



Intertemporal Consumption and Credit Constraints: Does Total Expenditure Respond to an Exogenous Shock to Credit?

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01 | 引言及背景



引言

主要内容:

基于1992年丹麦信贷市场改革—允许将自有房产作为信贷抵押—增加信贷供给，研究该政策（放松抵押信贷约束）对家庭总消费和负债的影响。

按照政策前1991年有房家庭的流动性资产水平的高低分为两组，运用matching方法匹配，低流动性资产意味着信贷约束紧，政策实施后将房产进行抵押继而增加消费和负债的可能性更高。

运用DID模型回归，发现低流动资产组的消费和负债会受到信贷政策宽松的刺激，且房产抵押净值越高、年龄越小，受影响程度越强。但整体上，信贷政策改革的总影响较小。

引言

相关研究现状：

信贷约束缺乏直接的衡量工具，容易将信贷供给和需求混在一起 (Browning and Lusardi, 1996)。

Gross and Souleles (2002) 从信贷供给端，研究信用卡的信用额度变化影响，发现信用额度的增大会使得人们消费更多。

Hurst and Stafford (2004) 发现低流动性资产的家庭在经历失业时，更有可能进行房产抵押和再融资。Yamashita (2007) 发现低资产收入比的家庭受房价上升的影响相对更强烈。但这两个研究无法将家庭偏好异质性（需求端）影响与信贷约束（供给端）影响分开，使因果关系不够清晰。比如更加缺乏耐心、偏好风险的家庭可能因为预期到未来借助房产抵押借贷消费，从而导致其现在的流动性资产持有量低。

背景

信贷政策改革：

丹麦信贷政策改革发生于1992年，其推出并未被人们预期到，避免了家庭偏好的影响，可以只考察抵押信贷约束改变对家庭消费和负债的影响。

这次改革主要改变了房屋抵押贷款规定的以下三个方面：

- (1) 有房家庭可以将自有房产进行抵押贷款用于非住房消费。
- (2) 贷款的最长期限由20年延长到30年。
- (3) 抵押贷款可以进行再融资。

抵押贷款条件的改变为信贷约束紧的家庭提供了更多的流动性支持，从而刺激其消费和负债的增长。

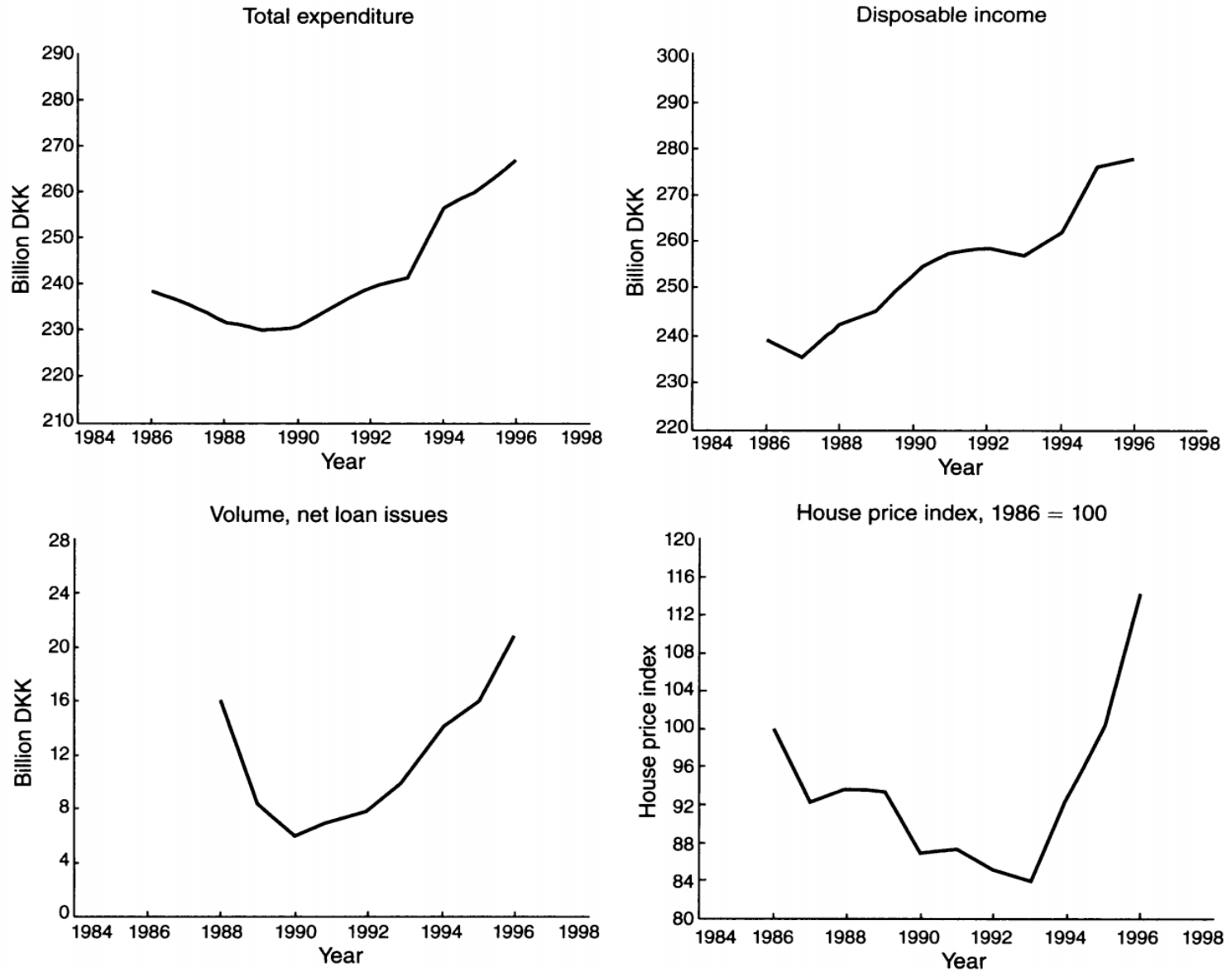


FIGURE 1. PRIVATE SECTOR TOTAL EXPENDITURE, NET DISPOSABLE INCOME FROM THE NATIONAL ACCOUNTS, NET MORTGAGE LOAN ISSUES, AND THE INDEX FOR HOUSE PRICES



03 | 数据

03

数据

The data used in this study are merged **Danish public administrative registers** giving annual longitudinal information on **wealth, income, household composition, and characteristics of the dwelling** for a ten percent random sample of the population over the period **1987 to 1996**. The income and wealth information exists because Denmark had a **wealth tax** during this period.

Assets are divided into six different categories up to 1992: housing assets, shares, deposited mortgage deeds, cash holdings, bonds, and other assets. (housing assets are defined as the cash value of property as set by the tax authorities.)

Liabilities are available under four different categories up to 1992: mortgage debt, bank debt, secured debt, and other debt.

Imputed total expenditure:

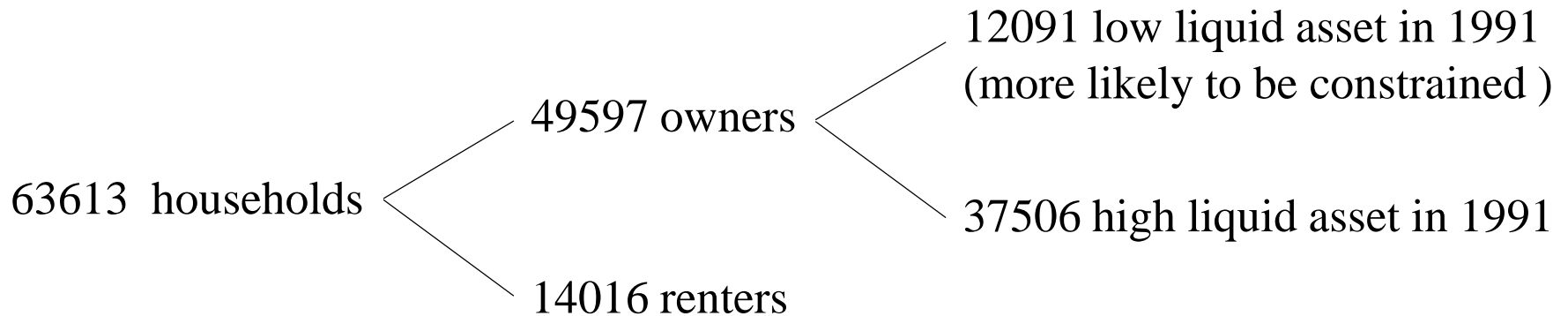
$$c_t = y_t - \Delta W_t$$

Let c_t be total expenditure, y_t be disposable income, and W_t be total wealth at the end of period t , where ΔW_t defines saving. The change in wealth can come from two sources: one is adjustment of asset portfolio, another is the capital gains due to the price changes. (Robustness check)

Sample selection criteria:

- (1) Drop: living with parents, living in a communal or common household, identification unclear (house renters or owners), obviously defective observations.
- (2) Keep: aged 25-65 in 1991, observed in all years over the period 1987-1996.

Balanced Panel :



Liquid assets are defined as the **value of non-housing assets**.(Zeldes (1989); Runkle (1991); Ziliak (1998); and Johnson, Parker, and Souleles (2006))

Low liquid asset group is restricted to having liquid assets worth **less than** one month of disposable income. (Robustness check)

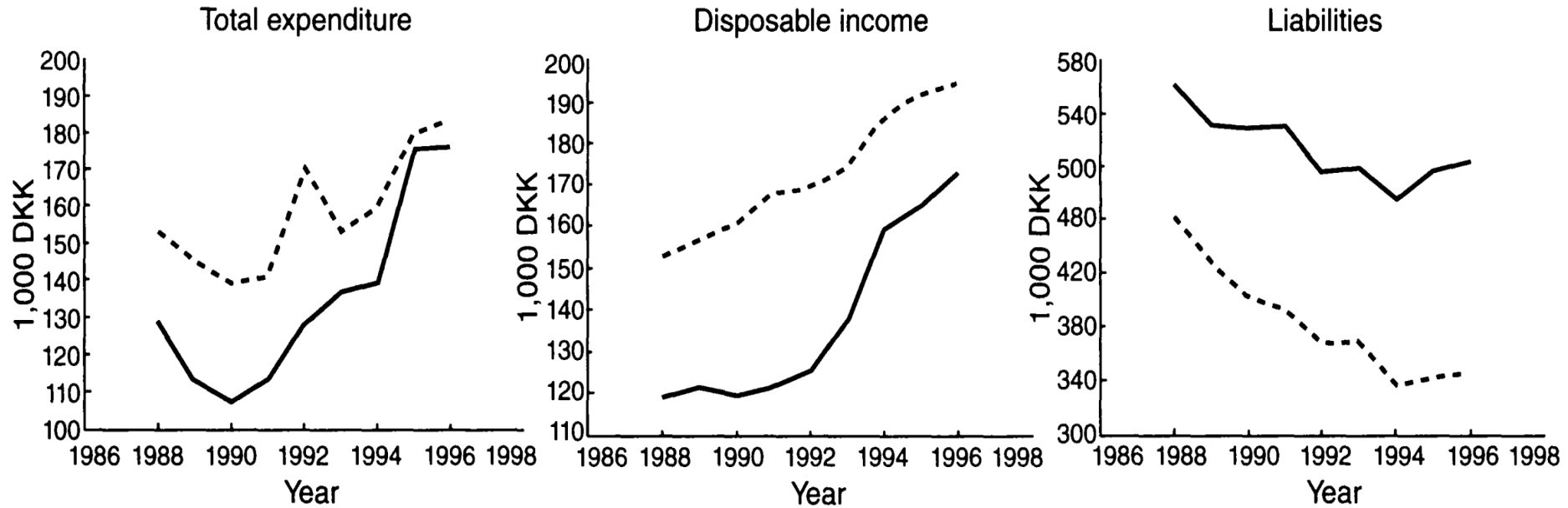


FIGURE 2. AVERAGE IMPUTED TOTAL EXPENDITURE, DISPOSABLE INCOME, AND TOTAL DEBT FOR HOUSEHOLDS HOLDING HIGH (*broken line*) AND LOW LEVELS OF LIQUID ASSETS IN 1991



04 | **模型**

04

模型

DID model

$$Q_{iA} - Q_{iB} = \beta_0 + \beta_1 X_{iB} + \beta_2 D_i + \varepsilon_{iA}$$

(**A** implies **after** the reform, **B** implies **before** the reform.)

Q_i is either total imputed **expenditure or liabilities** for household i .

X_i is a vector of **control variables** introduced to absorb preference heterogeneity.

D_i is an indicator variable.

$D_i=1$ if household i holds **low** liquid assets in 1991;

$D_i=0$ if holding **high** liquid assets in 1991.

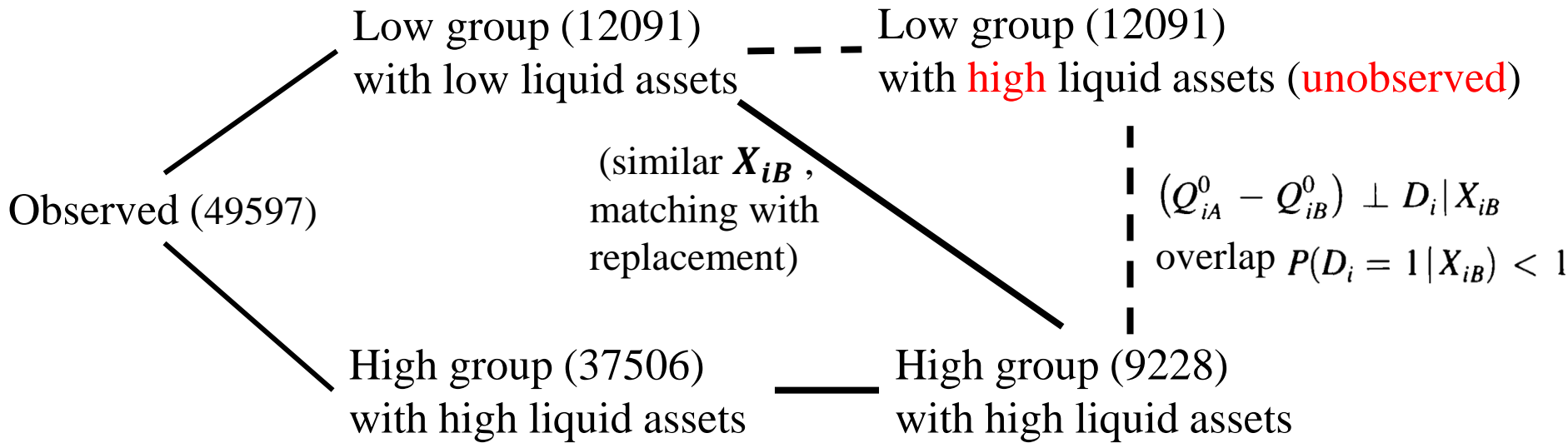
Low group	$D_i=1$	$\beta_0 + \beta_2$	β_2 measures the additional effect of the reform for the low group.
High group	$D_i=0$	β_0	β_0 measures the average effect of the reform under the null hypothesis of no credit constraints.

$$\beta_2 = (\beta_0 + \beta_2) - \beta_0 = effect_{Low} - effect_{High}$$

Matching

$$E[(Q_{iA}^1 - Q_{iB}^1) - (Q_{iA}^0 - Q_{iB}^0) | D_i = 1, X_{iB}]$$

$$= E[(Q_{iA}^1 - Q_{iB}^1) | D_i = 1, X_{iB}] - E[(Q_{iA}^0 - Q_{iB}^0) | D_i = 1, X_{iB}]$$



$$(Q_{iA}^0 - Q_{iB}^0) \perp D_i | X_{iB}$$

$$E[(Q_{iA}^0 - Q_{iB}^0) | D_i = 1, X_{iB}] = E[(Q_{iA}^0 - Q_{iB}^0) | D_i = 0, X_{iB}]$$

Matching方法:

1、covariate matching

首先定义一个metric来衡量两个个体 X_i 的近似程度，比如可以以欧氏距离或者马氏距离定义 X_i 的近似程度，然后选择一个threshold value，如果欧式距离小于这个threshold value，这两个个体就可以进行匹配，否则就不能进行匹配。

2、propensity score matching (本文)

只需要比较propensity score的近似程度即可，但PSM实际上是个两步法，首先需要用 X_i 做自变量，用 D_i 做因变量，用logit或probit估计出propensity score $P(D=1|X)$ ，然后再对计算出的score进行匹配：如果两个个体的scores 落在一个事先选定的threshold value以内，两个个体就可以进行匹配，否则不能匹配。

模型

Choice of Covariates (X_i)

- 1、选择改革前1991年的数据 X_{iB} ，还未受政策改革影响。
- 2、基于生命周期理论，选择能反映家庭所处生命阶段和关键特征变量。
例如：family composition, permanent income, discount rates, attitude to risk, house value, size of the house等。(不可观测的变量例如：Permanent income is approximated by the value of the house, level of education, labor supply, and by gross income measured in 1991. The discount rate will be approximated by age and education.)



05 | 实证分析



倾向得分估计

TABLE 1—PROBIT ESTIMATES FOR HOUSE OWNERS

Variable	Param.	SE
Housing equity/house value	-0.0561*	0.0226
(Housing equity/house value) ²	-0.3038*	0.0304
ln (house value)	-3.0835*	0.6274
ln (house value) ²	0.1052*	0.0243
ln (gross income)	-2.0078*	0.3865
ln (gross income) ²	0.0767*	0.0150
Age	0.0321*	0.0073
Age ²	-0.0005*	0.0001
Single	-0.1183*	0.0326
UI membership	-0.0097	0.0326
Size of house	0.0002	0.0002
(Size of house) ²	0.0000	0.0000
Labor supply, male	0.1190*	0.0297
Labor supply, female	0.0673*	0.0226
Self-employed, male	0.3310*	0.0337
Self-employed, female	0.2074*	0.0331
Education, short	-0.0463*	0.0156
Education, medium	-0.0723*	0.0204
Education, long	-0.1701*	0.0307
1 child	0.1632*	0.0189
2 children	0.2471*	0.0195
3 children	0.3904*	0.0280
4 children	0.5134*	0.0600
Constant	34.1068*	4.2918

Notes: The dependent variable takes the value 1 if the household holds low levels of liquid assets in 1991. All monetary values are measured in DKK, 1990 price levels.

*Significant at the 5 percent level.

倾向得分匹配

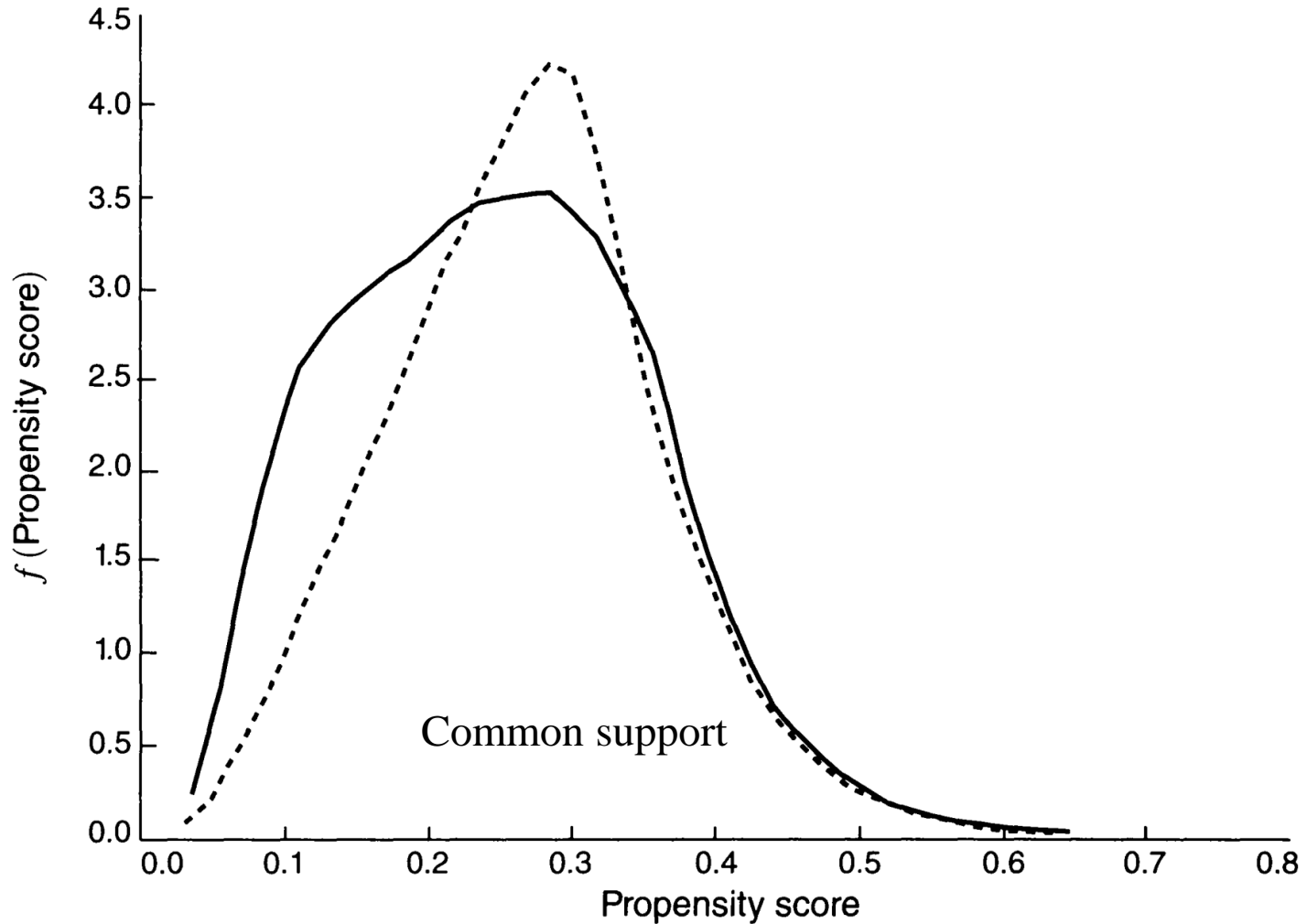


FIGURE 3. KERNEL DENSITIES OF PROPENSITY SCORES FOR LOW AND UNMATCHED HIGH (broken line) LIQUID ASSET HOUSE OWNERS

Note: Bandwidth set to $1.06\sigma n^{-(1/5)}$.

倾向得分匹配

TABLE A1—BALANCE OF INDIVIDUAL CHARACTERISTICS (*two-sample t-test*)

Variable	$E(X_{Low})$	$E(X_{High})$	t
Housing equity/house value	0.3222	0.3293	-0.0807
ln(house value)	12.9395	12.9355	0.0465
ln(gross income)	12.8712	12.8686	0.0301
Age	44.6993	44.8309	-0.3361
Single	0.0602	0.0624	-0.0326
UI membership	0.8726	0.8687	0.0508
Size of house	138.1897	138.4460	-0.2968
Labor supply, male	0.7858	0.7805	0.0611
Labor supply, female	0.7994	0.7966	0.0319
Self-employed, male	0.1516	0.1556	-0.0490
Self-employed, female	0.0777	0.0818	-0.0589
Education, short	0.4900	0.4897	0.0026
Education, medium	0.1734	0.1725	0.0110
Education, long	0.0539	0.0544	-0.0077
1 child	0.2368	0.2340	0.0320
2 children	0.3938	0.3882	0.0588
3 children	0.1050	0.1098	-0.0639
4 children	0.0176	0.0171	0.0102

The purpose of the matching procedure is to balance the covariates between the high and low liquid asset groups.

倾向得分匹配

Comparable:

政策改革之前，匹配的两组家庭的消费和负债增长没有显著不同。

TABLE 2—ESTIMATES OF THE AVERAGE PRE-REFORM EFFECT FOR OWNERS HOLDING LOW LEVELS OF LIQUID ASSETS IN 1991, FOR TOTAL EXPENDITURE, LIABILITIES, AND INCOME

		Average effect of the reform for low liquid asset households ^a		
		<i>Q</i> = Expenditure (1)	<i>Q</i> = Liabilities (2)	<i>Q</i> = Income (3)
1	$[(Q_{91} + Q_{90}) - (Q_{89} + Q_{88})]/2$	0.0066	-0.0012	0.0054
	Standard error ^b	0.0078	0.0021	0.0069

Notes: All variables are measured in DKK at 1990 price levels. Matching is done using replacement.

^aSize of low liquid asset group: 12,091. Size of matched high liquid asset group: 9,228.

^bStandard errors are calculated according to Theorem 7 in Alberto Abadie and Imbens (2006).

基本回归结果

Matching estimates:

TABLE 3—ESTIMATES OF THE AVERAGE EFFECT OF THE REFORM FOR OWNERS HOLDING LOW LEVELS OF LIQUID ASSETS IN 1991, FOR TOTAL EXPENDITURE, LIABILITIES, AND INCOME

	Average effect of the reform for low liquid asset households ^a		
	$Q = \text{Expenditure}$ (1)	$Q = \text{Liabilities}$ (2)	$Q = \text{Income}$ (3)
1 $[(Q_{96} + Q_{95} + Q_{94} + Q_{93}) - (Q_{91} + Q_{90} + Q_{89} + Q_{88})]/4$ Standard error ^b	0.0110* 0.0040	0.0594* 0.0066	0.0030 0.0028
2 $[(Q_{95} + Q_{94} + Q_{93}) - (Q_{91} + Q_{90} + Q_{89})]/3$ Standard error ^b	0.0077* 0.0046	0.0474* 0.0067	0.0028 0.0027
3 $[(Q_{94} + Q_{93}) - (Q_{91} + Q_{90})]/2$ Standard error ^b	-0.0145* 0.0059	0.0334* 0.0071	0.0053* 0.0027
4 $(Q_{93}) - (Q_{91})$ Standard error ^b	-0.0137 0.0089	0.0316* 0.0085	0.0062* 0.0031

Notes: All variables are measured in DKK at 1990 price levels. Matching is done using replacement.

^aSize of low liquid asset group: 12,091. Size of matched high liquid asset group: 9,228.

^bStandard errors are calculated according to Theorem 7 in Abadie and Imbens (2006).

*Significant at the 5 percent level.

基本回归结果

OLS estimates:

TABLE A2—OLS ESTIMATES OF THE AVERAGE EFFECT OF THE REFORM ON OWNERS HOLDING LOW LEVELS OF LIQUID ASSETS IN 1991, FOR TOTAL EXPENDITURE, LIABILITIES, AND INCOME

Dependent variable	Average effect of the reform for low liquid asset households		
	$Q = \text{Expenditure}$ (1)	$Q = \text{Liabilities}$ (2)	$Q = \text{Income}$ (3)
1 $[(Q_{96} + Q_{95} + Q_{94} + Q_{93}) - (Q_{91} + Q_{90} + Q_{89} + Q_{88})]/4$	0.0106*	0.0544*	0.0007
Standard error	0.0029	0.0050	0.0020
2 $[(Q_{95} + Q_{94} + Q_{93}) - (Q_{91} + Q_{90} + Q_{89})]/3$	0.0075*	0.0416*	0.0010
Standard error	0.0034	0.0052	0.0020
3 $[(Q_{94} + Q_{93}) - (Q_{91} + Q_{90})]/2$	-0.0097*	0.0275*	0.0047
Standard error	0.0047	0.0055	0.0019
4 $(Q_{93}) - (Q_{91})$	-0.0064	0.0247*	0.0073*
Standard error	0.0068	0.0066	0.0022

Notes: All variables are measured in DKK at 1990 price levels. Standard errors are robust to arbitrary forms of heteroskedasticity. Parameter estimates presented in this table are estimates of β_2 in equation (2) from 12 regressions run independently. All regressions also include the covariate vector used in the probit models reported in Table 2. Parameter estimates for these covariates are not reported.

* Significant at the 5 percent level.

影响程度 (ETV)

ETV : Equity to house value in 1991

$$E[(Q_{iA}^1 - Q_{iB}^1) - (Q_{iA}^0 - Q_{iB}^0) | D_i = 1, X_{iB}(ETV_{iB})]$$

Income (not reported):

no differences for two groups

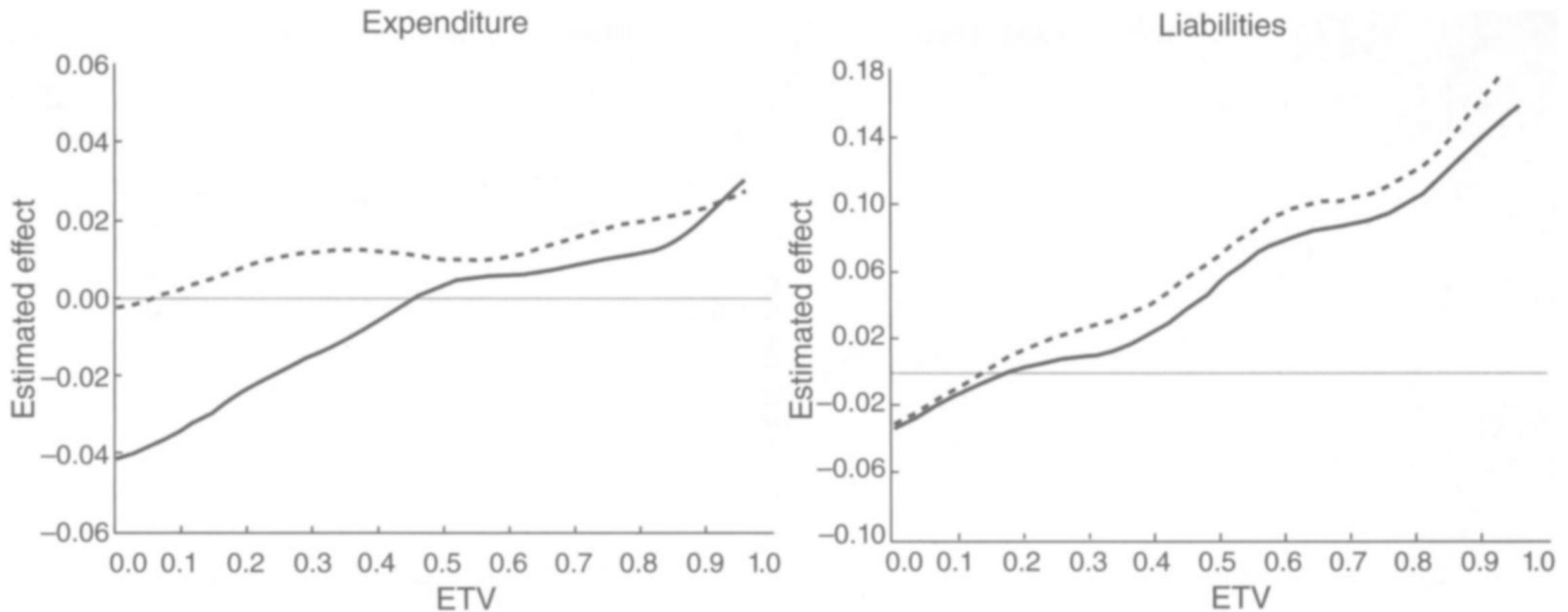


FIGURE 4. KERNEL REGRESSIONS OF THE ESTIMATED EXPENDITURE AND LIABILITY EFFECT OF THE REFORM FOR THE LOW LIQUID ASSET HOUSE OWNERS ON EQUITY TO VALUE (ETV) IN 1991

Notes: Bandwidths have initially been chosen by generalized cross validation. The kernel regressions presented in both panels are over-smoothed relative to the cross validated level. This is only of presentational importance. Estimates based on the period 1993–1994 relative to 1990–1991 (solid line) and 1993–1995 relative to 1989–1991 (broken line).

影响程度 (age)

Age : age of the oldest member of the household in 1991

Income (not reported):

Excess growth (<40) but much smaller magnitude.

$$E[(Q_{iA}^1 - Q_{iB}^1) - (Q_{iA}^0 - Q_{iB}^0) | D_i = 1, X_{iB}(age_{iB})]$$

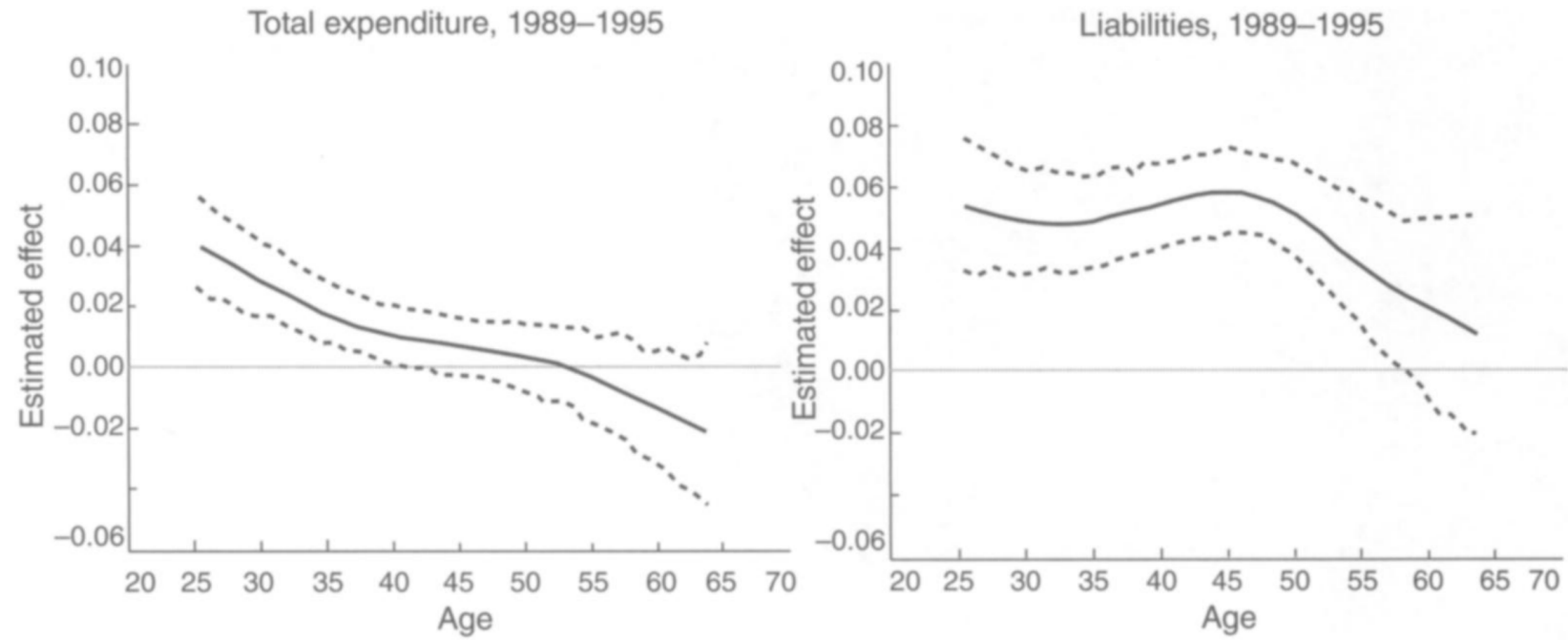


FIGURE 5. KERNEL REGRESSIONS OF ESTIMATED TOTAL EXPENDITURE AND LIABILITY EFFECT OF THE REFORM FOR THE LOW LIQUID ASSET HOUSE OWNERS ON AGE

Notes: Bandwidths have initially been chosen by generalized cross validation. The kernel regressions presented in both panels are over-smoothed relative to the cross validated level. This is only of presentational importance. Confidence intervals are bootstrap pointwise confidence intervals based on 500 replications, (cf., Wolfgang Härdle 1990). Estimates based on the period 1993-1995 relative to 1989-1991.

稳健性检验

- 1、 Renters
- 2、 Capital gains—subsample
- 3、 Sample split
 - (1) Education level—impatient
 - (2) Alternative indicators—three types
- 4、 Wealth effect

稳健性检验

1、Renters

Income (not reported):

Excess income growth for young, low liquid asset renters

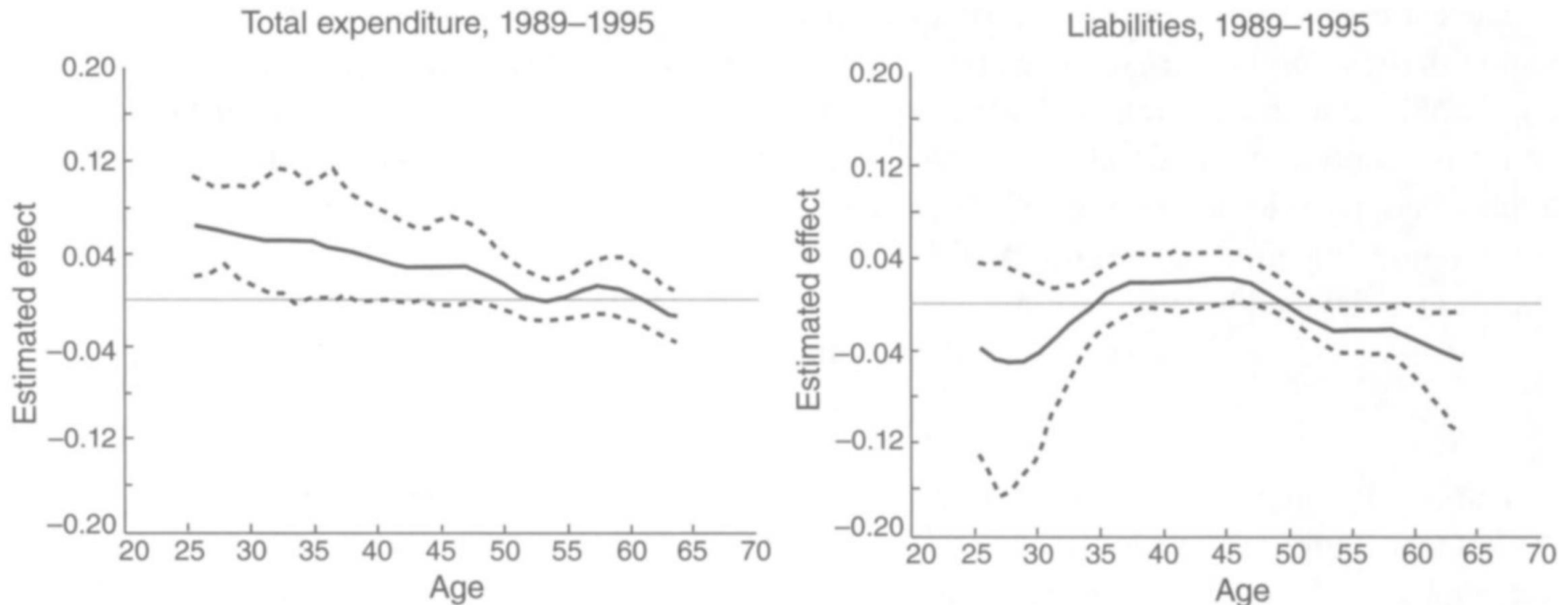


FIGURE 6. KERNEL REGRESSION OF ESTIMATED TOTAL EXPENDITURE AND LIABILITY EFFECT OF THE REFORM FOR LOW LIQUID ASSET RENTERS ON AGE

Notes: Bandwidths have initially been chosen by generalized cross validation. The kernel regressions presented in both panels are over-smoothed relative to the cross validated level. This is only of presentational importance. Confidence intervals are bootstrap point wise confidence intervals, (cf., Wolfgang Härdle 1990). Estimates based on the period 1993–1995 relative to 1989–1991.

稳健性检验

2、Capital gains—subsample

Capital gains on assets such as bonds and shares, subsample is created that includes only households that do **not hold shares or bonds** at any point in the observation period, **the results show the same** pattern as for the whole sample.

3、Sample split

(1) **Education level** low—impatient—Low group

The level of education has been suggested as an indicator for discount heterogeneity (Lawrance 1991). The regression curves generally lie close to each other and do **not suggest different responses across educational levels.**

3、Sample split

Impatient consumers of the type described in Carroll (1997) and Deaton (1991) **persistently keep low** levels of liquid assets.

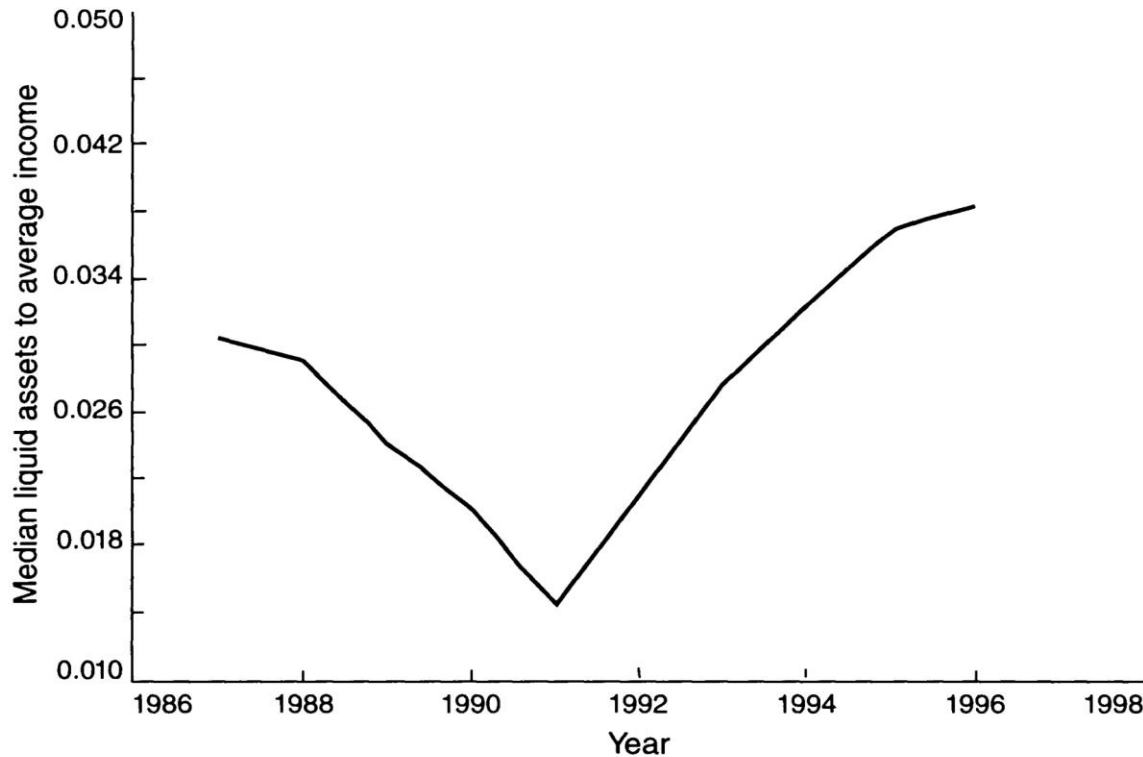


FIGURE 7. MEDIAN LIQUID ASSET HOLDINGS TO AVERAGE INCOME ACROSS THE PERIOD 1988 TO 1996 FOR HOUSEHOLDS WITH LOW LEVELS OF LIQUID ASSETS IN 1991

稳健性检验

3、Sample split

(2) Three alternative sample splits

因为丹麦大多数家庭收入(年末之前)和资产(年末)的统计时点不同，所以调整统计时长构建新的划分指标。

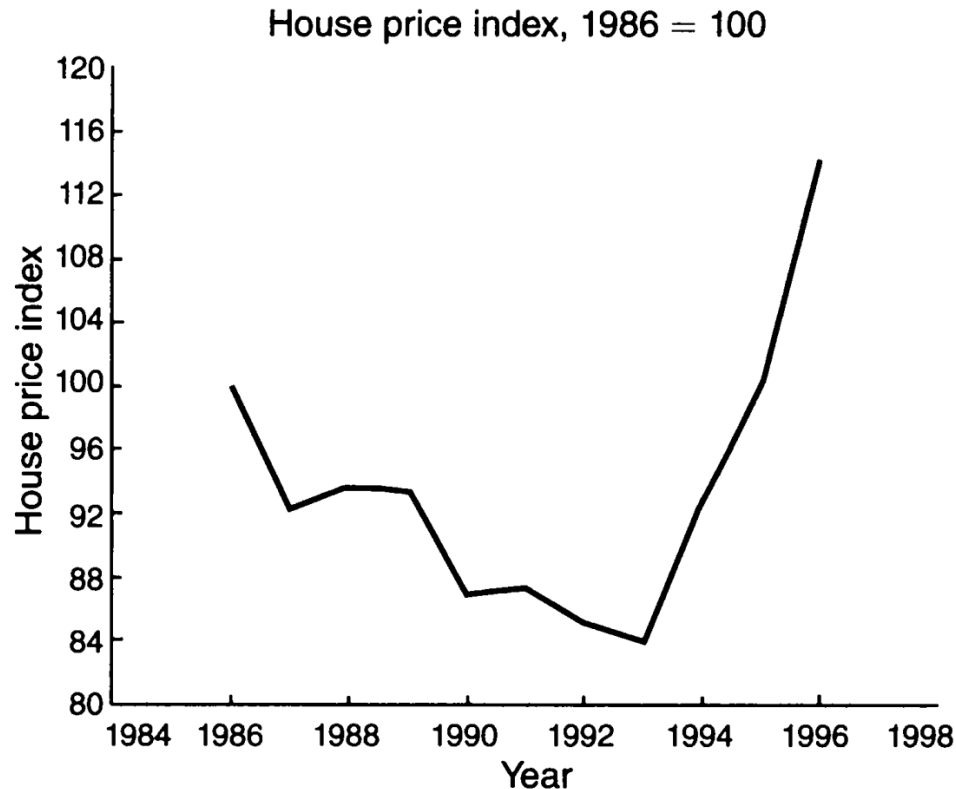
- ① having liquid assets corresponding to **two months** of disposable income;
- ② having liquid assets comparable to less than one month's disposable income in **both 1990 and 1991**.
- ③ having liquid assets comparable to less than one month's disposable income and subsequently experiencing an **unemployment shock**.

All cases the **basic results are similar**.

稳健性检验

4、Wealth effect

If the **low** liquid asset group experiences a **more rapid** expansion in wealth than the matched high liquid asset group, then the effect measured could be just a **wealth effect**.



稳健性检验

4、Wealth effect

Results show that the **average house value relative to average income** across the observation period in the **low** liquid asset group has **developed slower** than the average house value in the matched high liquid asset group in all periods considered.

At the same time, as shown earlier, **debt** to average income across the observation period has developed **more rapidly** for **low** liquid asset households over the period.

This suggests that the expenditure effect found is **not a housing wealth effect**.



06 | **总结**

06

结论

The effect of the reform is estimated using a **difference-in-differences** estimator comparing **the growth rate of total expenditure and debt** from before to after the reform for **two groups** of households; ones that were likely **to be constrained prior to the reform** and others that were **not constrained**.

We find that **the magnitude of the response** is correlated with the **amount of equity released by the reform** and that younger households were particularly affected by constraints. Many **younger** households did not have housing equity at the point of the reform but did so **later as house prices increased**. The findings suggest that the credit elements of the reform had a **limited aggregate impact**.



THANK YOU !

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