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Assessing the effects of the 2008 tax rebates on spending using daily data

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JEL Keywords: Fiscal Policy, Macroeconomic Policy, Consumption
JEL Codes: H30, E21, E62

1 Introduction

In 2008, the United States entered a severe recession. As a remedy, the Bush administration proposed tax rebates in order to stimulate spending of U.S. households. The decision to implement this program was taken in February of 2008 and the first checks were mailed in late April. The timing of the disbursement of the stimulus checks was based on the filing individual's social

[1] I am grateful to Alan Krueger for kindly enabling me to work with the Gallup data. I thank Jing Cai for research assistance. All errors are my own.
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security number.

The randomized timing of the dissemination of the tax rebates provides an attractive policy evaluation design. Previous literature concerned with the effects of tax rebates on spending considers the exogenous variation in tax rebate receipt to test the predictions of the life-cycle model/permanent income hypothesis. Specifically, these papers (Johnson et al. (2006), Parker et al. (2010), and Sahm et al. (2009)) are interested in utilizing the randomized timing of check receipt to causally estimate the marginal propensity to consume out of transitory income. Under the life-cycle/permanent income model, the receipt of tax rebate checks should not have an effect on the optimal consumption smoothing path other than by the amount it changes the annuity value of permanent income. This literature has found the marginal propensity to consume to equal about 0.30, suggesting moderate efficacy of stimulating spending.

Little is known about the timing of spending out of the tax rebate checks. Sahm et al. (2009) study responses of the University of Michigan's Survey of Consumers regarding the timing of spending of the tax rebates.[3] They find that many respondents plan to spend their checks within a short period of time (between a few weeks up to three months following check receipt). Broda and Parker (2008) use scanner data from ACNielsen to study the weekly response of spending of shoppers following receipt of tax rebates. They find an immediate response, with consumption rising by 3-6 percent in the week following tax rebate receipt. However, the rapid reaction found in their scanner data might partly reflect the effect of discounts offered by large retail chains to those shoppers who would spend their tax rebate check at the chain's store.

In this paper, I study the response of spending following the receipt of tax rebate using data collected at a daily frequency. This high frequency allows me to study whether there has been an immediate reaction in spending. To do this, I use data from the Gallup Daily Poll conducted by the Gallup Organization. Since 2008 Gallup has, on a daily basis, surveyed about 1,000 individuals on a variety of questions, including spending. Following the initial disbursement of tax rebate checks in April 2008, Gallup also collected daily information on tax rebate receipt until July 2008. As the timing of receipt of the tax rebate is as good as random, I am able to identify the effect of the rebate on spending.

The analysis of expenditures at a high frequency has been studied by Stephens (2003), (2006) who uses the U.K. Family Expenditure Survey and the U.S. Consumption Expenditure Survey to

[3] For a similar survey regarding the 2001 tax rebates, see Shapiro and Slemrod (2003).

test the predictions of the permanent income hypothesis model. Daily data is also studied by Shapiro (2005) who analyzes the behavior of food stamp receivers in order to pin down their time-preference parameter. Typically, the findings of these papers are at odds with the predictions of the life-cycle model. The dynamics of daily spending and information shocks are studied by Lachowska (2010) who finds that individuals exhibit a temporary reduction in spending following a negative information shock. In summary, relatively little is known about the predictors of spending at a frequency as fine as a day or a week.

The main findings of the paper are as follows. The results show that receipt of the tax rebate check had an instant effect on the daily probability to spend. On average, this propensity goes up by about 5 percent. Further, my results indicate that low-income earners are the most responsive to the stimulus checks, with an average effect of about 8 percent.

The paper is organized as follows. Section two presents the main features of the tax rebates package. Section three and four describe the data and the empirical methods. Section five discusses the results. The final section concludes.

2 Tax Rebates of the Economic Stimulus Act of 2008

The tax rebates are a part of the Economic Stimulus Act of 2008, intended to stimulate the U.S. economy facing a recession. The proposal was passed in February 2008, and most checks were mailed between late April and July. As described by Parker et al. (2010), a majority of U.S. households received these checks, about 130 million households.

Eligibility was determined by the 2007 tax returns.[4] The checks typically ranged between $300 and $600 for individual tax filers. For couples filing jointly, the rebates were bigger, ranging between $600 and $1,200. In addition, those with a dependent child under 17 years of age received an additional $300 per child. The tax rebates were targeted towards low- and middle-income households; hence the eligibility for the rebate was phased out at a rate of 5 percent of the income above income limit of $75,000 (this limit was $150,000 for couples). Also individuals with no net tax liability were eligible to receive a rebate, conditional on having a qualifying income of at least $3,000 per year.

The timing of when the tax rebate checks were sent was determined by the last two numbers of

[4]See http://www.irs.gov/newsroom/article/0,,id=179095,00.html

the Social Security numbers. Thus timing of check receipt is as good as randomized. This feature of the distribution of tax rebates has made them very attractive for policy evaluation, with numerous papers studying their effects.[5]

3 Data

The data come from the Gallup Daily Poll conducted by the Gallup Organization. The data, called G1K, are collected daily via telephone interviews with a random sample of about 1,000 individuals aged 18 and older living in the United States. Each day a new cross-section is drawn. The survey is conducted seven days a week excluding major holidays.[6]

Gallup collects the data using a dual-frame random-digit-dial of both landlines and cellular phones. The interviews are conducted with the head of the household. In order to make the sample representative, Gallup provides survey sampling weights to correspond to the national distribution of age, gender, race, region and educational level. I use these survey weights throughout the regression analysis.

The G1K data cover a variety of demographic measures, a rich set of questions on health and also evaluations of living and working conditions. G1K also collects economic information posed to a random half-sample of the respondents. Between April 26th and June 30th 2008 Gallup asked the respondents of the Daily Poll whether they have received a tax rebate. The question reads:

As part of an economic stimulus package passed by Congress, most individuals will receive a rebate check of between $300 and $600 from the federal government. These rebates are just starting to be sent to Americans or deposited in their checking accounts. Have you personally received this stimulus package rebate from the federal government, or not?

Figure 1 shows the proportion of recipients of the tax rebate checks from April 26th through June 30th. Between July 20-22 Gallup re-introduced the tax rebate question. By late July, almost 80 percent of the individuals surveyed reported to have received the rebates. These figures are similar

[5] Shapiro and Slemrod (2003), Johnson et al. (2006), and Agarwal et al. (2007) analyze the 2001 tax rebates which were implemented in a similar fashion.

[6] As the data are very recent, they have not yet been applied much in research. Lachowska (2010)) uses the data to study joint dynamics of information and consumption using data at a daily frequency. Krueger and Kuziemko (2009)use the data to estimate the price elasticity of the demand for health insurance. The Daily Poll data were also used by Deaton and Arora (2009) in a study on the benefits of height.

to those reported by the U.S. Treasury Department, which indicated that by July 4th about 105 million payments have been made to approximately 130 million eligible households.[7]

The G1K data also collect economic information posed to a random half-sample of the respondents. A unique feature is that it collects high frequency information on daily expenditure. The expenditure question reads:

Next, we'd like you to think about your spending yesterday, not counting the purchase of a home, motor vehicle, or your normal household bills. How much money did you spend or charge yesterday on all other types of purchases you may have made, such as at a store, restaurant, gas station, online, or elsewhere?

The answers measure the dollar amount spent on goods, services while excluding some of the biggest durables, such as the purchase of a home and car. As it collects daily information on 500 individuals, the G1K data is the biggest data set on daily expenditures in the U.S. in 2008.

4 Methods

The regression equation of interest is given by:

$$Expenditure_{it} = \alpha + \delta \mathrm{I}(TR_{it} > 0) + \mathbf{x}_{it}'\boldsymbol{\beta} + e_{it} \qquad (1)$$

TR is a dummy which equals one if the individual reports having received the tax rebate. Subscripts refer to respondent *i* and *t* to the date of the interview. The coefficient δ measures the average effect of tax rebate receipt daily expenditures. As mentioned previously, the randomized nature of tax rebate receipt makes δ a causal effect of the rebate on spending.

Had a longitudinal component been available, I could difference out the individual-specific and time-invariant unobservables, such as tastes or permanent income. The variation in the G1K is, however, cross-sectional. Hence, e.g., permanent income is unobserved and is an omitted variable. However, if the receipt of the tax rebate is determined exogenously, then it is not systematically correlated with the unobservables. In my specifications, I also include controls (contained in the vector $\mathbf{x}_{it}$) that to some extent account for differences in the life-cycle as well as factors possibly reflecting different preferences (e.g. gender, number of children).

[7] http://www.treasury.gov/press-center/press-releases/Pages/hp1066.aspx

Given that information on spending is collected on about 500 individuals daily, the G1K contains a great number of observations. In order to make the data set comparable to other papers on the effects of tax rebates, I impose certain sample restrictions. I exclude individuals who are older than 85 years; this incurs a loss of about 2,000 observations. The distribution of the main variable of interest is much skewed – about one third of the sample reports zero daily expenditures. At the same time, the distribution of expenditures has a long right tail. I trim the sample by dropping extreme expenditures above the 98th percentile, which corresponds to 700 dollars. Some 1,400 individuals reported expenditures this high.

Table 1 shows summary statistics of the sample, separated by whether the respondent has received a rebate check or not. Even after dropping very high daily expenditures, the mean daily expenditures are about 53 dollars, whereas the median expenditure is about 25 dollars (not shown).

The two subsamples in Table 1 are not different with respect to gender and income, but differ with respect to other demographics. These differences in the composition of the groups reflect that individuals who report not having received a tax rebate consist of two populations:

1) those eligible for the check who have not received it yet due to randomization in the timing of check dissemination
2) those who are not eligible for it.

Ideally, the comparison would be made between individuals, who, due to exogenous factors, received their tax rebate to those who, for the same reasons did not. In order to correct for this issue, one would need information on eligibility. The eligibility for the tax rebate check is a function of the previous year's tax returns, a variable not collected by the G1K survey. As a remedy, I include information on current household income, age, employment, number of children and marital status in the regressions. These variables ought to reflect some of the variation in the eligibility for the tax rebate check. In all of the regressions, unless stated otherwise, I utilize the survey weights and report robust standard errors.

In order to capture a general time trend in regression (1), I include week dummies. I also control for day of week dummies capturing seasonality in spending occurring during a week. Finally, I include dummies indicating the Memorial Day holiday, Mother's Day, Father's Day which occurred

during the sample.[8]

The data do not allow me to determine the precise date of receipt of the tax rebate. Ideally, one would like to control for the date when the check was received, τ. Since this information is unavailable, I also analyze my sample on a month-to-month basis. As previous research found an immediate response of spending following the receipt of the tax rebate (Broda and Parker (2008)), one could expect to see a reaction in spending to occur relatively shortly following check receipt. Since the first checks were mailed in late April, it is easier to narrow down the unobserved time elapsed between the receipt of the rebate and the date of the survey interview by studying the recipients in the first months since the program began.

As mentioned previously, the dependent variable, expenditure, is a sparse vector. In addition, the right skewed distribution of expenditure provides a challenge for an OLS analysis in levels and logs. Applying a logarithmic transformation to expenditures incurs a loss of information of about one third of the sample. It also introduces a selection bias. Alternatively, running a regression on spending solely in levels would lead to misleading estimates. In order study if there have been any effects on the intensive margin, I consider a median regression, a Tobit model and a simple two-part model (Cragg 1971). It turns out that the results are very similar to running the OLS model in levels and logs, with hardly any statistical significance.

The large cluster of zero expenditure enables me to study the effects of the tax rebate on the extensive margin. The dependent variable in this part of the analysis is a dummy taking on a value of one if $Expenditure_{it}$ is bigger than zero. The coefficient δ then captures the average effect of tax rebate on the probability to spend. Here I find a positive and significant effect with regards to the probability to spend out of the tax rebate check.

5 Results

Consider the first column of Table 2. On average, the effect of receipt of the tax rebate increases the probability of spending by about 4 percent. Recall that the mean of the dependent variable is about 0.30. Controlling for regional dummies and predictable time effects, such as day of week dummies, weekly dummies, and holidays increases the coefficient to about 5 percent.

If the timing of the receipt of the tax rebate is truly exogenous, controlling for other observable characteristics should not matter for the estimate of δ. Eligible recipients of the tax rebate should,

[8] Data were not collected on Independence Day.

on average, be identical to those individuals who are eligible but have yet not received their check. As shown in Table 2, the means of observable characteristics of the receivers of tax rebate to non-receivers differ. This is because the non-receivers consist of both those eligible for the tax rebate who have not received it yet as well as those who were not eligible. As the data do not allow me to define eligibility directly, I include various demographics as controls.

In the third column of Table 2, I control for various demographics. The controls include a square polynomial in age, gender, if the respondent is married, the number of children in the household, an interaction between "married" and the number of children, and household income dummies. Controlling for these characteristics reduces the estimate of δ, but it is still significant.

In columns (3)-(7), I look at the effects on the level of consumption. Applying a simple OLS in levels yields a small and negative result. Recall, however, that the distribution of expenditure in levels is much skewed. The effect is statistically not different from zero when running a Tobit and median estimations. Applying a logarithmic transformation in column (5) yields a negative effect, but this regression only uses about one-third of the sample.

To get an intuitive idea of the size of the average effect of the tax rebate on spending, I also compute an estimate based on two OLS regressions. This "two-part" model consists of a participation equation (whether to consume on a given day or not) and an outcome equation for the subsample with positive expenditures (Cameron and Trivedi 2007).

The average effect of a variable $x_i \in \mathrm{x}$ on expenditures can be computed using the following relation (I use c as in consumption in order to save space):

$$E(c \mid \mathrm{x}) = \Pr(c > 0 \mid \mathrm{x}) E(c \mid c > 0, \mathrm{x}).$$

Taking the partial derivative with respect to x_i and applying the chain rule, I obtain:

$$\frac{\partial E(c \mid \mathrm{x})}{\partial x_i} = \frac{\partial \Pr(c > 0 \mid \mathrm{x})}{\partial x_i} E(c \mid c > 0, \mathrm{x}) + \Pr(c > 0 \mid \mathrm{x}) \frac{\partial E(c \mid c > 0, \mathrm{x})}{\partial x_i}.$$

The participation equation can be computed either as a probit or logit. For simplicity, I use a linear probability model. I obtain the outcome equation by running an OLS on strictly positive values of consumption on the same regressors as used in columns (3)-(7). The estimate on the effect of the tax rebate is equal to -4.922 (t-statistic is equal to -2.535). The other terms I compute as predicted values from these two regressions. The receipt of the tax rebate on average reduces spending by about 2.15 dollars. Thus, the average effect is economically negligible as is also

suggested by the Tobit and median estimations in Table 2.

The receipt of the tax rebate has a positive significant effect along the extensive margin. Previous research has reported that the effect of the tax rebates was especially strong for low-income groups (see Broda and Parker (2008) and Parker et al. (2010)). In Table 3, I split the sample by different gross household income categories. The effects are the strongest for low-income households (here defined as reporting gross monthly household income below $2,999). Their probability to spend increases by more than 5 percent. The effect is similar for the jobless. The group presumably least affected by the receipt of the tax rebate, individuals living in high income households display no reaction. Along the intensive margin of spending, the effects are mixed: with little or no significance.

As mentioned earlier, the data do not include information on the time of the receipt of the checks. Since the first checks were sent in late April, this omitted variable problem should be less of a concern in the weeks following the initial disbursement of the tax rebates. Table 4 reports the effects of tax rebate on the probability to spend by the four months where tax rebate receipt is reported in the data.

For April and July, the samples are relatively small; the data from both April and July only cover three days for each month. Only less than 3 percent of the sample has received the checks in April, whereas more than 70 percent of the households have received the checks by late July. The positive effects seem mainly driven by the increase in activity in June, when the probability to consume goes up by nearly 3 percent.

In Table 3, I repeat the analysis from Table 3 restricted to June alone. The effect for low-income households is strong: the probability to spend goes up by nearly 8 percent. Again, the jobless also react strongly – their propensity to consume goes up by 4 percent. This finding supports the results of Broda and Parker (2008) and survey evidence from Sahm et al. (2009) who report that the strongest reaction is found among groups presumably facing liquidity constraints.

6 Conclusion

In this paper, I use high-frequency data to study the effects of the tax rebate checks of 2008 on spending. I find that at a fine frequency such as a day, there are no effects along the intensive margin of spending. However, I find that the propensity to spend goes up by about 4 percent

following check receipt; this effect is the strongest for low-income earners and those without work. At most, the probability to spend goes up by about 8 percent.

The results confirm the findings of previous papers concerned with the effects of the 2008 tax rebates. Households increase their spending, but the magnitude was of this increase is rather small. These small effects question the efficacy of this form of fiscal policy.

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Appendix

Figure 1: Percent reporting that they received the tax rebate. Source: Gallup Daily Poll.

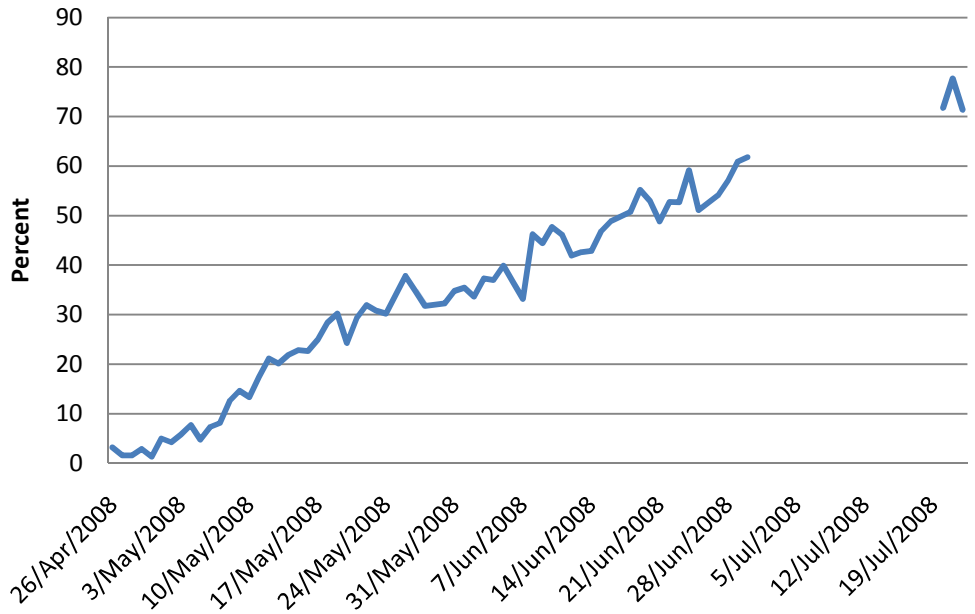

Table 1: Summary Statistics

Received Tax Rebate?	**No**			**Yes**		
Variable	**Mean**	**Sd**	**N**	**Mean**	**Sd**	**N**
Expenditure	55.3	86.16	19,081	55.44	83.41	9,522
I(Expenditure>0)	0.72	0.45	19,081	0.75	0.43	9,522
Woman	0.48	0.5	19,081	0.48	0.5	9,522
Age	53.71	16.79	19,081	51.79	15.73	9,522
Has job	0.6	0.49	19,052	0.67	0.47	9,505
Married	0.54	0.5	19,057	0.61	0.49	9,511
Single	0.17	0.38	19,057	0.13	0.34	9,511
No. Children < 18 years	0.56	1.05	19,062	0.65	1.07	9,511
Gross HH Income	4,879.30	3,208.60	14,625	4,912.63	2,870.38	7,787

Source: Gallup Daily Poll. Gross income computed at the middle of each discrete income bin. Unweighted sample.

Table 2: Effects of tax rebate on spending. Dependent variable is a dummy indicating positive expenditure: I(C>0), Expenditure in levels: C, or Log of expenditure: Log(C).

VARIABLES	(1) I(C>0)	(2) I(C>0)	(3) I(C>0)	(4) C	(5) Log(C)	(6) Tobit (C)	(7) Median regression (C)
Received tax rebate?	0.0433***	0.0518***	0.0203**	-2.760*	-0.0582**	-1.391	-0.635
	(6.512)	(7.032)	(2.574)	(-1.717)	(-2.315)	(-0.828)	(-0.807)
Day of week dummies?	no	yes	yes	yes	yes	yes	yes
Week dummies and Holidays?*	no	yes	yes	yes	yes	yes	yes
Regional dummies?	no	yes	yes	yes	yes	yes	yes
Demographics?*	no	no	yes	yes	yes	yes	yes
Constant	0.724***	0.699***	0.584***	28.02***	3.442***	-12.52	10.01**
	(177.1)	(37.83)	(10.73)	(3.194)	(19.96)	(-1.147)	(2.001)
Observations	28,603	28,603	22,306	22,306	16,760	22,159	22,159
R-squared	0.002	0.006	0.063	0.062	0.069		

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Regression based on weighted data.
*Holidays include controls for: Memorial Day, Mother's Day and Father's Day. Demographics include age and age squared, gender, a dummy if single, a dummy if married, if the respondent has a job and the type of job (full-time, part-time, unpaid), number of children in the household, an interaction between the dummy for married and the number of children, and gross monthly household income dummies.
Universe: individuals 18-85 years, April 26–June 30, July 20-22.

Table 3: The effect of tax rebate on the probability to spend across different income groups. Dependent variable: a dummy indicating positive expenditure, I(C>0).

VARIABLES	(1) Income: < $2,999	(2) Income: $3,000-$4,999	(3) Income: > $5,000	(4) No job
Received tax rebate	0.0561***	0.00884	-0.00679	0.0344***
	(3.826)	(0.556)	(-0.616)	(2.651)
Full-time housework				0.0323**
				(2.486)
Disabled				0.104***
				(6.829)
Full-time Student				-0.0810***
				(-3.393)
Constant	0.616***	0.786***	0.790***	0.480***
	(8.711)	(10.65)	(14.47)	(5.268)
Observations	7,860	5,088	9,358	10,830
R-squared	0.083	0.035	0.030	0.063

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Regressions based on weighted data. Regressions include the same controls as column (3) in Table 2. Universe: individuals 18-85 years, April 26–June 30, July 20-22. Income is measured as gross monthly household income.

Table 4: The effect of tax rebate on the probability to spend across different months.

Dependent variable: a dummy indicating positive expenditure, I(C>0).

VARIABLES	(1) I(C>0) April	(2) I(C>0) May	(3) I(C>0) June	(4) I(C>0) July
Received tax rebate	-0.00697	0.00683	0.0262**	0.0271
	(-0.0748)	(0.541)	(2.448)	(0.693)
Constant	0.302	0.622***	0.670***	0.441*
	(1.624)	(7.383)	(8.884)	(1.843)
Observations	1,717	9,919	9,510	1,013
R-squared	0.070	0.069	0.066	0.087

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Regressions based on weighted data. Regressions include the same controls as column (3) inTable 2. Universe: individuals 18-85 years, in different months.

Table 5: The effect of tax rebate on the probability to spend across different income groups. June only. Dependent variable: a dummy indicating positive expenditure, I(C>0).

VARIABLES	(1) I(C>0)	(2) I(C>0) Income: < $2,999	(3) I(C>0) Income: $3,000-$4,999	(4) I(C>0) Income: > $5,000	(5) I(C>0) No job
Received tax rebate	0.0285***	0.0784***	0.0149	-0.00655	0.0416**
	(2.701)	(4.106)	(0.665)	(-0.450)	(2.452)
Constant	0.711***	0.704***	0.902***	0.794***	0.529***
	(10.16)	(7.304)	(8.975)	(10.96)	(4.024)
Observations	9,568	3,348	2,145	4,075	4,609
R-squared	0.063	0.087	0.032	0.030	0.067

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Regression based on weighted data. Regressions include the same controls as column (3) in Table 2. Universe: individuals 18-85 years, April 26–June 30, July 20-22. Income is measured as gross monthly household income.