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Claus Thustrup Kreiner, David Dreyer  
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# CONSUMER RESPONSES TO FISCAL STIMULUS POLICY AND HOUSEHOLDS' COST OF LIQUIDITY

Claus Thustrup Kreiner, University of Copenhagen and CEPR  
David Dreyer Lassen, University of Copenhagen  
Søren Leth-Petersen, University of Copenhagen

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Centre for Economic Policy Research  
77 Bastwick Street, London EC1V 3PZ, UK  
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820  
Email: [cepr@cepr.org](mailto:cepr@cepr.org), Website: [www.cepr.org](http://www.cepr.org)

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## ABSTRACT

### Consumer Responses to Fiscal Stimulus Policy and Households' Cost of Liquidity\*

Consumption theory predicts that the cost of liquidity determines spending responses to a stimulus. We test this hypothesis directly using administrative records of individual-level loan and deposit accounts in combination with a Danish fiscal stimulus reform transforming illiquid pension wealth into liquid wealth. The data reveal substantial variation in the cost of liquidity across households, and this cost robustly predicts the propensity to spend. We find that the heterogeneity across households cannot be explained by short-lived shocks appearing within the duration of a typical business cycle but show that it is consistent with liquidity constraints being self-imposed by impatient types.

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Claus Thustrup Kreiner  
Institute of Economics  
University of Copenhagen  
StuDiestrede 6  
1455 Copenhagen K  
DENMARK

David Dreyer Lassen  
University of Copenhagen  
5 Øster Farimagsgade, byning 26  
1353 Copenhagen

Email: [ctk@econ.ku.dk](mailto:ctk@econ.ku.dk)

Email: [ddl@econ.ku.dk](mailto:ddl@econ.ku.dk)

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Søren Leth-Petersen  
University of Copenhagen  
5 Øster Farimagsgade, byning 26  
1353 Copenhagen  
DENMARK

Email: [soren. leth-petersen@econ.ku.dk](mailto:soren. leth-petersen@econ.ku.dk)

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# 1 Introduction

Across the world, governments reacted to the large negative shock that hit the global economy in 2008 by adopting unprecedented fiscal stimulus policies, in many cases with the explicit aim of increasing household consumption to boost aggregate spending. The efficacy of these policy actions, and fiscal policy more generally, is still intensely debated. According to the canonical Life-Cycle/Permanent Income Hypothesis model, rational households in a world with perfect capital markets will respond to fiscal stimuli in the form of tax rebates by increasing their savings, implying that such fiscal policy measures are ineffective in raising consumer spending. However, the assumption that households can save and borrow at the same interest rate is rarely satisfied in practice. Consumers face differential interest rates on savings and borrowing, and also differential interest rates on different types of borrowing. In this paper, we test whether the wedge between returns on saving and the interest rate faced by individuals on their marginal borrowing, a wedge we term the marginal cost of liquidity, is important for understanding consumer responses to fiscal stimuli.

We set up a basic consumption model and show that a household's marginal cost of liquidity is a robust predictor of the household's consumption response to a fiscal stimulus. We proceed to test this hypothesis directly using a novel and unique Danish data set on household marginal interest rates, computed from third-party reported administrative records of individual-level loan and deposit accounts. The data reveal substantial variation in the marginal cost of liquidity, with interest rates varying from close to 0 to more than 20% across households in our sample. We employ this data in an analysis of a 2009 fiscal stimulus policy initiative that transformed illiquid pension wealth of Danish households into liquid wealth available for consumption. The policy was unanticipated and changed the timing of access to wealth, making it ideal for testing the importance of liquidity constraints for spending responses to stimuli.

We measure the spending effect of the reform through a survey conducted in January 2010, immediately after the pay-out window had closed, resulting in about 5,000 completed

interviews with information about spending behavior related to the pension payout. We match these survey data at the person level to the loan and deposit accounts data as well as to income tax records and other administrative registers containing information about household demographics, incomes and wealth, and broad categories of financial asset holdings for the period 1998-2009. We find that households' marginal cost of liquidity is a robust predictor of the propensity to spend the stimulus, with a 1% point increase in the cost of liquidity being associated with a 0.5% point increase in the propensity to spend. This is consistent with the theory and suggests that liquidity constraints are important for explaining consumption responses to stimulus policies.

We proceed to investigate the origins of liquidity constraints in our setting: We show that a household's marginal cost of liquidity at the time of the policy initiative correlates strongly with its ratio of liquid assets to income more than a decade earlier. This result reflects heterogeneity across consumers that is permanent — or at least persistent to a degree that cannot be accounted for by shocks appearing within the horizon of a typical business cycle — and suggests that differences in the marginal cost of liquidity to a large extent are driven by differences in the demand for liquidity, i.e. that liquidity constraints are self-imposed.

Our paper contributes to the literature measuring effects of stimulus policies in several ways. It is the first paper that directly examines the role of the marginal cost of liquidity for the propensity to spend out of a stimulus. Johnson et al. (2006) estimate the change in consumption expenditures caused by the 2001 federal income tax rebates. They show that people with little liquid wealth are likely to spend more and point at credit market constraints as a likely driver of spending responses. Souleles (1999) examines the effects of tax refunds and reach similar findings. Agarwal et al. (2007) show, using credit card data, that consumers initially increased credit card payments but soon after increased spending following the 2001 US income tax rebate. The focus on credit card use is interesting because credit cards are likely to be the source of credit that carries the highest marginal cost of liquidity. The high frequency of the credit card data makes it possible to follow

the short term dynamics of spending, but the Agarwal et al. study does not have data on other household assets and spending and cannot measure the cost of liquidity directly. Parker et al. (2011) investigate the effect of the 2008 tax rebate and find that low income households tend to have a higher propensity to spend, but do not provide clear evidence for the importance of liquidity constraints. There is, in fact, little consensus about the role of liquidity constraints for the propensity to spend out of stimuli. Shapiro and Slemrod (2003, 2009) examine the effects of the 2001 and 2008 tax rebates, respectively, using survey information and find that respondents with low income do not have a higher propensity to spend the stimulus and interpret this finding to mean that liquidity constraints are not important, echoing conclusions from their 1995 study of responses to a change in tax withholding.

Our results potentially reconcile these disparate findings. Common to all the studies is that they do not measure the marginal cost of liquidity directly. We find that households facing a high marginal cost of liquidity, those with credit cards and consumer credit loans, spend more than households with low marginal liquidity costs, and this result is robust to controlling for various income measures, financial assets, expectations and the size of the payout. The marginal cost of liquidity is correlated with the level of assets but only weakly correlated with income. This is consistent with studies using indicators for low income status finding liquidity constraints to be unimportant, whereas studies using indicators for holding low levels of assets find liquidity constraints to be important determinants of consumer behavior.

The finding of substantial heterogeneity in households' marginal cost of liquidity is also consistent with results from a broader literature about the role of liquidity constraints and consumption behavior, including Gross and Souleles (2002) and Leth-Petersen (2010), showing that changes in the supply of credit has an effect on consumption for some, but not all, groups of consumers. Our finding that household marginal cost of liquidity at the time of the policy initiative is correlated with asset holdings more than a decade earlier suggests that variation across households in liquidity constraint tightness is to a

large extent demand driven. While not identifying any particular model, such a pattern is consistent with models of savings behavior where agents are heterogeneous with respect to how they discount the future, including recent empirical work by Alan and Browning (2010), who reject homogeneity of discount factors, and Hurst (2006) who present empirical evidence consistent with the view that some agents discount the future heavily while others do not. Our findings are therefore broadly consistent with Mankiw's (2000) savers-spenders model of fiscal policy.

The next section presents details of the stimulus reform. Section 3 develops a theory of spending behavior with heterogeneous borrowing and lending rates. The following sections introduce the data and present the results. The final section concludes.

## **2 The Danish fiscal stimulus policy**

On March 1, 2009, the centre-right Danish government announced a major fiscal stimulus policy initiative, aimed at stabilizing the Danish economy in the midst of the financial and economic crisis: The Special Pension (SP) payout. The SP scheme was introduced in 1998 as a compulsory individual pension account, into which everyone earning income in Denmark deposited one percent of their gross income. The scheme was administered by the largest Danish public pension fund ATP, and individuals would receive their pension at age 65. Compulsory payments into the scheme were suspended in 2004. The stimulus policy gave individuals the possibility of having the balance on their SP-account paid out in the period from June 1 to December 31 in 2009, and the payout was to be taxed at 35 percent for the first 15,000 DKK (approx. 3,000 USD) and at 50 percent beyond 15,000 DKK, reflecting that all pension benefits are taxable in Denmark.

The stimulus policy was noteworthy for several reasons: First, by allowing individuals to withdraw a part of their own pension funds that would otherwise be unattainable until age 65, the stimulus payment received by an individual would be financed by a corresponding reduction in the person's pension wealth rather than government borrowing and future tax increases. The stimulus policy preserved therefore Ricardian equivalence



at the individual level: Having the money paid out and used for present spending would restrict future spending possibilities with certainty.<sup>1</sup>

Second, the stimulus policy initiative was completely unanticipated. This can be seen from Panel A in Figure 1, which shows the number of mentions of the words “SP” and “pension” in all Danish media, electronic and print, from October 2008 to June 2009. The early spikes are due to reports that the government first proposed and then abandoned plans to reinstate payments into the SP as part of the 2009 government budget proposal, and the small blip in early February was media reports on capital losses on accumulated SP-savings following the financial crisis, after which there was no mention of the SP until March 1, 2009.

Third, the policy was transparent. All account holders received a personal letter, shown in the appendix, from ATP with a pre-filled form including the account balance on May 1, 2009. To have the balance paid out, account holders should sign a slip and return it in an enclosed, stamped envelope. The money would then be transferred directly to the holder’s main bank account, already on file.

Fourth, the stimulus was large. On June 1, 2009, there were 2,603,565 individuals with an SP account, corresponding to 70 percent of the adult population ( $\geq 25$  years), and the average account balance was 14,924 DKK (approximately 3,000 USD). Of the account holders, 94 percent chose to have their funds paid out. The average gross payout was 15,447 DKK and the corresponding average payout net of taxes was 9,536 DKK (approximately 1,900 USD). In comparison, the 2008 US tax rebates were between \$300 and \$600 per adult and \$300 per dependent child (Parker et al., 2011). The total sum paid out was 23.3 billion DKK net of taxes, equal to 1.4 percent of GDP. Following the payout, aggregate consumption picked up; Panel B in Figure 1 shows aggregate Danish quarterly consumption with the turning point in Q1, 2009 when the initiative was announced.

< Figure 1 >

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<sup>1</sup>The tax scheme involved a small wealth effect for high wage earners who could obtain a higher net wealth from taking the SP funds out and placing the funds in a private pension scheme if the rate of returns are expected to be the same on the two schemes.

### 3 The relationship between consumption responses and household's cost of liquidity: A simple theoretical framework

This section explains within a basic two-period model why the marginal cost of liquidity of a household is a robust predictor of the household's consumption response to a fiscal stimulus policy.

Let  $c_1$  and  $c_2$  denote the consumption levels of a household in period 1 and period 2, respectively, and assume that household behavior is governed by a standard homothetic utility function  $u(c_1, c_2)$ .<sup>2</sup> Note that since our focus is on predicting household behavior, this utility function may be different from the utility metric determining the well-being of the household due to present bias or other types of behavioral effects, without affecting the results.

The household has both illiquid wealth and liquid wealth (which may be negative) at the beginning of period 1. Let  $y_1$  denote the cash-on-hand in period 1 such as earnings and liquid wealth carried over from the previous period, and let  $a_1$  denote illiquid household wealth which is not accessible before period 2, e.g. a positive balance on pension accounts that cannot be withdrawn or used as collateral for loans. The household budget constraint in period 1 then becomes

$$c_1 \leq y_1 + d, \tag{1}$$

where  $d$  is household debt at the end of period 1 (or savings if  $d < 0$ ). The second period consumption level has to fulfill

$$c_2 \leq y_2 + (1 + \tilde{r}) a_1 - (1 + \bar{r}) d, \tag{2}$$

where  $y_2$  is earnings and other non-capital income in period two,  $\tilde{r}$  is a fixed rate of return on illiquid wealth, while  $\bar{r}$  is the average interest rate on the household debt/savings. The interest rate on a loan depends on the risk of default and on the availability of collateral,

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<sup>2</sup>Within the class of homothetic utility functions is the specification  $u(c_1, c_2) = c_1^{1-\theta} / (1-\theta) + \beta c_2^{1-\theta} / (1-\theta)$  commonly used in consumption theory and macro economics and where  $\beta$  is the subjective discount factor while  $\theta > 0$  is the coefficient of relative risk aversion.

which will be related to the existing debt of a household. Here, we simply assume that the interest rate on marginal lending of the household can be described by a function  $r(d)$ , where  $r'(d) \geq 0$  implying that the marginal borrowing costs are weakly increasing in the amount borrowed  $d$ . We assume for simplicity that the rate of return on savings is constant and equal to  $\tilde{r}$  such that  $r(d) = \tilde{r}$  for  $d < 0$ . The average interest rate on household debt/savings is then equal to

$$\bar{r} = \begin{cases} \left( \int_0^d r(h) dh \right) / d & d \geq 0 \\ \tilde{r} & d < 0 \end{cases}. \quad (3)$$

The household optimum is characterized by a standard tangency condition

$$\text{MRS}(c_1/c_2) \equiv \frac{u_1(c_1, c_2)}{u_2(c_1, c_2)} = 1 + r(d), \quad (4)$$

where the interest rate on marginal lending  $r(d)$  depends on the consumption choice (through  $d$ ), and where the marginal rate of substitution is a function only of relative consumption levels  $c_2/c_1$  because of the assumption of homothetic preferences. Note that the optimum condition (4) may be rewritten as

$$\text{MRS}(c_1/c_2) = (1 + \tilde{r})(1 + \psi), \quad \psi(d) \equiv \frac{r(d) - \tilde{r}}{1 + \tilde{r}},$$

where  $\psi$  is the shadow price of liquidity (Browning and Lusardi, 1996). This shows that a higher marginal interest rate of the household  $r(d)$  is equivalent to a higher marginal cost of liquidity.

Consider now a fiscal stimulus policy that allows households to transfer a certain amount of their illiquid wealth  $a_1$  to cash-on-hand wealth  $y_1$ . We assume that the permitted transfer amount is small compared to total wealth allowing us to approximate the effect of the reform as a marginal change  $dx$  giving each household the opportunity to change the allocation of wealth between liquid and illiquid wealth according to

$$dy_1 = -da_1 = dx. \quad (5)$$

For simplicity, we assume that the interest rate is locally constant at the initial equilibrium,  $r'(d) = 0$ . From differentiation of eqs (1)–(5), we obtain:

**Proposition 1** *The household consumption response to the reform (5) is characterized by*

$$\frac{dc_1}{dx} = \frac{r(d) - \tilde{r}}{1 + r(d) + c_2/c_1}. \quad (6)$$

The effect of the reform is illustrated in Figure 2. The black curve in Panel A shows the intertemporal consumption trade-off faced by the household. The curve becomes steeper as the household raises its consumption level in period 1, reflecting that the marginal interest rate is increasing in the amount borrowed. The reform expands the budget set of the household as illustrated by the gray curve. From expressions (1)–(3), it follows that the horizontal movement equals  $|dc_1/dx|_{dc_2=0} = (r(d) - \tilde{r}) / (1 + r(d))$ , showing that the effect is increasing in the marginal interest rate. For example, points on the line segment with an interest rate of  $r_2$  shift to the right with  $(r_2 - \tilde{r}) / (1 + r_2)$  as shown in the diagram (for  $c < y$  the household is not credit constrained,  $r(d) = \tilde{r}$ , implying that the points on this line segment is completely unchanged by the reform).

Panel B illustrates possible consumption responses depending on household preferences. Consider first a person with indifference curves represented by  $I_1$  and  $I_2$ , where the optimum before the reform is point  $\mathbf{Y}$ . With homothetic preferences, MRS is constant along a ray from origo, implying that the new optimum is at  $\mathbf{Y}'$ . A more impatient person will be at  $\mathbf{Z}$ , with a higher marginal interest rate before the reform, and move to  $\mathbf{Z}'$ , which gives a larger immediate consumption response to the stimulus policy. On the other hand, a person at point  $\mathbf{X}$  where  $r(d) = \tilde{r}$  will not respond to the reform at all.

< Figure 2 >

Figure 2 thus illustrates how heterogeneity in preferences across households create “self-imposed”, or demand-driven, variation in the marginal cost of liquidity before the reform, implying that households with a high marginal cost of liquidity will respond more to stimulus policies.

Differences in the marginal cost of liquidity may also arise because of heterogeneity in the budget set. For example, one household may receive the main part of life time

income in period 1 and save funds for period 2 consumption while another household may receive the main part of life time income in period 2 and borrow money in period 1. This is illustrated in Figure 3 where household **A** has all life time income in period 1 while household **B** has a large part of life time income in period 2 implying that household **A** faces the intertemporal trade-off  $1+\tilde{r}$  everywhere, while the trade-off is larger for household **B** when borrowing money. With identical preferences and no credit market imperfections both households would attain the consumption levels at **X** but because **B** faces a higher marginal cost of liquidity, she obtains only the consumption level at **Y** in Figure 3. The stimulus policy does not have any impact on the budget set of household **A** but expands the budget set of household **B** and moves the optimum from **Y** to **Y'**, thereby increasing current consumption.

< Figure 3 >

Our data reveals substantial variation in marginal interest rates across households. Two leading explanations for this variation are differences in preferences (patience and risk aversion) and differences in timing of income (Fisher, 1930; Deaton, 1999).<sup>3</sup> In both cases, the basic theory predicts that the pre-reform variation in marginal interest rates across households, and therefore in the marginal costs of liquidity, generates differences in consumption responses to fiscal stimulus policy across households. In practice,  $r$  can also be affected by other factors influencing the slope of the budget set, for example differences in the share of durable goods that may be used as collateral, so that otherwise observationally equivalent households face different marginal costs of liquidity. Also in these cases, the basic theory predicts that households facing the highest marginal costs of liquidity will respond most to the stimulus policy.

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<sup>3</sup>Fisher (1930, ch. IV) considers both, distinguishing between impatience originating from characteristics of the income stream, including its time shape, and impatience originating from what he termed personal factors, including (lack of) self-control and foresight.

## 4 Data

The measurement of household spending responses to the stimulus policy is based on survey data collected in January 2010 for a random sample of persons with SP-savings. For that purpose, we commissioned a survey company that asked individuals about their response to the SP-release. The survey data are joined at the individual level with 3rd party reported administrative register data from the Danish Tax authorities containing information about loans, deposits and interest payments, used to compute the household marginal cost of liquidity, as well as a host of background information from other administrative registers.

### 4.1 Survey data and the spending response to the stimulus policy

The window of the SP-release ended 31 December 2009. Shortly after, in weeks 4-7 2010, we issued a telephone administered survey where we asked questions about the use of the SP-funds. The survey includes 5,055 completed interviews and is sampled randomly from the entire set of SP-account holders. Each interview lasted 10-12 minutes and covered 40 questions about the SP-policy and a range of other topics. The questions about the SP-policy were placed in the beginning of the interview and were followed by questions about the households' financial situation and expectations regarding the future. In the survey we asked respondents about their SP-account balance, whether the money were withdrawn and finally the following question:<sup>4</sup>

The sum of money that you have at your disposal is the sum of money that you have available for spending, saving, and reducing your debt. The SP payout increased the amount that you have at your disposal in 2009. Considering this increase, how did you allocate it?

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<sup>4</sup>The question is inspired by Shapiro and Slemrod (1995, 2003) and Parker et al. (2011). However, while their question presents mutually exclusive alternatives our question allows respondents to distribute the stimulus across all alternatives. Parker et al. (2011) validate the questionnaire methodology and find that it is able to capture spending responses.

- to increase spending (for example on food, travelling, clothes, televisions, cars, home appliances, computers, restaurants, maintaining the house, or other types of spending)
- to increase your free savings (i.e. putting money in the bank, buying shares, bonds, or other securities)
- to reduce your debt
- to increase your pension savings

Figure 4 shows a scatter plot of the propensity to spend against the size of the SP payout together with a local polynomial regression through the data. Most of the responses are corner solutions, either spend (63%) or not spend (33%). The smoothed regression shows that the propensity to spend is higher among respondents with small SP-accounts balances.

< Figure 4 >

## **4.2 3rd party data on loans/deposits and computation of household interest rates**

The register data come in three groups covering different periods and providing different amounts of detail. First, we have the register with information about SP-accounts from the government pension fund, ATP. The data includes information about all SP-accounts and the value of these on 1 May 2009. These data were used to draw the random sample of persons that were interviewed.

The second group of register data includes standard demographic information from several public administrative registers as well as information from the income-tax register for the period 1998-2009. The income tax register holds detailed information about incomes and values of assets and liabilities measured at the last day of the year. The asset and liability information that we have access to from these registers is aggregated into broad classes such as bonds, stocks, cash in banks, mortgage loans and the sum of other loans. An important feature of these data is that they are organized longitudinally, enabling us

to track incomes and assets/liabilities back in time for the persons in our survey. Another attractive feature is that the data are third party reported: Information about earnings is collected directly from employers and information about transfer income from government institutions, while information about the value of assets and liabilities by the end of the year is reported directly from banks and other financial institutions. The tax authorities use the income information to calculate tax liabilities and the wealth data to cross check if reported income is consistent with the level of asset accumulation from one year to the next. A recent study by Kleven et al. (2011) conducted a large scale randomized tax auditing experiment in collaboration with the Danish tax authorities and documents that tax evasion in Denmark is very limited, in particular among wage earners. This indicates that the third party reported information about income collected by the tax authorities is of very high quality; see also Chetty et al. (2011) for more detailed information on Danish income-tax data, and Leth-Petersen (2010) for a detailed description of the wealth data.

The third group of register data is obtained from the raw data files of the tax authorities and provide information about every individual deposit and loan accounts held by the persons included in our sample in 2007 and 2008. These data provide information about the value of deposits and loans at individual account levels at the last day of the year as well as interest payments over the past year. We use this information to impute a marginal interest rate for each person in our survey.

To do this we link the interview persons to any partners or spouses and calculate an interest rate for each and every account held by the household. We do this at the household level to allow for the possibility that spouses can shift funds within the household to obtain the lowest possible marginal interest rate.<sup>5</sup> Account specific interest rates are calculated as interest payments on loan  $i$  relative to average debt on loan  $i$  over the year:  $r_{h,i} = \frac{R_{h,i}^{08}}{\frac{1}{2}[D_{h,i}^{07} + D_{h,i}^{08}]}$  where  $R_{h,i}^{08}$  are interest payments from account  $i$  for household  $h$  during 2008,  $D_{h,i}^{07}$  is the value of the account by the end of 2007 and  $D_{h,i}^{08}$  is the value of the account by the end of 2008. To impute the marginal interest rate,  $r_h^m$ , for a given household  $h$ , we pick the highest account-specific interest rate from a loan account if the household has at

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<sup>5</sup>We also performed all calculations at the person level. This did not affect the results.



least one loan account. If the household has only deposit accounts, we pick the smallest account-specific interest rate among the imputed account-specific interest rates for that household. The idea is that if a household has loan accounts then the marginal cost of liquidity is determined by the highest interest rate, whereas the marginal cost of liquidity is given by the account where the lowest return is earned when the household has only deposit accounts.

The high level of detail in these data generates significant dispersion in the imputed marginal interest rates across persons. Figure 5 plots the distribution of marginal interest rates for our sample.

< Figure 5 >

The distribution of marginal interest rates is bimodal. The area around the lower modal point is dominated by households that have only deposit accounts, while the area around the upper modal point is dominated by households that have loan accounts. The distribution suggests that there is a significant amount of heterogeneity in the marginal interest rates in our sample. By imputing the interest rates we potentially introduce a measurement error. However, our detailed account data includes a subset of accounts with information about the actual interest rate and this enables us to directly compare the calculated interest rates with an actual interest rate to get an impression of the accuracy of our imputation. Figure 6 plots calculated interest rates against actual interest rates for 1,435 observations where we have an actual interest rate that matches the account that we have selected in our procedure. The figure shows that the estimated interest rates from our procedure matches the actual interest rates quite well.<sup>6</sup>

< Figure 6 >

A number of previous studies have used proxies for credit market constraints when investigating the responses to stimulus policies. Shapiro and Slemrod (1995, 2003, 2009)

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<sup>6</sup>We have reproduced the entire analysis on this subsample and using the actual interest rates. Estimates were practically similar, but standard errors were obviously much larger.

use (low) income as a proxy for constraints. In the left panel of Figure 7 we show a local polynomial smooth of the marginal interest rate against the log of income. The correlation between these two measures is very weak and suggest that income is not a good proxy for credit market imperfections, consistent with the empirical findings of Shapiro and Slemrod and recent theoretical work by Kaplan and Violante (2011). Another line of studies, Zeldes (1989), Johnson et al. (2006) and Leth-Petersen (2010), have used the level of liquid assets relative to income as an indicator for liquidity constraints. In the right panel of Figure 7, we plot a local polynomial smooth of the marginal interest rate and the level of liquid assets by the end of 2008 relative to disposable income during 2008. The picture shows a clear negative relation between the marginal interest rate and liquid asset holdings.

< Figure 7 >

## 5 Empirical results

### 5.1 Household interest rates and the marginal propensity to spend

The theory presented in Section 3 suggests that the propensity to spend the stimulus should be correlated with the marginal interest rate. Figure 8 plots a local polynomial smooth of the propensity to spend against the imputed marginal interest rates. Consistent with the predictions of the theory, the figure shows a significant positive and almost linear relationship between the propensity to spend and the marginal interest rates, with a 1% point increase in the marginal interest rate being associated with a 0.5% point increase in the propensity to spend.

< Figure 8 >

The regression in Figure 8 illustrates the simple bivariate relationship between the propensity to spend and the marginal interest rate. In Table 1 we run corresponding OLS regressions and include more covariates.

< Table 1 >

Column 1 reports the bivariate relationship that compares to Figure 8. In column 2, the liquid asset measure is added showing a negative relationship between spending and liquid asset holdings. Adding liquid assets relative to disposable income reduces the size of the estimated effect of the interest rate, but it is still clearly significant. In column 3 we include the size of the SP-payout, income in 2008 and a measure of permanent income calculated as the average of incomes over the period 1998-2008. The inclusion of these covariates affects the parameter estimate of the interest rate only slightly.

In column 4 we include a standard set of demographic covariates. This reduces the size of the parameter of interest to 0.33. According to the life cycle framework, agents that have a precautionary motive also adjust their behavior if they expect to be affected by constraints in the future. In column 5 we introduce a set of indicators for expected constraints. Specifically, in the survey we have asked if people expect their chances of obtaining credit over the next year to be better or worse than in the year that has just passed. Similarly, we asked about expectations over next year's income. Neither of these indicators turn out significant, even when testing for their joint significance. Finally, the SP-release was announced at the same time as a tax reform to be implemented from January 2010 aiming at increasing the incentives to work. The tax reform was fully financed and lowered the highest marginal tax rate on wage income from 63 percent to 56 percent. In the survey we asked about subjective expectations regarding the permanent effects of the tax reform on the respondent's own income, and included two variables for this in the regression presented in column 5, but neither of these indicators were significant.

Across the regressions in Table 1, we find that the marginal interest rate – the marginal cost of liquidity – is significant, both statistically and economically, in explaining the propensity to spend the stimulus. These results confirm the theoretical conjecture that the marginal interest rate is a robust predictor of the spending response, and they provide an explanation for the diverging results found in previous studies concerning the importance of

credit market imperfections based on two different proxies for credit market imperfections.<sup>7</sup>

Estimations are based on OLS, and this can potentially lead to biased estimates as most responses are either 0 or 1. To make sure that potential misspecification is not driving the results, we have also reproduced the results using probit and tobit estimators, which did not affect results (see Table A1 in the appendix). Furthermore, the specification presented in Table 1 includes linear terms only. Figure 1 suggested that the propensity to spend could be nonlinearly related to the size of the SP-payout. Another concern might be that marginal interest rates are in fact just picking up variations in income across the persons/households in our sample. To address these concerns we repeated the estimations including up to 4th order polynomials in the size of the SP-payout, in all the income variables, and age. The inclusion of the polynomials affected the results the results only marginally. Results are reported in Table A2 in the appendix.

The average propensity to spend out of the stimulus was quite high according to our survey. While this is not inconsistent with existing evidence from US stimulus policies, Figure 8 also suggests that the propensity to spend is relatively high among individuals/households observed to have low marginal interest rates, even though the theory predicts low responses for people with a low price on liquidity.<sup>8</sup> A potential explanation for this pattern is related to the size of the SP-payout. Previous studies have found that the propensity to spend is high for small payout amounts but considerably smaller for large payout amounts.<sup>9</sup> While the SP-payout is large relative to typical US stimuli, it is

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<sup>7</sup>Browning and Crossley (2009) find evidence that when people face liquidity constraints they cut back on durable spending. In a follow-up question we asked: *Concerning the part of the increase [in the sum of money that you have at your disposal] that you allocated for spending, did you mainly spend it on: 1) large items (for example a televisions, cars, white goods, computers, maintaining/improving the house) or unusual items (for example travels, nice clothes, eating at restaurants) 2) everyday spending, for example food. 3) do not know.* 67% of the spenders indicated that they had spent the money on large or unusual items. In a set of regressions (not reported), similar to the regressions presented in table 1 but using an indicator for having spent the money on large or unusual items as the dependent variable, we confirm the results from table 5.

<sup>8</sup>As noted before 67% of the spenders indicated that their spending was mainly on large or unusual items. To the extent that such items are durable goods actual consumption in 2009 will be lower.

<sup>9</sup>Hsieh (2003) finds that the propensity to consume out of (large and anticipated) payments from Alaska's Permanent Fund is smaller than the same individuals' propensity to consume out of (small and irregular) income tax refunds. The point that the propensity to consume depends on size seems to have been made first by Landsberger (1966) in a discussion of Bodkin (1959).

still relatively modest in terms of the overall household economy. The results suggest that size is important. However, the SP-scheme collected a fixed percentage of people's income in the period 1998-2003, and size variation is therefore limited relative to long term or permanent income. To get further insight in to the importance of a size effect we repeated the survey in January 2012 and asked hypothetical questions about what the spending response would have been had the SP-payout been 1,000DKK, 10,000DKK and 100,000DKK (in random order). The follow-up survey includes 3,135 persons from the original survey and was supplemented with randomly selected new respondents to reach a total of 5,920 respondents. We then matched these responses with the marginal interest rates from 2008 that we used in Figure 8. The results are presented in Figure 9 and they show that the intercept, i.e. the spending response at a zero interest rate, varies considerably with the size of the hypothetical pay-out. Changing the size of the hypothetical pay-out from 1,000 to 10,000 to 100,000 changes the intercept from 60% to 40% to 25%. This suggest that the level of the response is clearly affected by the size of the pay-out. Interestingly, the interest gradient that we observed for the actual outcome in Figure 8 appears in all panels in Figure 9 as well.<sup>10</sup>

Spending was by far the most important allocation of the SP funds, but according to the survey 10% of the funds were used for reducing debt, 20% was allocated in to free savings and 5% was put in to pension savings schemes. We have run regressions corresponding to column (5) in table 1 for these alternative outcomes and also for these outcomes is the marginal interest rate significantly correlated with the response: respondents with high marginal interest rates save less and debt reduce more. The median interest rate among savers is 6%, and the median interest rates among spenders and debt reducers are 9 and 11%. Moreover, the median level of liquid assets to disposable income is 32% for savers but 13% and 7% for spenders and debt reducers. This suggests that debt reducers were at least as affected by constraints as spenders. However, having experienced lower income in 2009 than expected and/or expecting to have lower chances of obtaining credit in 2010

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<sup>10</sup>We also performed the exercise for the subsample of 3,135 persons who participated in the original survey and the results were unchanged.

than in 2009 significantly explains debt reduction but not spending. This pattern suggests that debt reducers are significantly affected by credit market imperfections, but expect constraints to be more binding in the future and therefore debt reduce rather than spend. These results are reported in Table A3 the appendix.

## 5.2 Why do household interest rates predict the marginal propensity to spend?

The simple theory presented above suggests that preference heterogeneity or other person fixed factors potentially play an important role in explaining the heterogeneity in marginal interest rates across consumers. One advantage of the Danish administrative register data is that it is possible to track people's financial asset holdings back to 1998. This enables us to check if the marginal interest rates that we observe in 2008 are correlated with the amount of liquid assets held by the same people in 1998. The idea that we pursue in this section is that if marginal interest rates in 2008 is correlated with financial information recorded in 1998 then that suggests that marginal interest rates observed in 2008 are the result of factors that are fixed or at least persistent to a degree that cannot be explained by what is usually thought of as transitory shocks.

Figure 10 depicts the bivariate relationship between marginal interest rates in 2008 and the level of liquid assets in 1998.

< Figure 10 >

The bivariate relationship is, of course, potentially misleading because the 1998 level of assets may proxy for other variables measured in 2008. For example, Figure 8 showed an equally strong relationship between marginal interest rates in 2008 and the level of liquid assets in 2008. Table 2 presents the results from a multivariate analysis of the ability of historical asset levels to predict current marginal interest rates. The first column in Table 2 repeats the estimation from column (5), Table 1. In column (2) the marginal interest rate is regressed on the set of covariates used in column 1 and on the level of liquid assets in 1998, the level of liquid assets in 2008 and the interaction between these two. The latter

two variables do not enter the regression in the first column. The level of liquid assets in 1998 significantly predicts the marginal interest rate in 2008 given the other covariates. In the next step we predict the interest rate using the estimates in column (2) and use the predicted interest rate as a regressor in the spending regression presented in column (3) where we also include as a separate variable the residual variation in the interest rate. The interest rate predicted from the 1998 level of financial asset holdings is significant at the 1% level and much larger in magnitude than in the basic estimation presented in column (1). This suggests that fixed or very persistent factors play an important role in predicting the interest rate and thereby the spending response to the stimulus policy.

< Table 2 >

One objection to this analysis could be that people observed with low levels of assets in 1998 have been exposed to continuing bad luck in the labor market over the period. In columns (4) and (5) we repeat the exercise on a subsample of people that have not been affected by unemployment at any point in the period 1998-2008. Results from this subsample, consisting of more than half of the sample used in the other estimations, confirm the previous findings. While these results do not rule out a role for historical shocks so persistent that they impact behavior more than ten years after they appeared, they suggest a role for heterogeneity that is persistent to a degree that cannot be accounted for by shocks appearing within the typical duration of a business cycle, and point out that the interest rate heterogeneity observed in the data is likely demand driven.

## 6 Conclusion

This paper has studied the effects of a 2009 Danish stimulus policy that transformed illiquid pension wealth into liquid wealth, available for consumption. We examine the payout in the context of basic consumption theory extended with heterogeneous interest rates. This model predicts that the consumption response to a stimulus is a function of the marginal cost of liquidity, which is given by the difference between interest rates on

marginal borrowing and saving. We test this proposition directly by merging, at the person level, survey records with third party reported information from income-tax registers about all individual deposit and loan accounts in 2007-2008 held by our survey respondents. Consistent with the theory we find that the interest wedge between borrowing and saving is a robust predictor of the propensity to spend out of the stimulus. We also find that the overall level of spending was significant. Projecting the results from our survey to the aggregate level gives a large spending effect corresponding to 1.8% of total private spending and 0.9% of GDP.

Finally, we find that a household's marginal interest rate at the time of the policy initiative is strongly correlated with its ratio of liquid assets to income more than a decade earlier. This suggests that differences in marginal interest rates across people observed in our data are the result of heterogeneity that is persistent to a degree that cannot be explained by typical short lived shocks appearing within the duration of a typical business cycle and this, in turn, suggests that differences in the demand for liquidity is an important driver for the observed spending responses. This finding of persistent heterogeneity is consistent with models of consumption behavior where agents are inherently different in terms of how they discount the future, including Mankiw's (2000) savers-spenders model of fiscal policy.

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**Table 1. Spending share regressed on covariates (OLS)**

	(1)	(2)	(3)	(4)	(5)
<b>Credit</b>					
Marginal interest rate	0.518 ***	0.368 ***	0.361 ***	0.332 ***	0.332 ***
Liquid assets / disp income, 2008		-0.064 ***	-0.054 ***	-0.039 **	-0.039 **
<b>Size Effect</b>					
Ln(net SP)			-0.075 ***	-0.074 ***	-0.074 ***
<b>Income controls</b>					
Ln(income), register			-0.009	-0.021	-0.020
Ln(permanent income)			-0.042	-0.018	-0.019
sd[Ln(income)]			-0.017	-0.023	-0.023
Income developed better, 2009 (d)			0.025	0.017	0.024
Income developed worse, 2009 (d)			-0.005	-0.008	-0.007
<b>Demographic controls</b>					
Age				-0.002 **	-0.002 **
Woman (d)				0.026	0.026
Single (d)				0.007	0.007
Number of children				0.022 **	0.021 **
Education, short (d)				-0.006	-0.006
Education, medium (d)				-0.020	-0.020
Education, long (d)				-0.046	-0.046
Owner (d)				0.023	0.022
<b>Expected Constraints</b>					
Change E[credit possibility 2010]<0, 2009 (d)					0.013
Change E[credit possibility 2010]>0, 2009 (d)					-0.004
Change E[income 2010]>0, 2009 (d)					-0.020
Change E[income 2010]<0, 2009 (d)					-0.001
Taxreform => permanent income increase (d)					-0.011
Taxreform => permanent income decrease (d)					-0.037
N	5055	5055	5055	5055	5055

(d) for discrete change of dummy variable from 0 to 1.

\* p&lt;0.05, \*\* p&lt;0.01, \*\*\* p&lt;0.001

**Table 2. Spending, the interest rate and historical asset levels**

	All individuals			Never unemployed	
	Spending	Interest Rate	Spending	Interest Rate	Spending
	Share		Share		Share
	(1)	(2)	(3)	(4)	(5)
<b>Credit</b>					
Marginal interest rate	0.332 ***				
Marginal interest rate, predicted			2.048 **		3.162 **
Marginal interest rate, residual			0.311 ***		0.262 *
Liquid assets / disp income, 2008	-0.039 **	-0.046 ***	0.035	-0.044 ***	0.080
<b>Liquid assets 1998</b>					
Liquid assets / disp income, 1998		-0.024 ***		-0.020 ***	
(LiqAss/disp,1998)*(LiqAss/disp,2008)		0.014 ***		0.012 ***	
<b>Size effect</b>	Yes	Yes	Yes	Yes	Yes
<b>Expected constraints</b>	Yes	Yes	Yes	Yes	Yes
<b>Income controls</b>	Yes	Yes	Yes	Yes	Yes
<b>Demographic controls</b>	Yes	Yes	Yes	Yes	Yes
N	5055	5055	5055	2698	2698

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

**Table A1. Spending share regressed on covariates**

	OLS	Tobit	Probit	OLS	Tobit	Probit
<b>Credit</b>						
Marginal interest rate	0.518 ***	0.519 ***	0.573 ***	0.332 ***	0.342 ***	0.395 ***
Liquid assets / disp income, 2008				-0.039 **	-0.038 **	-0.039 **
<b>Size Effect</b>						
Ln(net SP)				-0.074 ***	-0.095 ***	-0.081 ***
<b>Income controls</b>						
Ln(income), register				-0.020	-0.019	-0.026
Ln(permanent income)				-0.019	-0.017	-0.012
sd[Ln(income)]				-0.023	-0.017	-0.028
Income developed better, 2009 (d)				0.024	0.026	0.027
Income developed worse, 2009 (d)				-0.007	-0.008	-0.010
<b>Demographic controls</b>						
Age				-0.002 **	-0.002 *	-0.002 *
Woman (d)				0.026	0.023	0.026
Single (d)				0.007	0.007	0.015
Number of children				0.021 **	0.023 **	0.020 **
Education, short (d)				-0.006	-0.005	-0.003
Education, medium (d)				-0.020	-0.021	-0.020
Education, long (d)				-0.046	-0.051	-0.049
Owner (d)				0.022	0.025	0.018
<b>Expected Constraints</b>						
Change E[credit possibility 2010]<0, 2009 (d)				0.013	0.015	0.012
Change E[credit possibility 2010]>0, 2009 (d)				-0.004	-0.008	0.002
Change E[income 2010]>0, 2009 (d)				-0.020	-0.021	-0.024
Change E[income 2010]<0, 2009 (d)				-0.001	-0.001	-0.001
Taxreform => permanent income increase (d)				-0.011	-0.011	-0.006
Taxreform => permanent income decrease (d)				-0.037	-0.037	-0.035
N	5055	5055	5055	5055	5055	5055

(d) for discrete change of dummy variable from 0 to 1.

\* p&lt;0.05, \*\* p&lt;0.01, \*\*\* p&lt;0.001

**Table A2. Spending share regressed on covariates (OLS)**

	(1)	(2)
<b>Credit</b>		
Marginal interest rate	0.332 ***	0.336 ***
Liquid assets / disp income, 2008	-0.039 **	-0.043 **
<b>Size effect</b>		
Ln(net SP)	-0.074 ***	-0.021
[Ln(net SP)]^2		-0.003
[Ln(net SP)]^3		0.000
[Ln(net SP)]^4		-0.000
<b>Income controls</b>		
Ln(income), register	-0.020	-0.037
Ln(income)^2, register		0.053
Ln(income)^3, register		-0.008
Ln(income)^4, register		0.000
Ln(permanent income)	-0.019	33.867
Ln(permanent income)^2		-4.171
Ln(permanent income)^3		0.228
Ln(permanent income)^4		-0.005
<b>Other income controls</b>	Yes	Yes
<b>Demographic controls</b>		
Age	-0.002 **	-0.078
Age^2		0.003
Age^3		-0.000
Age^4		0.000
<b>Other demographic controls</b>	Yes	Yes
<b>Expected constraints</b>	Yes	Yes
N	5055	5055

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

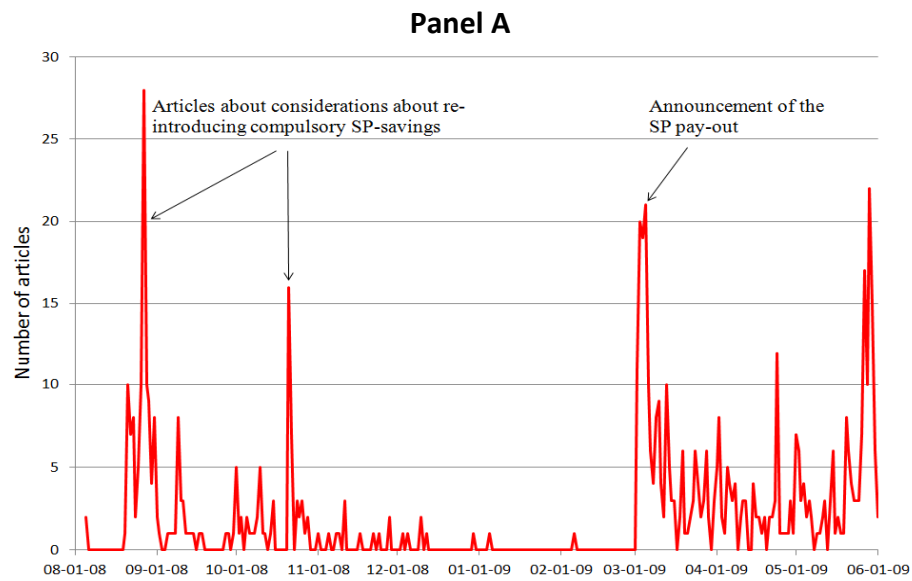
**Table A3. Spending, Debt reduction, saving, and pension saving regressed on covariates (OLS)**

	Spend	Debt	Save	Pension
<b>Credit</b>				
Marginal interest rate	0.332 ***	0.332 ***	-0.581 ***	-0.083 *
Liquid assets / disp income, 2008	-0.039 **	-0.042 ***	0.067 ***	0.014 *
<b>Size Effect</b>				
Ln(net SP)	-0.074 ***	0.034 ***	0.031 ***	0.008
<b>Income Controls</b>				
Ln(income), register	-0.020	-0.005	0.011	0.013 **
Ln(permanent income)	-0.019	0.018	-0.019	0.020
sd[ln(income)]	-0.023	0.029 *	-0.023	0.016 *
Income developed better, 2009 (d)	0.024	-0.011	0.010	-0.023 **
Income developed worse, 2009 (d)	-0.007	0.054 ***	-0.032 *	-0.015
<b>Demographic controls</b>				
Age	-0.002 **	-0.001	0.002 ***	0.001
Woman (d)	0.026	-0.008	-0.014	-0.003
Single (d)	0.007	0.037 **	-0.045 **	0.001
Number of children	0.021 **	0.001	-0.019 ***	-0.003
Education, short (d)	-0.006	-0.012	0.010	0.007
Education, medium (d)	-0.020	-0.007	0.001	0.026 **
Education, long (d)	-0.046	0.014	0.007	0.025 *
Owner (d)	0.022	-0.009	-0.014	0.001
<b>Expected Constraints</b>				
Change E[credit possibility 2010]<0, 2009 (d)	0.013	0.028 *	-0.046 **	0.005
Change E[credit possibility 2010]>0, 2009 (d)	-0.004	0.030	-0.021	-0.004
Change E[income 2010]>0, 2009 (d)	-0.020	0.022	-0.005	0.002
Change E[income 2010]<0, 2009 (d)	-0.001	-0.002	0.006	-0.003
Taxreform => permanent income increase (d)	-0.011	0.007	-0.004	0.008
Taxreform => permanent income decrease (d)	-0.037	0.009	0.018	0.010
N	5055	5055	5055	5055

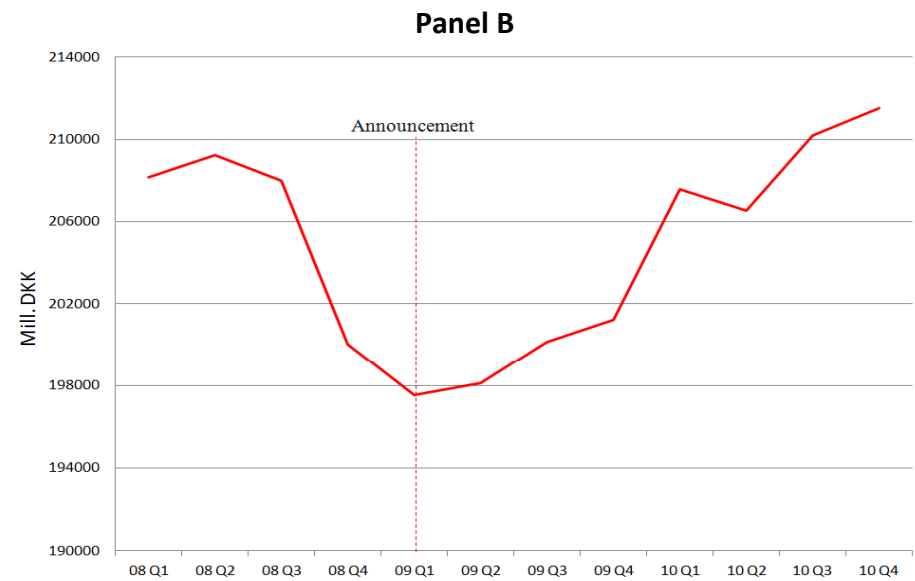
(d) for discrete change of dummy variable from 0 to 1.

\* p&lt;0.05, \*\* p&lt;0.01, \*\*\* p&lt;0.001

**Figure 1: Newspaper coverage of SP scheme (A) and aggregate household spending (B)**



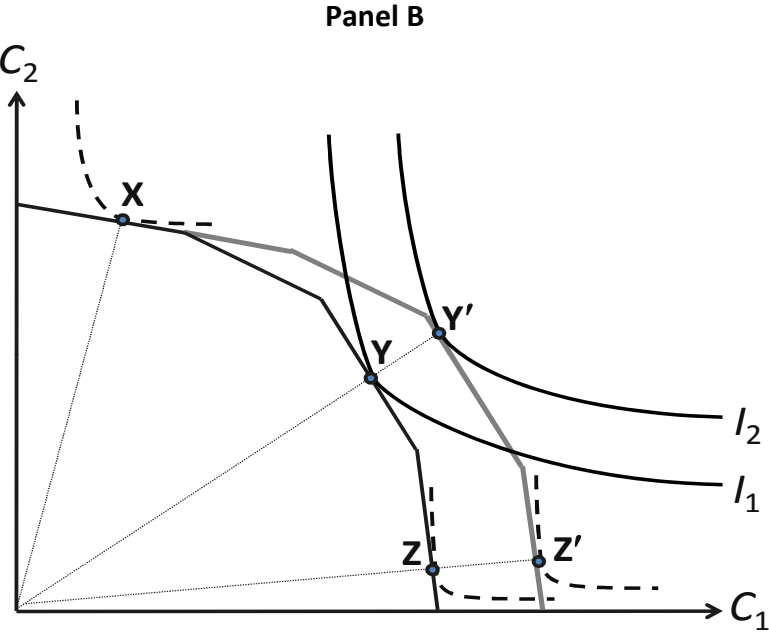
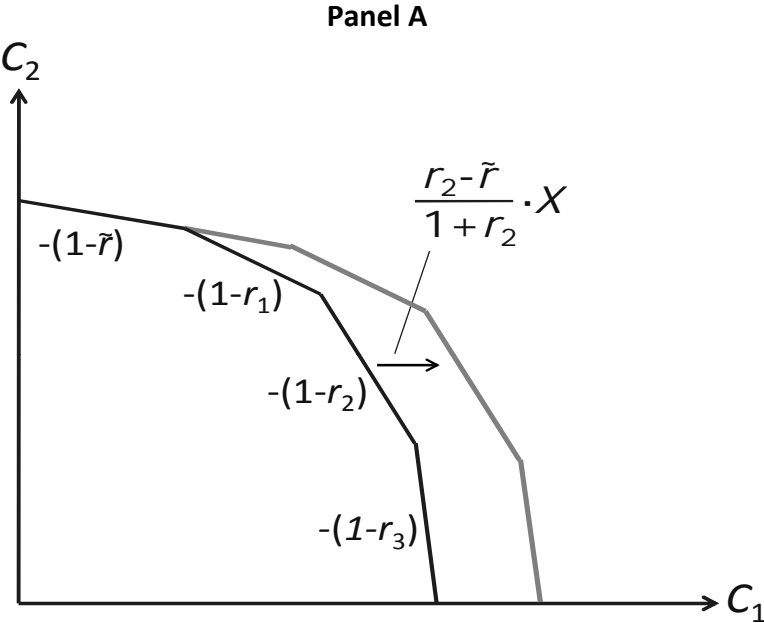
NOTE: Number of articles about SP-savings scheme in national newspapers.  
SOURCE: Infomedia.



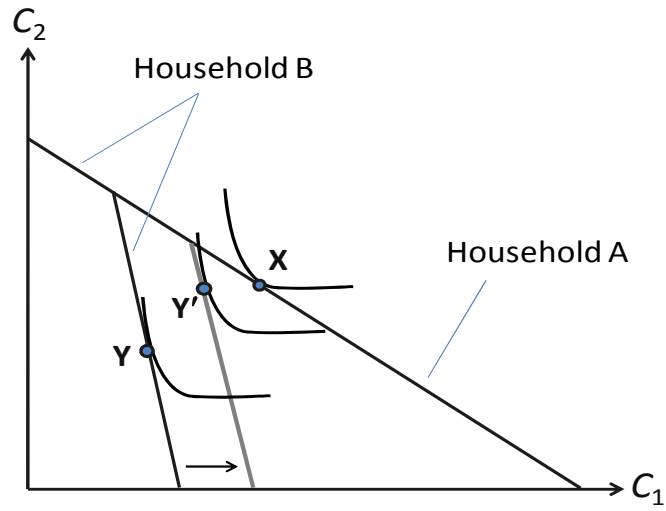
NOTE: Measured in current prices.  
SOURCE: National accounts.



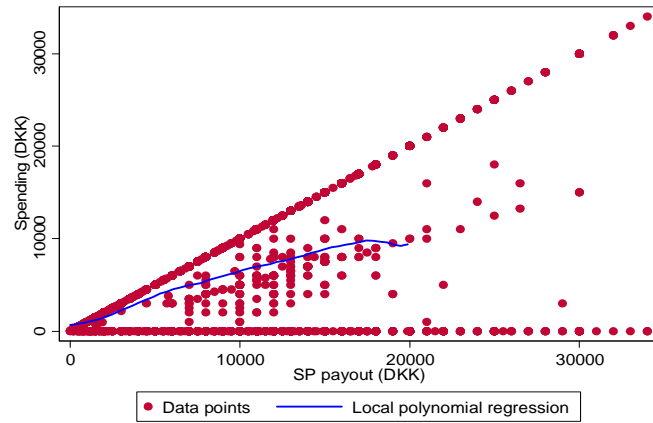
Figure 2: Stimulus policy and preference heterogeneity



**Figure 3: Stimulus policy and budget set variation**

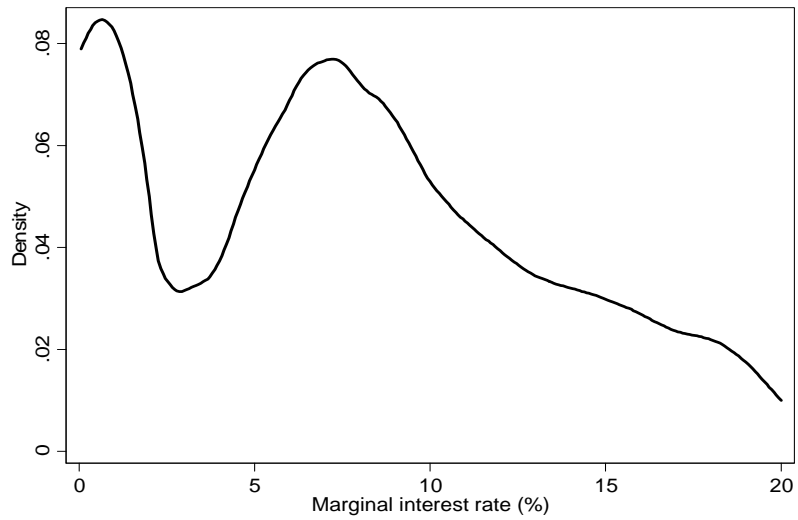


**Figure 4: Spending and the size of the SP payout**



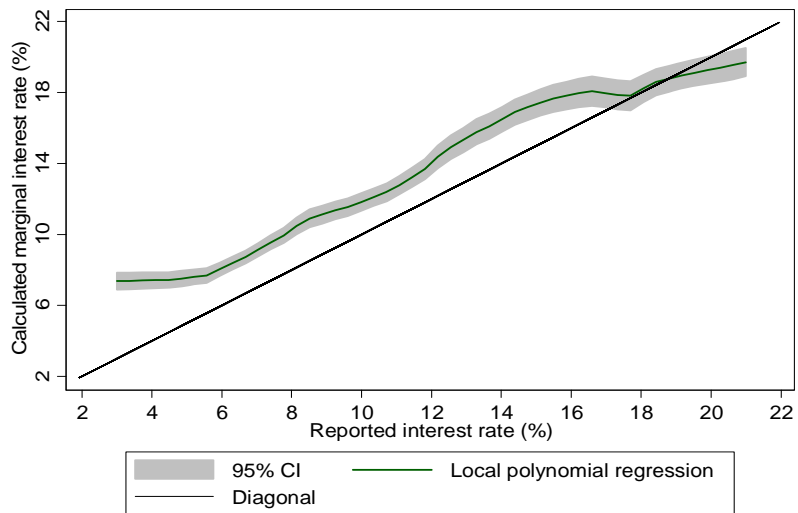
NOTE: 5055 observations.

**Figure 5: Distribution of marginal interest rates across households**



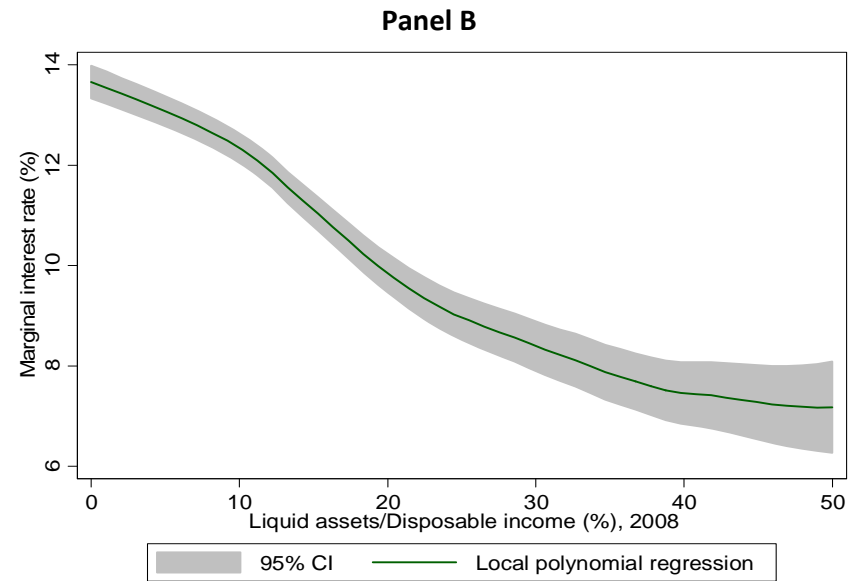
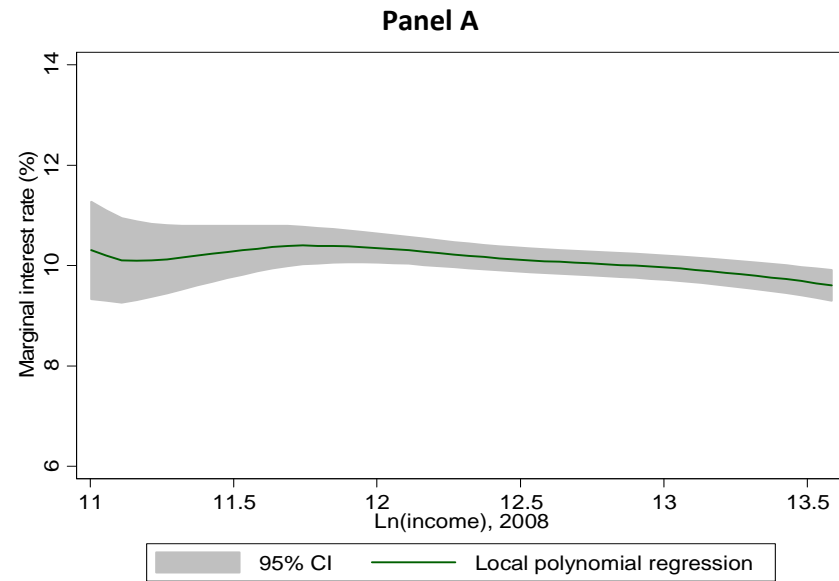
NOTE: 5055 observations.

**Figure 6: Calculated interest rate and the corresponding reported interest rate**



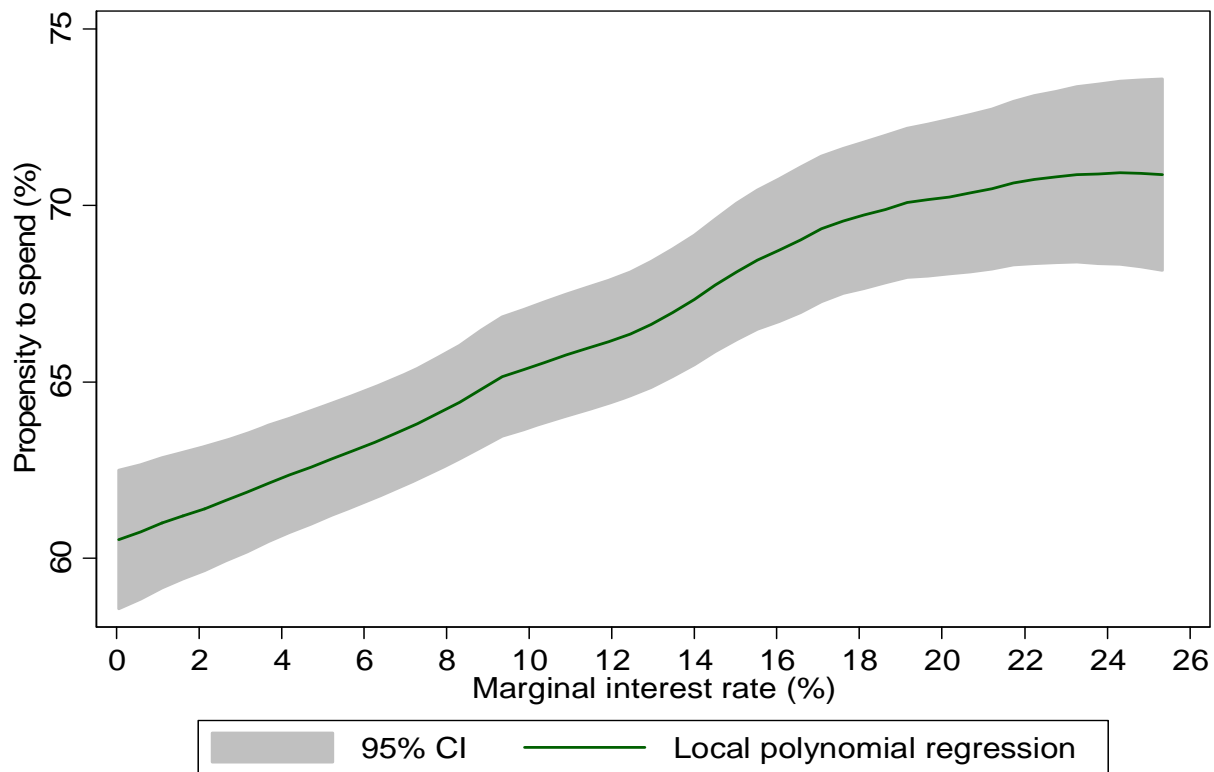
NOTE: 1435 observations.

**Figure 7: Marginal interest rate and ln(income) (A) and liquid assets (B)**



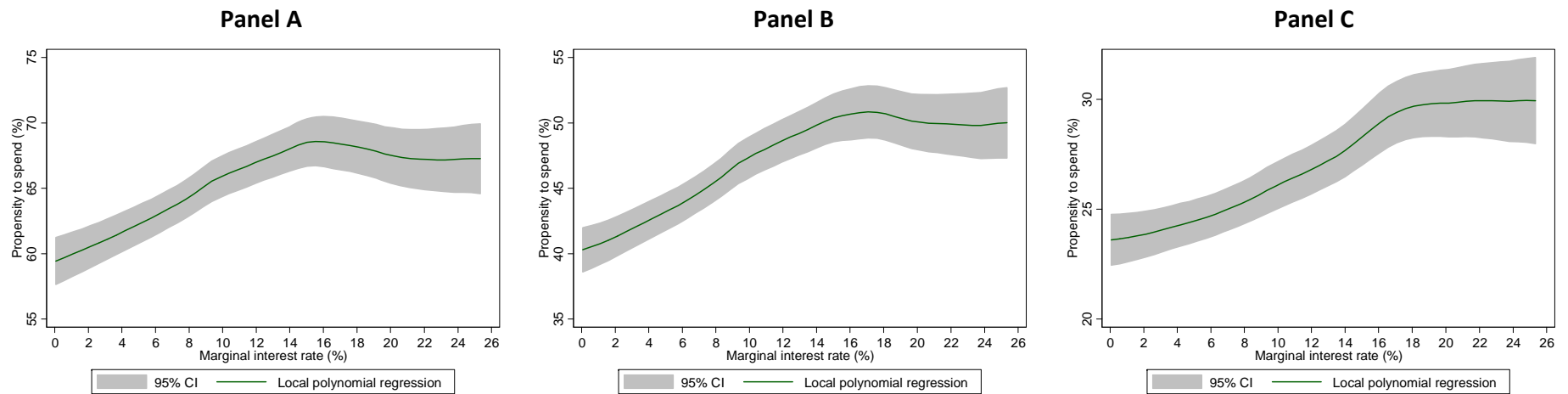
NOTE: 5055 observations.

**Figure 8: Household propensity to spend and marginal interest rate**



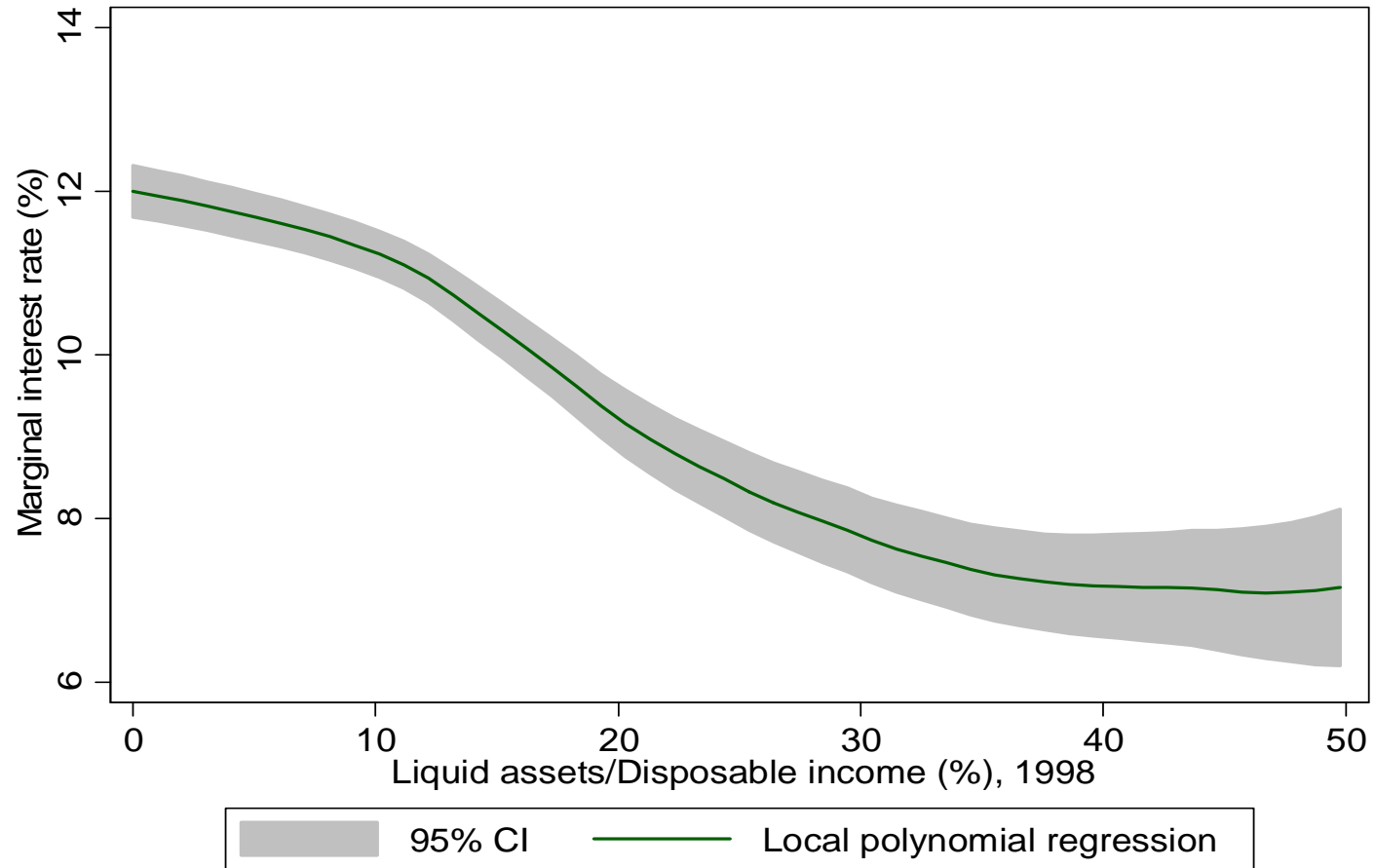
NOTE: 5055 observations.

**Figure 9: Household propensity to spend and marginal interest rate for hypothetical SP payouts equal to 1,000 DKK (A), 10,000 DKK (B), and 100,000 DKK (C)**



NOTE: 5920 observations.

**Figure 10: Marginal interest rate 2008 and liquid assets in 1998**



NOTE: 5055 observations.

Figure A1: The SP-letter

**atp=**

1. maj 2009

**Din Særlige Pensionsopsparing**

Nu kan du vælge at få udbetalt din Særlige Pensionsopsparing (SP). Baggrunden er den nye skattereform, som betyder, at du i 2009 – og uanset din alder – kan få pengene udbetalt. Du kan selvfølgelig også vælge at lade din SP være, hvor den er. Så skal du ikke gøre noget.

Den 1. maj 2009 er værdien af din konto: **16.610,07 kr. før afgift**

Vi kan først opgøre det endelige beløb, når udbetalingen sker. Det skyldes, at værdien af din opsparing kan ændre sig fra dag til dag – både positivt og negativt.

**Hvis du vælger at få din SP udbetalt i 2009:**

1. Skal du underskrive blanketten og sende den til os i vedlagte kuvert
2. Vi skal have modtaget blanketten senest den 31. december 2009
3. Vi sætter pengene ind på din NemKonto

Vær opmærksom på, at det kan tage op til 3 uger, fra vi får blanketten, til pengene er på din NemKonto. Du skal have en NemKonto, for at vi kan overtære pengene til dig.

Venlig hilsen  
ATP

ATP  
Kongens Vænge 8  
3400 Hillerød  
www.atp.dk/sp  
CVR-nr.: 43405810

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**Udbetaling af din Særlige Pensionsopsparing**

Skriv ikke beskeder på kortet - det læses maskinelt

Pengene bliver automatisk sat ind på din NemKonto.  
Har du ikke en NemKonto, kan du få din bank til at oprette en til dig.

Dato:	Underskrift:
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Når du har udfyldt blanketten, sender du den til ATP i vedlagte kuvert.