

# Precautionary motives in short-term cash management: Evidence from German POS transactions

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*This presentation represents the authors' personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank or its staff.*

# Outline

- 1 Introduction
- 2 Empirical strategy
- 3 Results
- 4 Robustness checks
- 5 Summary and conclusions

# 1 Introduction

Keynes (1936) distinguishes between three reasons for money holdings: transaction motive, **precautionary motive** and speculative motive

Precautionary reserves (**cash or demand deposits**) have the purpose to hedge against unforeseen expenses in **the distant future**.

**Research question:** Do individuals keep **short-term cash reserves** in their wallet in order to hedge against POS transactions that arrive before new cash can be withdrawn?

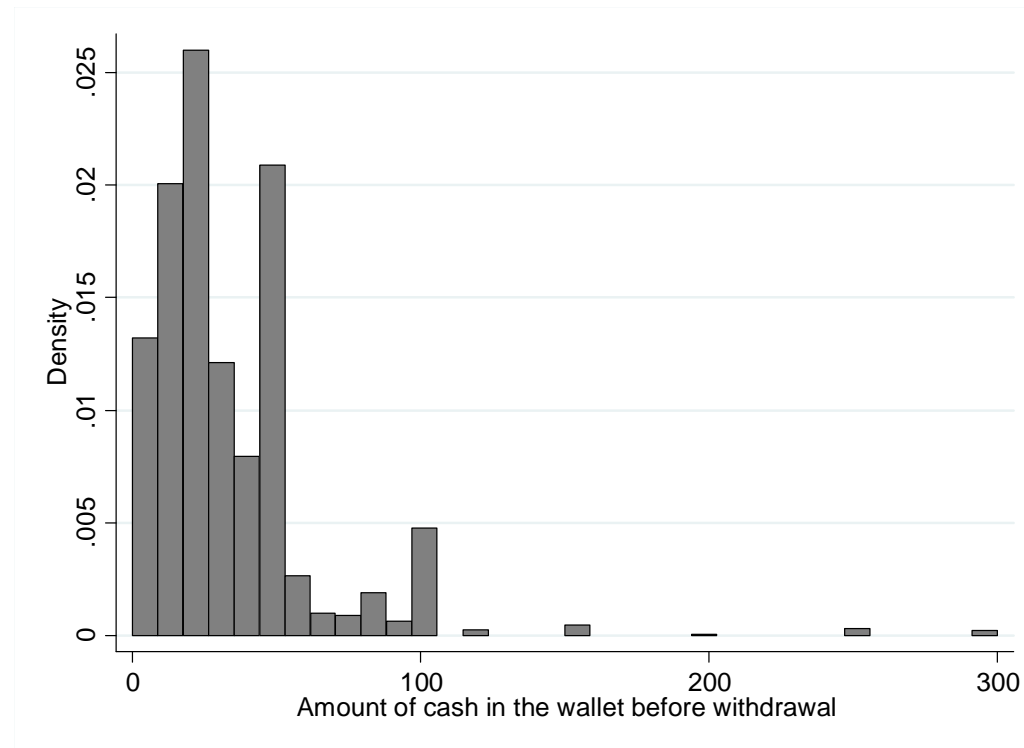
# 1 Introduction

## Why should individuals keep short-term precautionary cash reserves?

- Withdrawal **costs**
- **Uncertainty** with regard to future transactions
- Payment cards as alternative?
  - 2009 Payment Behaviour Study: cash is quick, anonymous and universally accepted
  - only 60% of transactions allowed free choice between cash and cards

# 1 Introduction

**Evidence of precautionary behaviour** with regard to short-term cash management: individuals **withdraw** cash **before cash balances** are down to **zero** (e.g. Alvarez and Lippi 2009)



Source: 2011 Payment Behaviour Study, Deutsche Bundesbank.

# 1 Introduction

## Contribution

- Do individuals **avoid cash payments** in order not to run out of cash?
  - = Do individuals consider the amount of cash left in the wallet when selecting a payment instrument at the POS?
- What are the main **reasons** for withholding cash?
  - A lack of suitable **withdrawal opportunities**?
  - Low share of **card acceptance**?
- The study further elucidates the **choice of payment instrument** at the POS by analysing **dynamic aspects**

## 2 Empirical strategy

### Data: 2011 Payment Behaviour Study

- **Representative sample** of the German speaking population aged 18 years or above living in **Germany**
- **Interviews** and one-week payment **diaries**  
(2,098 respondents; 20,130 transactions)
- **Germany** as an example of a **cash intensive** country

	AU	AT	CA	FR	DE	NL	US
<b>Payment share by volume</b>							
Cash	0.65	0.82	0.53	0.56	0.82	0.52	0.46
Debit	0.22	0.14	0.25	0.31	0.13	0.41	0.26
Credit	0.09	0.02	0.19	0.01	0.02	0.01	0.19
<b>Payment share by value</b>							
Cash	0.32	0.65	0.23	0.15	0.53	0.34	0.23
Debit	0.32	0.25	0.30	0.43	0.28	0.60	0.27
Credit	0.18	0.05	0.41	0.03	0.07	0.04	0.28

Source: Bagnall et al, 2014

## 2 Empirical strategy

### Sample restrictions:

- Individuals that **own a payment card**
  - Transactions that allow for a free **choice between cash and card** payment
  - Individuals with **accurate information on cash flows** (+/- 0.50 €)
  - 636 respondents, 2,801 transactions
- => Robustness checks



## 2 Empirical strategy

**H1: Consumers refrain from parting with the entire amount of cash in a payment situation and keep a precautionary cash reserve.**

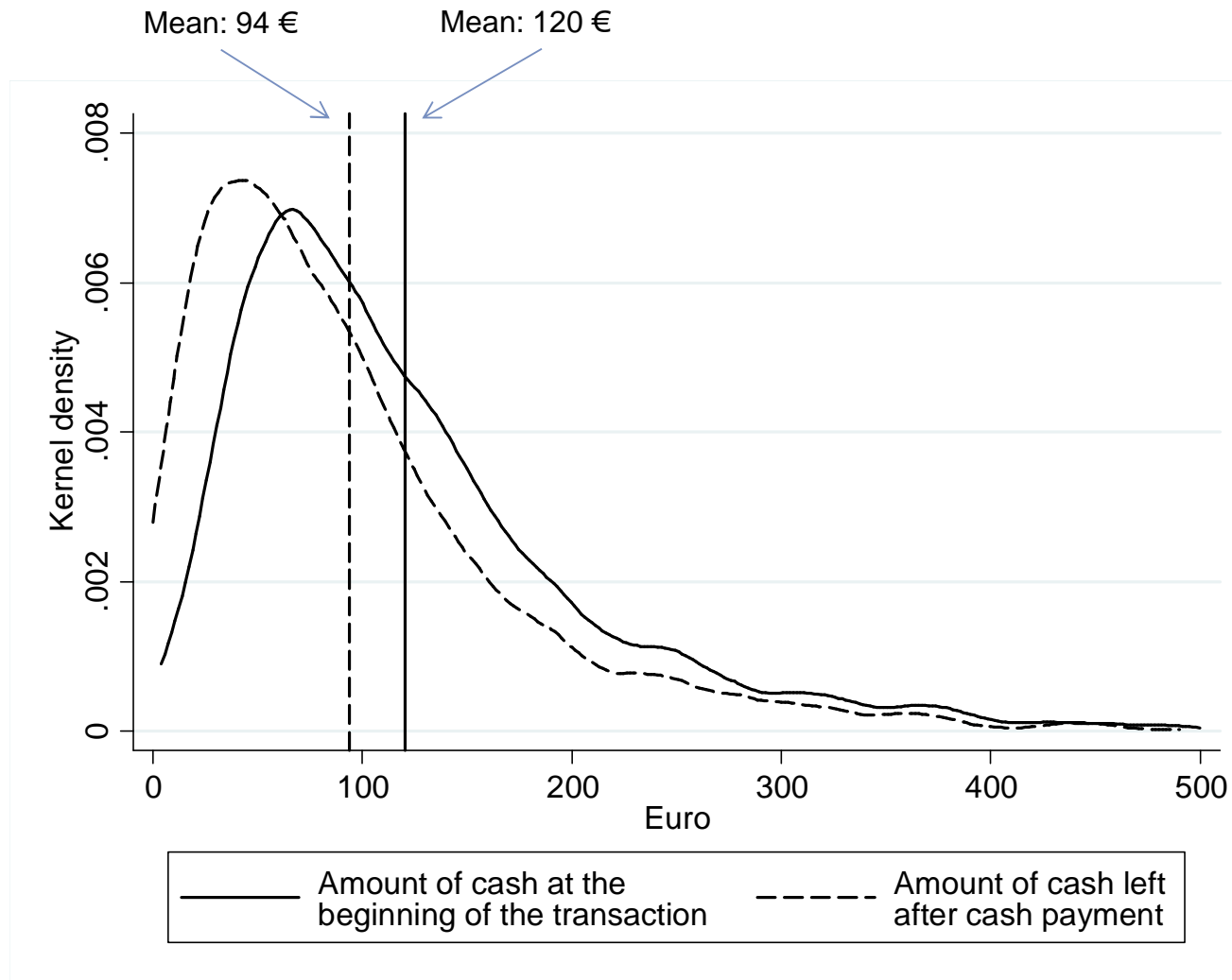
-> positive relationship between „**cash reserve**“ and the probability to pay cash

**Probit** model on the level of transaction with „**cash payment**“ (0/1) as dependent variable (mean=0.81)

Main explanatory variable „**cash reserve**“ = cash at the beginning of the diary – previous cash payments + previous cash withdrawals – size of the ongoing transactions

## 2

# Empirical strategy



Source: 2011 Payment Behaviour Study, Deutsche Bundesbank.

## 2 Empirical strategy

### Control variables:

- Transaction specific: transaction size, location, day of the week, month
- Individual specific: age, education, income, sex, marital status, number of household members, community size, citizenship (German/other), West/East German household, credit card possession

## 2 Empirical strategy

**H2: Consumers are guided by a fixed minimum threshold of cash reserves.**

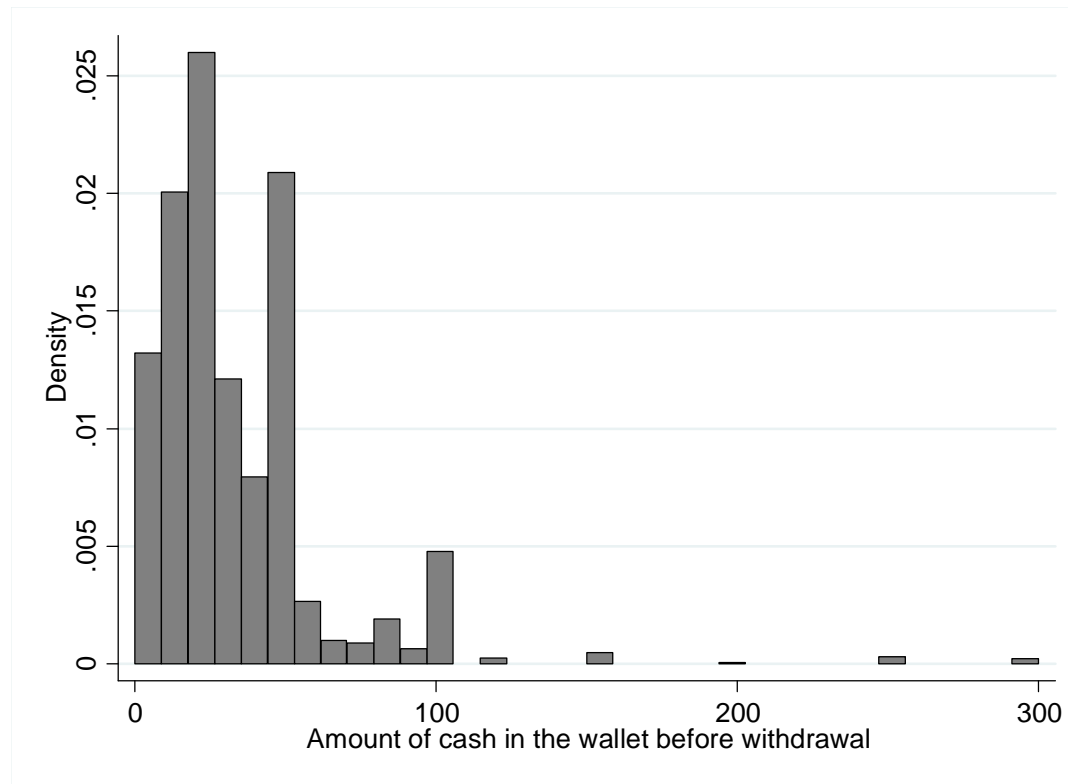
-> positive relationship between „cash reserve“ and „cash payment“ is **stronger** if cash reserve drops **below withdrawal threshold** (20% of transactions)

**Specification:**

Probit model + indicator variable which is one if cash payment leaves the individual with less than her threshold + interaction term between this variable and the remaining cash reserve

## 2

# Empirical strategy



Source: 2011 Payment Behaviour Study, Deutsche Bundesbank.

## 2 Empirical strategy

### H3: Withdrawal opportunities?

-> positive relationship between „cash reserve“ and „cash payment“ is **weaker** if transaction is **followed by a withdrawal** (10% of transactions)

#### Specification:

Probit model + indicator variable which is one if the transaction is followed by a withdrawal + interaction term between this variable and the remaining cash reserve

## 2 Empirical strategy

### H4: Card acceptance?

-> positive relationship between „cash reserve“ and „cash payment“ is **increasing** in the **share of transactions the consumer was required to pay in cash**

### Specification:

Probit model + share of transactions requiring cash payment + interaction term between this variable and the remaining cash reserve

### 3 Results hypothesis 1

**Results of a probit model on the level of transaction with „cash payment“ (0/1) as dependent variable:**

Average marginal effect of  $\ln(\text{cash reserve})$ : 0.0618\*\*\*  
(0.00814)

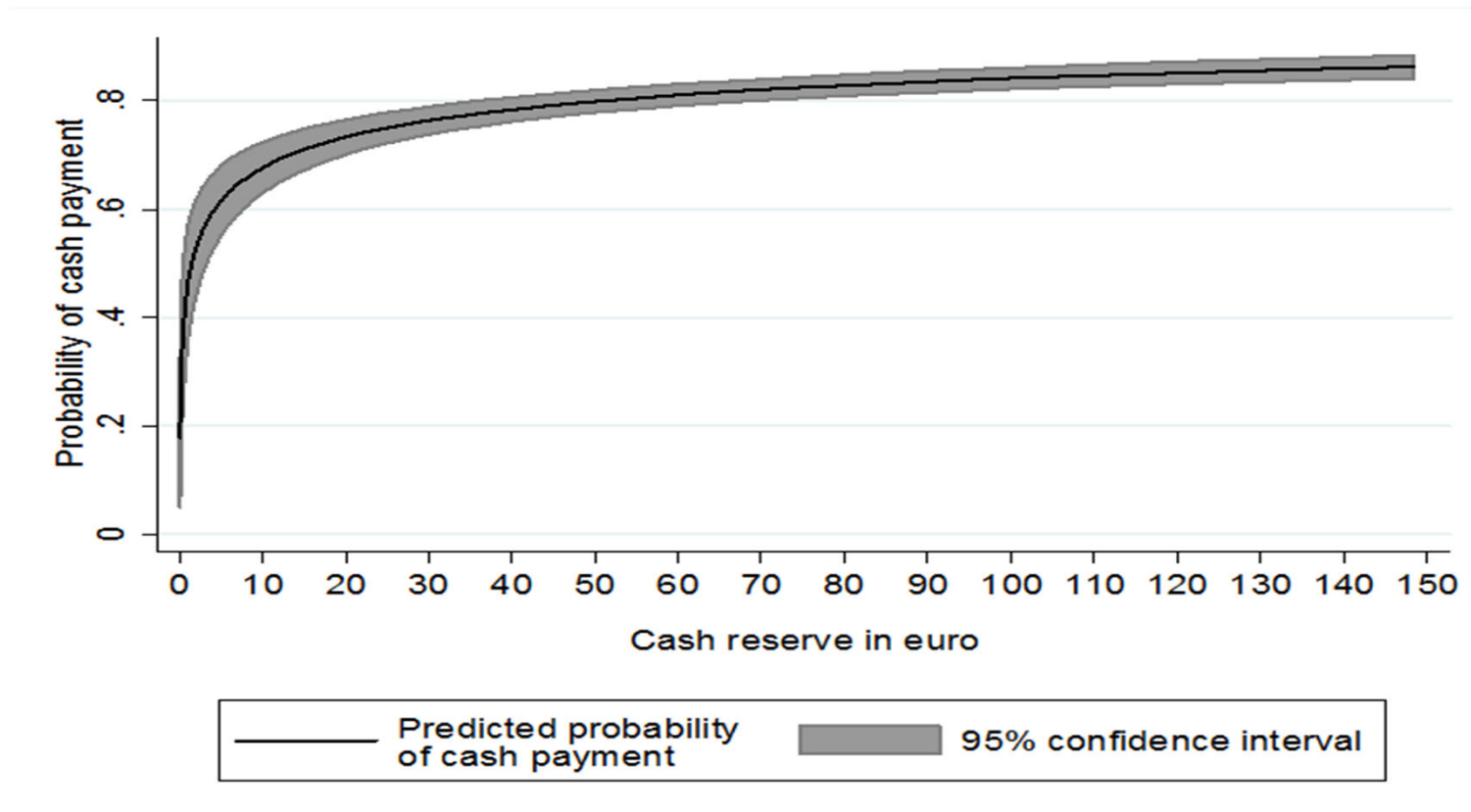
Average cash reserve elasticity: 0.102\*\*\*  
(0.0151)

A 10% fall in the remaining cash reserve is correlated with a 1% (0.6 percentage points) fall in the probability to pay in cash.



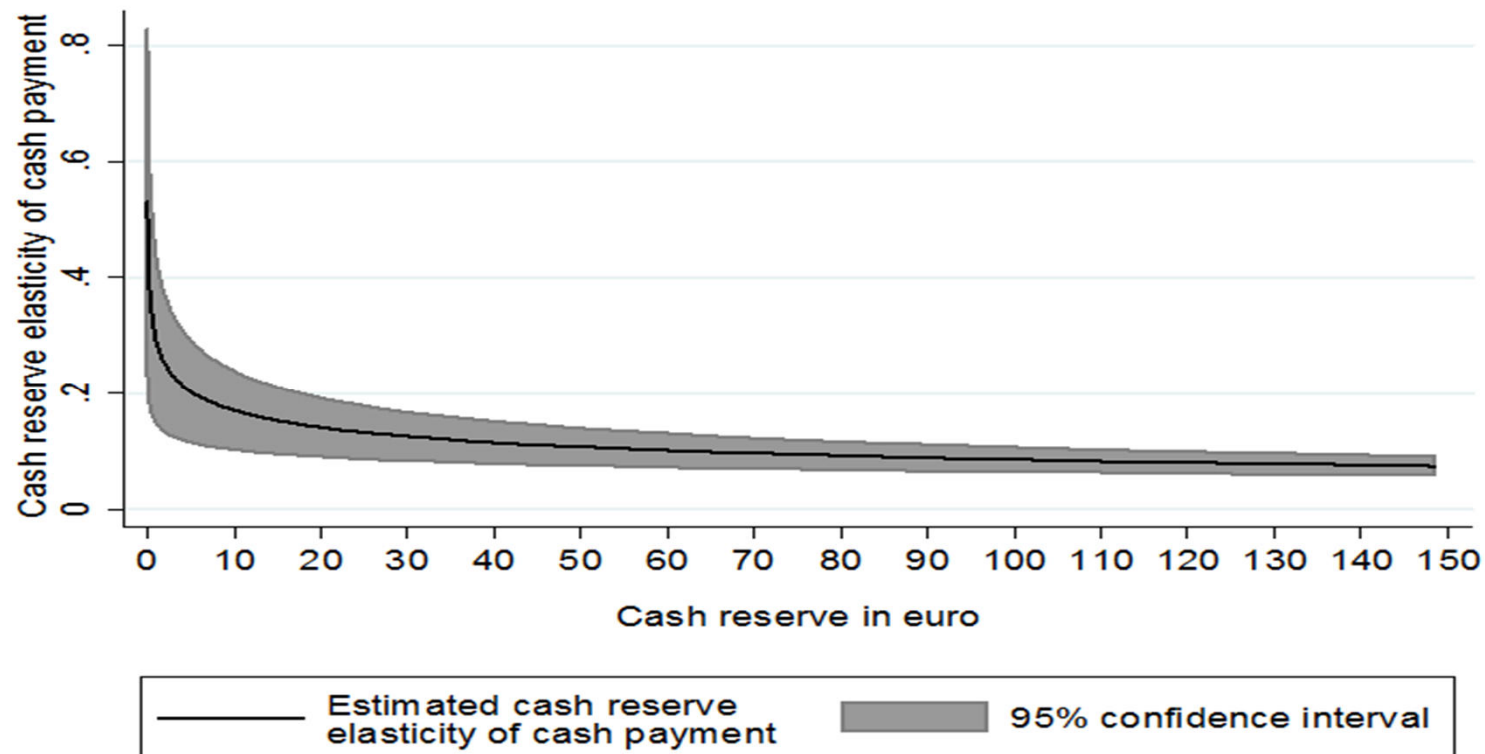
### 3 Results hypothesis 1

If the remaining cash reserve falls to €10 the cash payment probability drops from 81% to 67%. With only €1 left, it falls below 50%.



### 3 Results hypothesis 1

The cash reserve elasticity increases as the amount of cash in the wallet tends towards zero, i.e. the **precautionary behaviour** clearly **intensifies** as the amount of **cash in wallet approaches zero**.



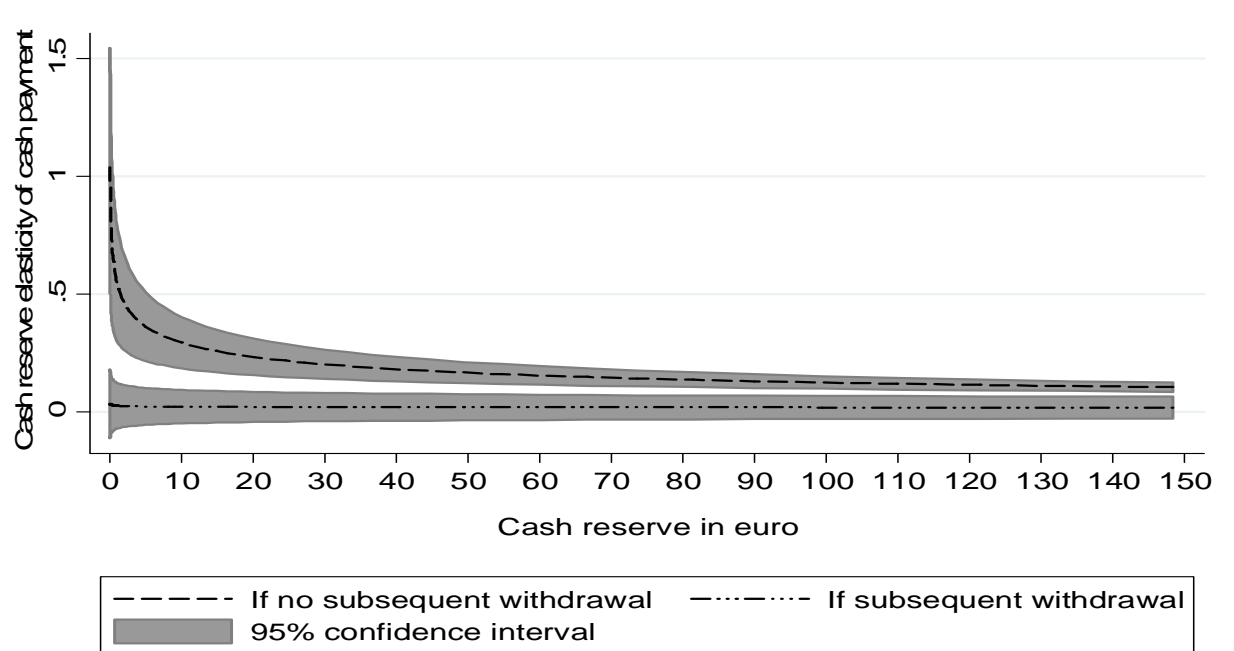
### 3 Results hypotheses 2, 3 and 4

#### Results of different probit models with „cash payment“ (0/1) as dependent variable and interaction terms:

Variable	Average marginal effect	Standard error
<u>Hypothesis 2: rejected</u>		
Cash reserve (log)	0.0656***	(0.012)
Cash reserve below threshold	0.0259	(0.024)
Cash reserve (log) × cash reserve below threshold	0.00140	(0.019)
<u>Hypothesis 3: supported</u>		
Cash reserve (log)	0.0772***	(0.009)
Cash withdrawal afterwards	0.0697***	(0.026)
Cash reserve (log) × cash withdrawal afterwards	-0.0730***	(0.028)
<u>Hypothesis 4: supported</u>		
Cash reserve (log)	0.0625***	(0.008)
Share of transactions requiring cash payment	-0.0816*	(0.043)
Cash reserve (log) × share of transactions requiring cash payment	0.0777*	(0.043)
Number of transactions:	2,801	
Number of individuals:	636	

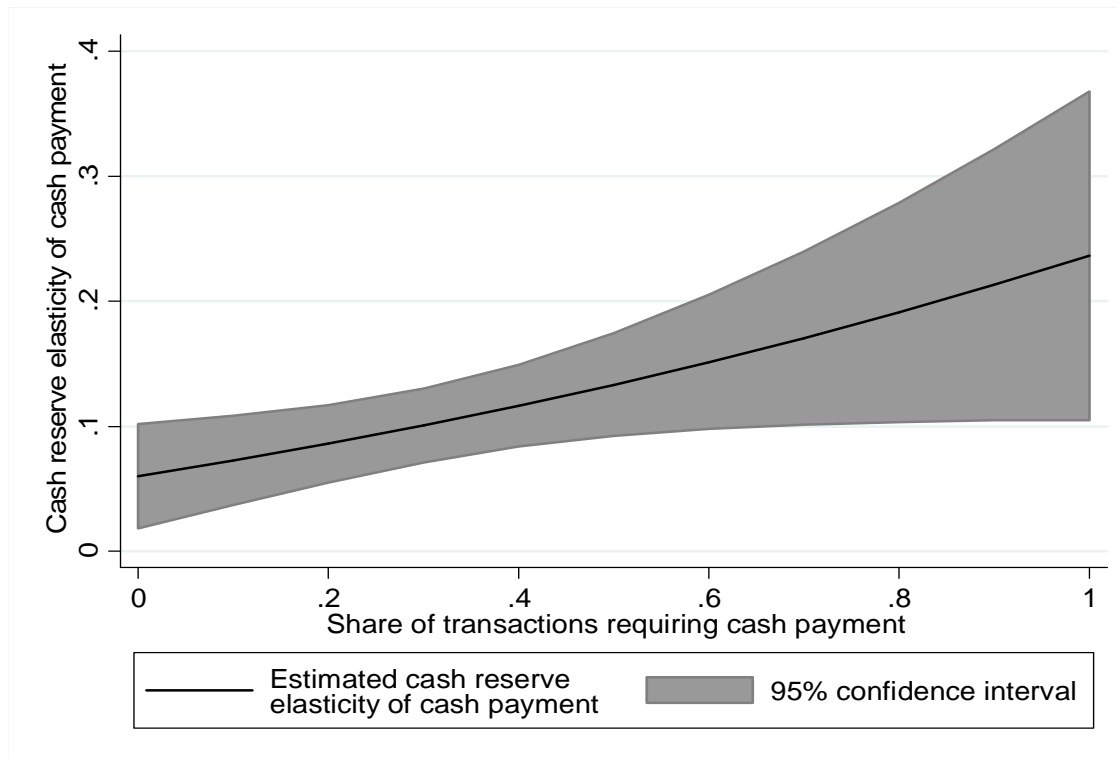
### 3 Results hypothesis 3

The **precautionary behaviour completely disappears** when the individual can **withdraw money directly after** making a transaction.



### 3 Results hypothesis 4

Cash reserve elasticity increases in share of transactions requiring cash payments.



## 4 Robustness Checks

### Sample selection?

– Biased results if individuals with accurate information and individuals with inaccurate information on cash flows differ in payment behaviour

– **Initial** result allowing for **measurement error € 0.50**  
(34% of the sample)

Average cash reserve elasticity: **0.102\*\*\*** (0.016)

– Model allowing for **larger measurement error in cash reserve (€ 10)**  
(62% of the sample left)

Average cash reserve elasticity: **0.090\*\*\*** (0.011)

– Model using the **first transaction of every respondent**

Average cash reserve elasticity: **0.081\*\*\*** (0.017)

## 4 Robustness Checks

### Endogeneity of „cash reserve“?

– If individual wants to use cash she must have a sufficient amount of cash

=> positive relationship between the amount of cash in wallet and frequency of cash payments can appear even though amount of cash in the wallet has no influence on payment behaviour.

– Investigate two sources of endogeneity:

- (i) individual specific heterogeneity: individual with high preference for cash payment has higher probability of paying in cash and carries more cash on her *in general*.
- (ii) individual who plans to use cash in a particular payment situations carry more cash on her *for this particular transaction* (reverse causality).

## 4 Robustness Checks

### Endogeneity of „cash reserve“?

– **Individual specific heterogeneity**: comparing the results of a linear probability model with individual random effects vs. individual fixed effects

– A consistent estimation of the random effects model requires the covariates to be uncorrelated with individual specific unobservables. The fixed effects model can produce consistent estimates even though this condition is violated.

=> A significant difference between the estimates of the two models suggests that individual specific unobservables are correlated with the covariates which might also lead to a bias in our probit results.

– Average cash reserve elasticity **linear RE**: **0.0994\*\*\*** (0.009)

– Average cash reserve elasticity **linear FE**: **0.1120\*\*\*** (0.012)



## 4 Robustness Checks

### Endogeneity of „cash reserve“?

- **Reverse causality**: Is the cash reserve elasticity **higher** for transactions which are directly **preceded by a cash withdrawal**?
- If individual withdraws money directly before making a particular transaction, chances will be high that she is planning on paying for this transaction in cash.  
  
=> In case of reverse causality, the cash reserve elasticity should be higher for transactions which are directly preceded by a cash withdrawal.
- Average cash reserve elasticity for transactions **preceded** by a withdrawal:  
**0.0338** (0.0287)
- Average cash reserve elasticity for transactions **not preceded** by a withdrawal:  
**0.114\*\*\*** (0.0169)

## 5 Summary ...

The probability of a transaction being made **using cash significantly declines as the amount of cash in the wallet declines.**

-> **Consumers** refrain from parting with the entire amount of cash in the wallet and **keep a precautionary cash reserve.**

The **precautionary behaviour completely disappears** when the consumer can **withdraw money right after the transaction.**

## 5 ... and conclusions

The **results underline the special role of cash** as a flexible and reliable payment instrument.

For consumers it would be desirable to further simplify the access to cash by reducing withdrawal fees or increasing ATM density.



**Thank you for your attention!**