that recipients in the top two deciles of this measure are indeed liquidity sensitive while those in other deciles of this measure exhibit much less sensitivity to Social Security checks.

For each decile of the share of Wednesday fills that occurred on Social Security payday, we estimate the following regression:

$$\log(Y_{ict}) = \alpha_i + \alpha_t + \beta \times \mathbf{I}\{t - s_c \geq 0\} + \varepsilon_{ict}. \quad (\text{A1})$$

For each recipient  $i$  in cohort  $c$  of recipients who transition copayment groups in the same calendar month  $s_c$ , we study their out-of-pocket payments and overall number of fills in each calendar month  $t$ . We include a fixed effect for each recipient,  $\alpha_i$ , and a fixed effect for each calendar month,  $\alpha_t$ . The parameter of interest in equation (A1) is  $\beta$ , which captures the change in the outcome of interest after recipients transition to the other copayment group.<sup>3</sup> We use that parameter to estimate the price elasticity of demand, dividing estimates when number of prescriptions is the outcome of interest by estimates when out-of-pocket price is the outcome of interest.

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<sup>3</sup>See Gross, Layton and Prinz (2020) for additional results relating to these elasticities, including event-study figures.

Appendix Figure B2 presents estimates of the price elasticity of demand across this proxy of liquidity sensitivity. The red square plots the price elasticity across all recipients, which is roughly  $-0.041$ .<sup>4</sup> The blue circles plot the estimated price elasticity for each decile of our measure of liquidity sensitivity.<sup>5</sup> The figure suggests that nearly all deciles exhibit roughly the same price elasticity of demand, with the exception of the last two deciles. Recipients in the top decile exhibit a price elasticity of demand that is roughly twice as large as the elasticity of demand exhibited by other recipients. Recipients in the ninth decile also exhibit higher price sensitivity than others, though the difference is not as large. In that way, Appendix Figure B2 suggests that those recipients who are liquidity sensitive are also the most price sensitive.

These results shed some light on the overall effect of Social Security checks described in Section 2. Section 2 demonstrates that recipients increase their prescription fills on their Social Security paydays. But the exercises in that section do not distinguish between two potential mechanisms. First, liquidity-sensitive recipients may solely re-time their drug consumption based on when their check arrives. Alternatively, liquidity-sensitive recipients may not consume as many drugs as they would if they did not face liquidity-related frictions. Appendix Figure B2 suggests that both mechanisms are relevant. Recipients respond to lower copayments by increasing the number of drugs they purchase, and liquidity-sensitive recipients respond even more. Thus, the results of Section 2 are likely not solely a matter of re-timing; rather, liquidity-sensitive Medicare recipients demand fewer drugs than they otherwise would. However, these results do not prove this definitively, as the higher levels of price sensitivity among the most-liquidity-sensitive beneficiaries may simply be a matter of heterogeneous preferences rather than the relaxation of liquidity-related frictions. Future research should attempt to differentiate between these two explanations.

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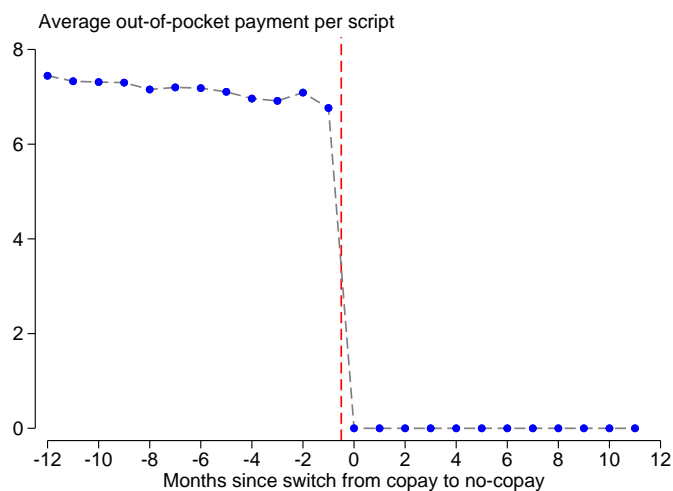
<sup>4</sup>We exclude recipients with no Wednesday fills (and thus no *share* of Wednesday fills on payday) and recipients with zero payday fills but with some Wednesday fills.

<sup>5</sup>Appendix Table B2 presents regression estimates for each decile, the estimated price-elasticity of demand along with the change in out-of-pocket payments and change in utilization.

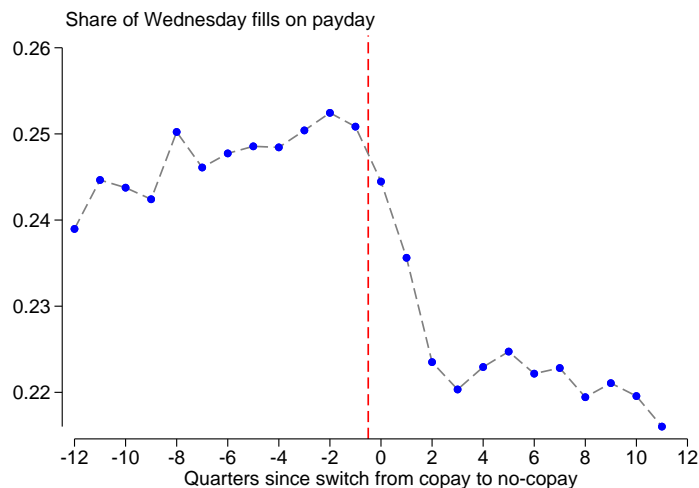


Appendix Figure B1. Re-Centered Time Series For Recipients who Switch From a Copay Group to the No-Copay Group

(a) Out-of-Pocket Payments

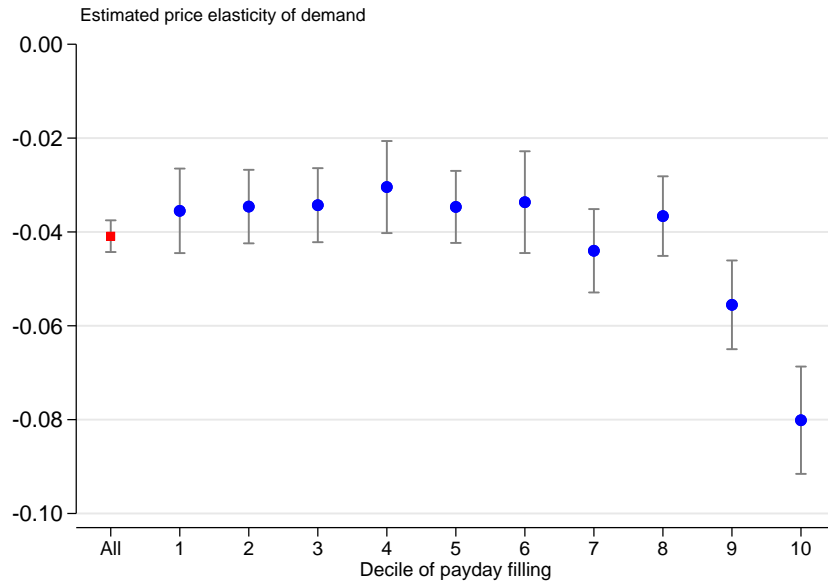


(b) Payday Filling



*Note:* Panel (a) plots monthly average out-of-pocket spending per script for recipients who transition from either the full-copay group or the subsidized-copay groups to the no-copay group. Panel (b) plots the quarterly share of Wednesday prescription fills that fall on Social Security payday for recipients who transition from either the full-copay group or the subsidized-copay groups to the no-copay group.

Appendix Figure B2. Comparison of Price Elasticities of Demand Across Recipients' Propensity to Fill on Social Security Paydays



*Note:* This figure presents estimated price elasticities of demand when recipients are divided into deciles based on the proportion of their Wednesday prescription fills that fall on their Social Security payday. The sample is restricted to recipients who switch from either the full-copay group or the subsidized-copay group to the no-copay group one year before and after their switch. These coefficients come from estimating an individual-level version of equation (A1). Standard errors are based on the delta method.

Appendix Table B1. Effect of Changes in the Generosity of Coverage on the Share of Wednesday Fills that Occur on Social Security Payday

	(1)	(2)	(3)
	Copay to No-Copay	Subsidized -Copay to No-Copay	Full-Copay to No-Copay
Post Transition	-0.0259 (0.0021)	-0.0257 (0.0034)	-0.0239 (0.0036)
Mean	0.25	0.25	0.24
<i>N</i>	8,939	8,822	8,867

*Note:* This table presents regressions in which the outcome is the share of Wednesday prescriptions filled on the recipient’s Social Security payday. The first column studies transitions from either copay group to the no-copay group while the second and third columns study transitions from either copay group to the no-copay group respectively. Each observation consists of a recipient-month. Standard errors in parentheses. These coefficients come from estimating equation (A1). Cohort-specific fixed effects and calendar-month-specific fixed effects not shown.

Appendix Table B2. The Effect of Changes in Generosity of Coverage Across Deciles of Share of Wednesday Fills on Payday for Transitions to the No-Copay Group

	(1)	(2)	(3)
	Log Total Scripts	Log Out-of-Pocket	Elasticity
All	0.08076 (0.00280)	-1.26905 (0.00867)	-0.06364 (0.00224)
All excl. Zero or Missing	0.05949 (0.00250)	-1.45447 (0.00912)	-0.04090 (0.00172)
Decile 1	0.05272 (0.00686)	-1.48468 (0.01657)	-0.03551 (0.00460)
Decile 2	0.05146 (0.00581)	-1.48733 (0.01616)	-0.03460 (0.00400)
Decile 3	0.05179 (0.00614)	-1.51008 (0.01783)	-0.03430 (0.00402)
Decile 4	0.04628 (0.00745)	-1.52073 (0.01985)	-0.03043 (0.00501)
Decile 5	0.05126 (0.00574)	-1.47875 (0.01535)	-0.03467 (0.00392)
Decile 6	0.05180 (0.00837)	-1.53920 (0.01889)	-0.03365 (0.00553)
Decile 7	0.06381 (0.00641)	-1.44965 (0.01676)	-0.04401 (0.00453)
Decile 8	0.05576 (0.00652)	-1.52242 (0.01481)	-0.03663 (0.00433)
Decile 9	0.07592 (0.00641)	-1.36698 (0.01558)	-0.05554 (0.00482)
Decile 10	0.09565 (0.00648)	-1.19370 (0.01744)	-0.08013 (0.00583)
Zero	0.12102 (0.00548)	-0.98967 (0.01304)	-0.12229 (0.00588)
Missing	0.19245 (0.00719)	-0.15497 (0.00692)	-1.24187 (0.07993)

*Note:* This table presents estimates of equation (A1) across deciles of the proportion of Wednesday fills that fall on a recipient’s Social Security payday. The sample is restricted to recipients who switch from either the full-copay group or the subsidized-copay group to the no-copay group, 12 months before and 12 months after their switch. The first row presents estimates for all beneficiaries. The second row presents results for recipients with at least one Wednesday fill on a payday. The subsequent rows present estimates for recipients who have at least one Wednesday fill on a payday and are in the given decile of the proportion of Wednesday fills on payday. The final rows presents results for recipients who have no Wednesday fills on payday or no Wednesday fills. Standard errors in parentheses clustered on cohort of recipients transitioning copay groups for the first two columns. Standard errors are based on the delta method for the elasticity estimation in the third column. Recipient-specific fixed effects and year-times-month-specific fixed effects not shown.

## References

**Gross, Tal, Timothy Layton, and Daniel Prinz.** 2020. “The Liquidity Sensitivity of Healthcare Consumption: Evidence from Social Security Payments.” National Bureau of Economic Research Working Paper 27977.