Digital Payment, Heterogenous Households, and Financial Inclusion

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Thailand's National e-Payment Master Plan

The Thai government has officially launched the National e-Payment Master Plan in December 2016. There are 5 projects under the master plan:

- PromptPay (AnyID): to provide more convenience on money transfer by using registered ID through internet banking, mobile banking, & ATM.
- EDC(Electronic Data Capture) and Card Acceptance Expansion: to promote cardless usages.
- E-Tax: to integrate tax filing systems.
- Government e-Payment: to provide more accuracy and convenience and reduce the cash usage in government payments.
- Market Education: to provide e-Payment knowledge to the general public.

Introduction of the State Welcare Card

The State Welfare Card scheme has become another important part of the government National e-Payment Master Plan since Septemer 2017. Thai government has distributed the cashless welfare card to Thai people who are :

- older than 18 years old
- annual income below 100,000 THB (3,300 USD)
- with financial asset value lower than 100,000 THB

Monthly allowance and other benefits from the SWC

The SWC holder will receive the following benefits

- 200-300 THB (6-9 USD) a month to buy items (consumer goods, goods for children's education, and agricultural raw materials) at specified Thong Fah shops;
- a 500 THB monthly subsidy for public buses, intra-provincial buses and electric trains;
- and a 45 THB discount for cooking gas every three months.
- can use the SWC as e-wallet

There were 14M applicants, and 11M people confirmed eligible for the card.
Thai population is around 70M, and the the number of people under poverty line is approximately 5-6M.
The report shows that 93-94% of the SWC holders use the card to buy basic consumer goods.

Thailand's SWC is introduced country-wided

Recent Cashless Card Transfer Programs

	Thailand's State Welfare Card	**Australia's Cashless Debit Card**
Scope	Country-wide	Selected trial regions
Target	Low income individuals	People under government welfare program
Purpose	To reduce economic burden of low-income individuals and promote the cashless society	To test whether reducing cash circulation will reduce the harm from misuse of alcohol, gambling, and drug
Instrument	Cashless debit card and e-Wallet	Cashless Debit Card
Active	2017-current	2016-current

Relevant Studies

The existing studies focus on the introduction of a particular type of technology resulting in increase in consumptions and savings, such as

- Mobile payment [Agarwal et al., 2020] , [Agarwal et al., 2019]
- Debit card and POS terminal [Bachas et al., 2018] , [Higgins, 2020]
- Digital wallet [Agarwal et al., 2019] , [Bandi et al., 2019]

(Indirect) Policy impact:

- Cash demonetization policy [Chodorow-Reich et al., 2018]

The present study

Direct policy intervention:

Use the introduction of Thailand's State Welfare Card as a quasi-experimental setting to study the digital payment adoption and impacts

Theoretical framework and hypothesis

- Consider a representative household who maximizes the utility function subject to the budget contraint
- If the Household receives the SWC, she will have higher budget constraint in each month
- If the household can use the SWC to purchase consumption goods without any problem (full adoption), she will increase consumption accordingly.
- On the other hand, if household cannot use the SWC fully or find difficulties using it, she will not increase consumption.
- For example, it is reported that there is a market for the SWC where household can sell the card at discount around 50% for cash.
- Finally, the spillover is from increased financial literacy and inclusion.

Regression Discontinuity Design

- Regression: conditional independence assumption: $E[Y_i|X_i, D_i] = E[Y_i|X_i]$
- The key to the RD design is that we have a deep understanding of the mechanism which underlies the assignment of treatment D_i (SWC). In this case, assignment to treatment depends on a single variable X_i (income).
- In the sharp RD design this variable fully determines the treatment according to the cutoff rule c (100K THB per annum):

$$D_i = \begin{cases} 1 & \text{if } X_i \leq c \\ 0 & \text{if } X_i > c \end{cases} \tag{1}$$

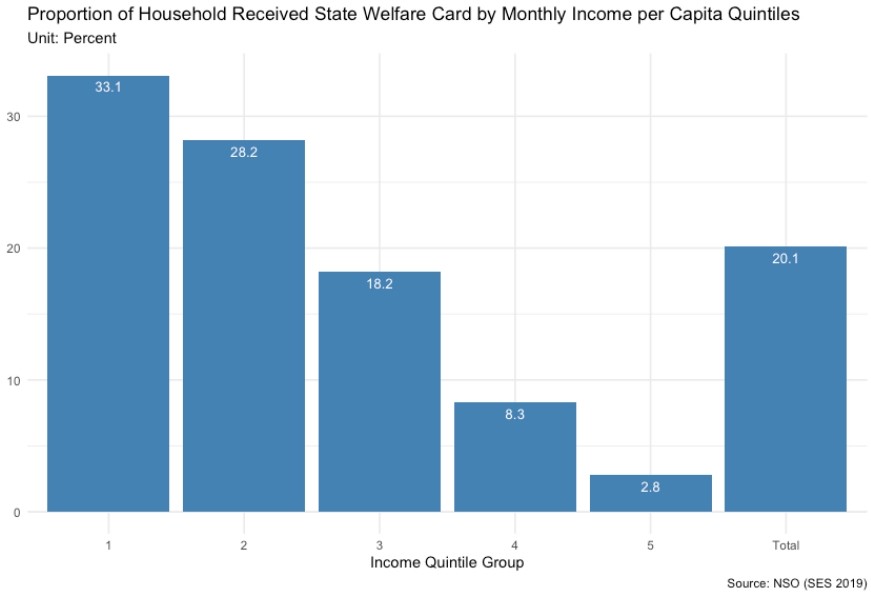
First main data: Household Socio Economic Survey

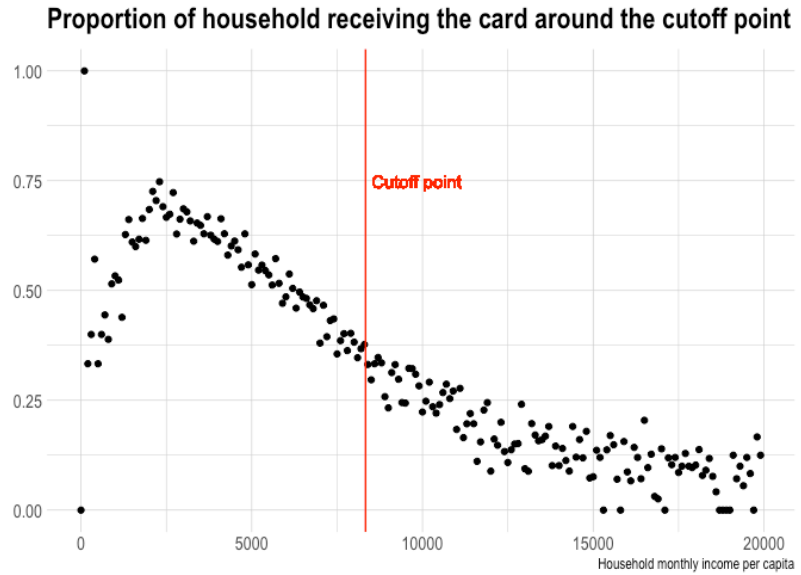
- Thailand's Household Socio Economic Survey 2019 data
- The survey uses a stratified two–stage sampling method, considering Bangkok Metropolitan and 76 Provinces as constituted strata.
- There were altogether 77 strata, each stratum (except Bangkok Metropolitan) was further divided into two parts: municipal areas, and non-municipal areas
- The sample of about 55,584 households was divided into twelve equally representative sub–samples.

Identification Challenges: Household level survey and individual level policy

- We use the household level survey data with the individual level eligibility criteria.
- As a result, even household in the high income can receive the Card if any member fit the eligibility criteria.
- As a result, when using the Monthly Income at 8,333.33 THB as the cutoff point, the proportion of households receiving the card is higher when the monthly income per capita is lower than the cutoff point. Nevertheless, the proportion of households receiving the card around the cutoff point does not show strict compliance.

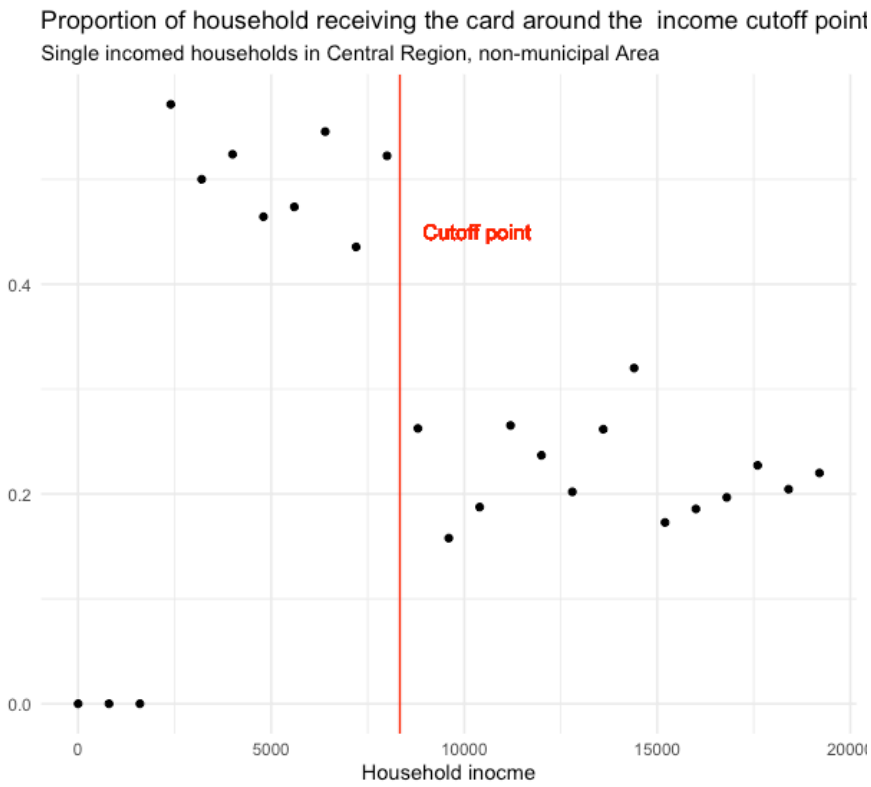
No discontinuity

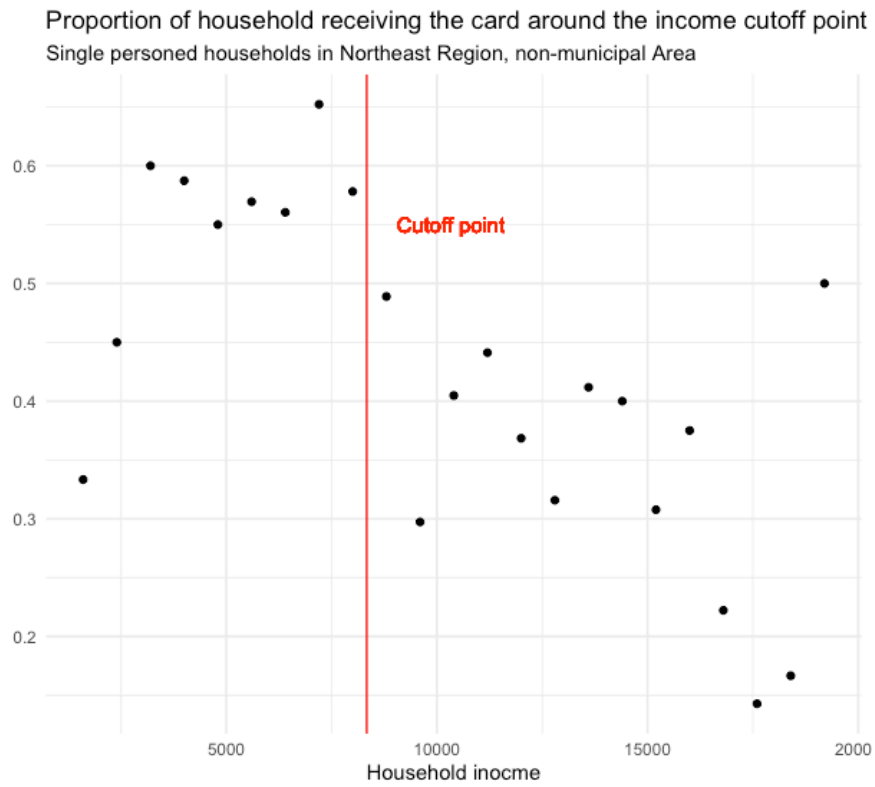




Single personed households

Even single personed households, we note the compliance issue





Single personed households

Possible reasons

- The eligibility rule is not strictly implemented.
- Some individuals under reported the income and financial asset when apply for the SWC but not when interviewed in the Survey
- Measurement errors
- Income volatility – time lag: espeically low income or agriculture-based households

Fuzzy Regression Discontinuity Design

In this case, the treatment status (receiving the SWC) does not change 100% at the cutoff, I implement the fuzzy regression discontinuity designs.

Formally,

$$0 < \lim_{x \uparrow c} \Pr(D_i = 1 | X_i = x) - \lim_{x \downarrow c} \Pr(D_i = 1 | X_i = x) < 1 \tag{2}$$

This implies:

$$\Pr(D_i = 1 | X_i \geq c) - \Pr(D_i = 1 | X_i < c) = k \tag{3}$$

where
X_i is running variable (household income)
D_i is treatment status (receiving the SWC)
c is the income cutoff
$0 < k < 1$

Fuzzy Regression Discontinuity Design

To estimate the impact on outcome variable, I use two stage least square method as follows:
First stage equation:

$$Card_i = \alpha + \gamma 1[Income_i < c] + f(Income_i - c) + \nu_i \tag{4}$$

Second stage equation:

$$Exps_i = \alpha + \tau \hat{Card}_i + f(Income_i - c) + \epsilon_i \tag{5}$$

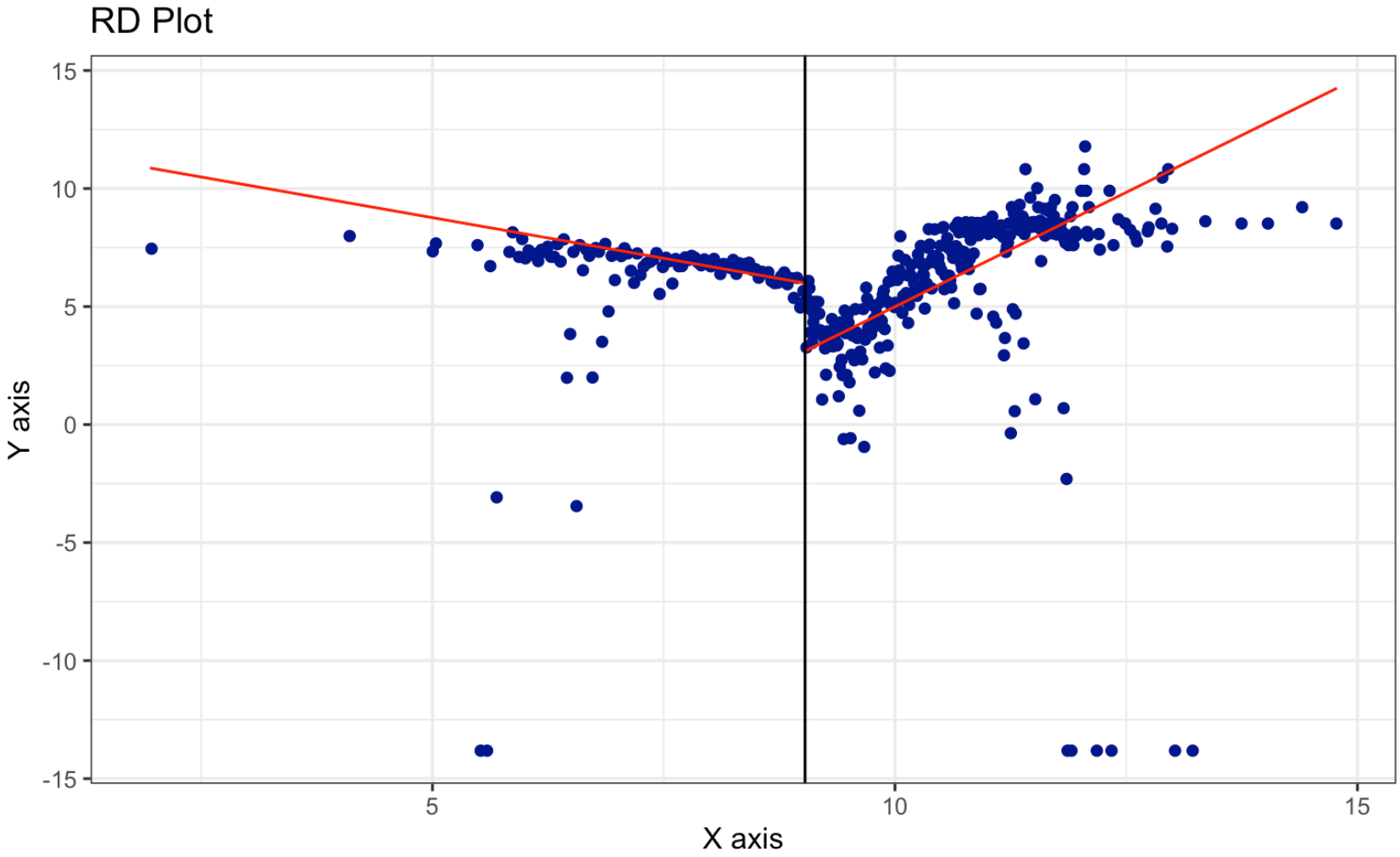
In addition, I run OLS for the following reduced form equation for reference.

$$Exps_i = \alpha + \tau 1[Income_i < c] + f(Income_i - c) + \epsilon_i \tag{6}$$

Finally, I specify the bandwidth that is close the cutoff as:
$c - h \leq X_i \leq c + h$.

Impact on Expenditures: all samples

- Household average income (X) agaist In-kind consumption expenditure (Y)



Impact on Expenditures: all samples

- All consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)	Fuzzy RD linear (bw = 0.7)	Fuzzy RD cross (bw = 0.5)	Fuzzy RD cross (bw = 0.6)	Fuzzy RD cross (bw = 0.7)
(Intercept)	8.617***	8.589***	8.681***	8.650***	8.607***	8.668***
	(0.296)	(0.188)	(0.126)	(0.269)	(0.177)	(0.120)
log_average_income_centered	1.007**	1.050***	0.924***	0.907***	0.999***	0.957***
	(0.415)	(0.250)	(0.160)	(0.350)	(0.228)	(0.147)
card1	0.916	1.002*	0.735*	0.838	0.962*	0.765**
	(0.893)	(0.567)	(0.379)	(0.822)	(0.539)	(0.366)
log_average_income_centered × card1				0.185	0.094	-0.058
				(0.198)	(0.130)	(0.091)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: all samples

- In-kind consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)	Fuzzy RD linear (bw = 0.7)	Fuzzy RD cross (bw = 0.5)	Fuzzy RD cross (bw = 0.6)	Fuzzy RD cross (bw = 0.7)
(Intercept)	-6.358	-5.456*	-5.260**	-4.232	-4.148	-4.246**
	(5.611)	(3.220)	(2.316)	(4.541)	(2.830)	(2.043)
log_average_income_centered	10.022	8.673**	8.371***	3.477	4.958	5.848**
	(7.866)	(4.275)	(2.926)	(5.972)	(3.673)	(2.503)
card1	32.714*	29.985***	29.354***	27.654**	27.043***	27.114***
	(16.935)	(9.712)	(6.948)	(13.876)	(8.598)	(6.198)
log_average_income_centered × card1				12.066***	6.832***	4.356***
				(3.201)	(2.011)	(1.508)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: all samples

- In-kind FB consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)	Fuzzy RD linear (bw = 0.7)	Fuzzy RD cross (bw = 0.5)	Fuzzy RD cross (bw = 0.6)	Fuzzy RD cross (bw = 0.7)
(Intercept)	-8.277*	-8.653***	-8.234***	-7.428*	-7.786***	-7.404***
	(4.419)	(2.787)	(1.983)	(3.952)	(2.562)	(1.806)
log_average_income_centered	1.743	2.250	1.577	-0.874	-0.209	-0.490
	(6.193)	(3.699)	(2.505)	(5.172)	(3.323)	(2.226)
card1	21.420	22.430***	21.059***	19.397	20.482***	19.223***
	(13.336)	(8.405)	(5.948)	(12.090)	(7.790)	(5.478)
log_average_income_centered × card1				4.824*	4.524**	3.568***
				(2.852)	(1.832)	(1.331)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: all samples

- All Food and Bev. consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)	Fuzzy RD linear (bw = 0.7)	Fuzzy RD cross (bw = 0.5)	Fuzzy RD cross (bw = 0.6)	Fuzzy RD cross (bw = 0.7)
(Intercept)	9.269***	8.714***	8.626***	9.349***	8.777***	8.661***
	(0.466)	(0.199)	(0.148)	(0.467)	(0.200)	(0.144)
log_average_income_centered	-0.779	0.056	0.187	-1.026	-0.121	0.099
	(0.662)	(0.266)	(0.186)	(0.643)	(0.277)	(0.184)
card1	-1.849	-0.169	0.105	-2.040	-0.309	0.027
	(1.410)	(0.602)	(0.441)	(1.427)	(0.605)	(0.431)
log_average_income_centered × card1				0.455	0.325**	0.152
				(0.342)	(0.153)	(0.109)
Num.Obs.	22042	25793	29332	22042	25793	29332

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: all samples

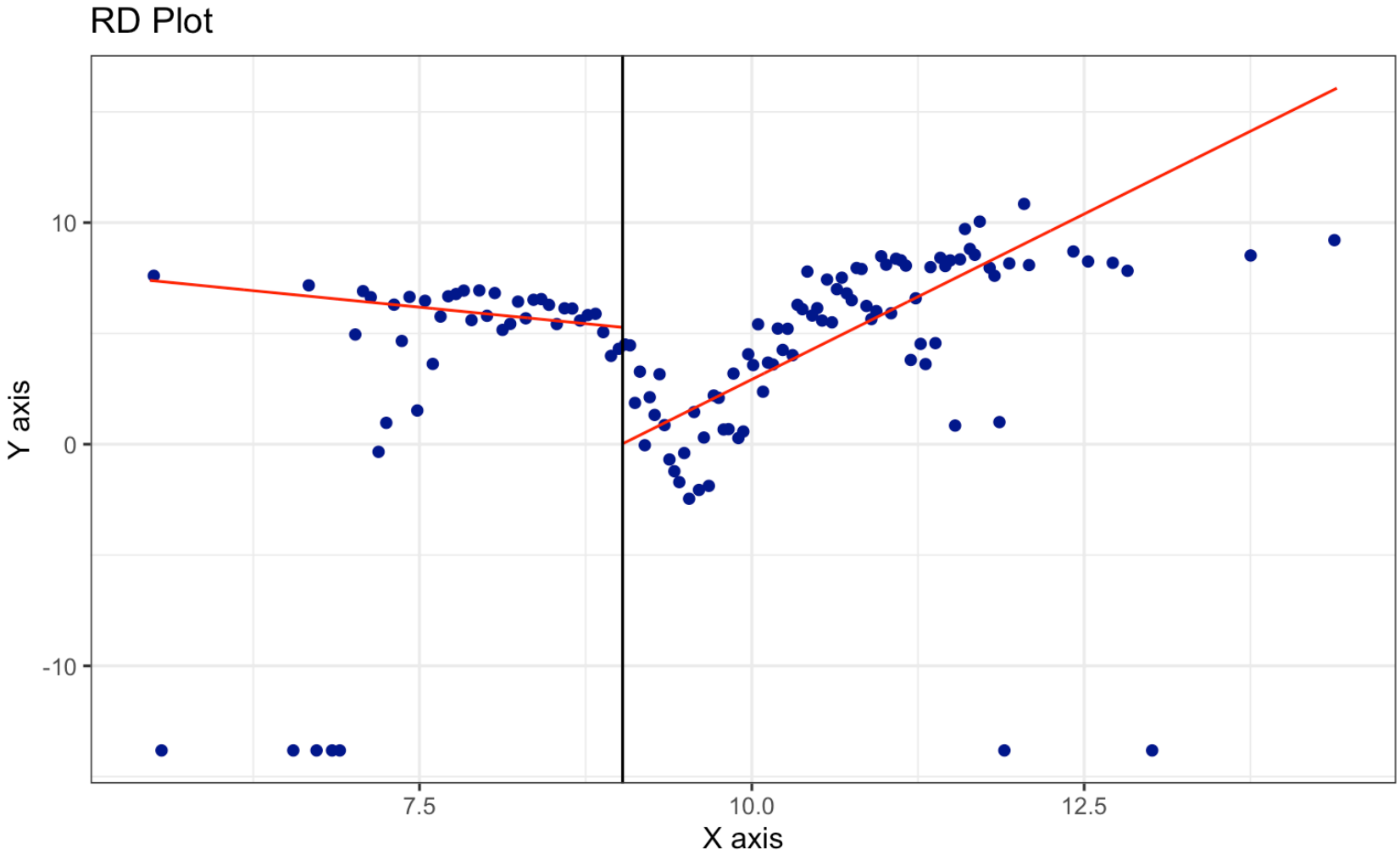
- All Tobacco consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)	Fuzzy RD linear (bw = 0.7)	Fuzzy RD cross (bw = 0.5)	Fuzzy RD cross (bw = 0.6)	Fuzzy RD cross (bw = 0.7)
(Intercept)	-8.835**	-11.354***	-11.466***	-9.604***	-11.706***	-11.585***
	(3.525)	(1.870)	(1.365)	(3.122)	(1.771)	(1.276)
log_average_income_centered	-6.617	-2.853	-2.723	-4.250	-1.854	-2.426
	(4.943)	(2.485)	(1.726)	(4.053)	(2.282)	(1.548)
card1	-10.426	-2.833	-2.558	-8.596	-2.042	-2.295
	(10.637)	(5.638)	(4.093)	(9.560)	(5.393)	(3.881)
log_average_income_centered × card1				-4.365*	-1.837	-0.512
				(2.333)	(1.310)	(0.978)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: single person households

- Household average income (X) agaist In-kind consumption expenditure (Y)



Impact on Expenditures: single person households

- All consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.7)	Fuzzy RD linear (bw = 0.8)	Fuzzy RD linear (bw = 0.9)	Fuzzy RD cross (bw = 0.7)	Fuzzy RD cross (bw = 0.8)	Fuzzy RD cross (bw = 0.9)
(Intercept)	8.007***	7.995***	8.019***	7.997***	7.992***	8.018***
	(0.129)	(0.100)	(0.084)	(0.132)	(0.101)	(0.085)
log_average_income_centered	1.093***	1.114***	1.080***	1.059***	1.101***	1.076***
	(0.176)	(0.131)	(0.106)	(0.188)	(0.137)	(0.106)
card1	0.590	0.638*	0.562**	0.670	0.670**	0.575**
	(0.439)	(0.344)	(0.286)	(0.448)	(0.342)	(0.292)
log_average_income_centered × card1				0.242*	0.092	0.034
				(0.130)	(0.107)	(0.087)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: single person households

- In-kind consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.7)	Fuzzy RD linear (bw = 0.8)	Fuzzy RD linear (bw = 0.9)	Fuzzy RD cross (bw = 0.7)	Fuzzy RD cross (bw = 0.8)	Fuzzy RD cross (bw = 0.9)
(Intercept)	-4.188	-6.763**	-8.341***	-4.460	-6.805**	-8.405***
	(3.191)	(3.023)	(2.949)	(3.303)	(3.022)	(2.999)
log_average_income_centered	1.690	5.763	8.092**	0.764	5.601	7.856**
	(4.361)	(3.936)	(3.689)	(4.750)	(4.088)	(3.708)
card1	23.664**	32.730***	37.981***	25.834**	33.135***	38.657***
	(10.896)	(10.381)	(10.058)	(11.102)	(10.256)	(10.351)
log_average_income_centered × card1				6.570**	1.171	1.813
				(3.240)	(3.141)	(2.914)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: single person households

- all food and bev consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.7)	Fuzzy RD linear (bw = 0.8)	Fuzzy RD linear (bw = 0.9)	Fuzzy RD cross (bw = 0.7)	Fuzzy RD cross (bw = 0.8)	Fuzzy RD cross (bw = 0.9)
(Intercept)	7.873***	7.769***	7.768***	7.862***	7.767***	7.765***
	(0.319)	(0.247)	(0.217)	(0.313)	(0.243)	(0.217)
log_average_income_centered	0.547	0.710**	0.711***	0.510	0.701**	0.699***
	(0.431)	(0.310)	(0.259)	(0.463)	(0.330)	(0.265)
card1	0.529	0.893	0.891	0.615	0.916	0.925
	(1.082)	(0.834)	(0.725)	(1.033)	(0.797)	(0.719)
log_average_income_centered × card1				0.260	0.069	0.089
				(0.320)	(0.238)	(0.164)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impact on Expenditures: single person households

- all tobacco consumption expenditure (Y)

	Fuzzy RD linear (bw = 0.7)	Fuzzy RD linear (bw = 0.8)	Fuzzy RD linear (bw = 0.9)	Fuzzy RD cross (bw = 0.7)	Fuzzy RD cross (bw = 0.8)	Fuzzy RD cross (bw = 0.9)
(Intercept)	-13.127***	-12.716***	-12.663***	-13.065***	-12.670***	-12.644***
	(1.902)	(1.452)	(1.258)	(1.886)	(1.443)	(1.263)
log_average_income_centered	-0.501	-1.126	-1.222	-0.290	-0.949	-1.151
	(2.605)	(1.898)	(1.579)	(2.694)	(1.974)	(1.585)
card1	-0.675	-2.043	-2.267	-1.170	-2.483	-2.469
	(6.494)	(4.979)	(4.279)	(6.366)	(4.878)	(4.324)
log_average_income_centered × card1				-1.498	-1.275	-0.541
				(1.883)	(1.553)	(1.249)

* p < 0.1, ** p < 0.05, *** p < 0.01

Impacts on Expenditure: Findings from SES data so far

- The analysis show the use of SWC as in-kind consumption expenditure mainly through food & bev consumption.
- Overall consumption also increase for the SWC recipients in line with the existing literatures, albiet small and not robust.
- We find no negative impact such as increase in tobacco product consumption.

Additional Survey

- SES data show compliance issue: even based on single person household, non-compliance ratio is still high.
- One of the reasons is income volatility: SES data is 2 years lag.
- We should use income as 2017 as cutoff: past income when the SWC has been distributed.
- So, we conducted the survey of 256 individuals whose income around the threshold in Chainat, Saraburi, and Singburi additionally during Mar-Jun 2022.
- The survey also test Financial Literacy score, measure trust in digital payment system, among other spillovers.

Financial Literacy Model

- the full score is 8

	Fuzzy RD linear (bw = 0.4)	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)
(Intercept)	2.103***	2.102***	2.193***
	(0.535)	(0.525)	(0.523)
log_income_centered	1.925**	1.651**	1.357**
	(0.777)	(0.684)	(0.527)
CARDY	1.900***	1.871***	1.684***
	(0.514)	(0.512)	(0.516)
EDUCATION	0.703***	0.689***	0.684***
	(0.114)	(0.110)	(0.107)
INTERNET_USAGEY	0.000	0.043	0.023
	(0.416)	(0.389)	(0.368)

* p < 0.1, ** p < 0.05, *** p < 0.01

(Reduced) Gambling Model

- Aware of the negative consequences

	Fuzzy RD linear (bw = 0.4)	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)
(Intercept)	9.005***	8.884***	7.323***
	(2.841)	(2.776)	(2.777)
log_income_centered	4.636	4.433	-0.090
	(5.202)	(4.552)	(3.558)
CARDY	-9.613***	-9.607***	-9.356***
	(2.882)	(2.887)	(2.946)
EDUCATION	-2.456***	-2.387***	-2.382***
	(0.711)	(0.677)	(0.670)
INTERNET_USAGEY	-0.526	-0.584	1.156
	(2.416)	(2.302)	(2.217)

* p < 0.1, ** p < 0.05, *** p < 0.01

Trust in Digital Payment

- Some evidence although not conclusive.

	Fuzzy RD linear (bw = 0.4)	Fuzzy RD linear (bw = 0.5)	Fuzzy RD linear (bw = 0.6)
(Intercept)	2.254***	2.251***	2.315***
	(0.354)	(0.351)	(0.358)
log_income_centered	-0.345	-0.197	0.134
	(0.494)	(0.448)	(0.330)
CARDY	0.428	0.445	0.564*
	(0.299)	(0.303)	(0.302)
EDUCATION	0.206***	0.216***	0.214***
	(0.061)	(0.061)	(0.060)
INTERNET_USAGEY	0.753**	0.704**	0.620**
	(0.292)	(0.277)	(0.264)

* p < 0.1, ** p < 0.05, *** p < 0.01

Additional Findings from Questionaires

- As we also asked about income in the past 5Y, the compliance improve.
- SWC holders show improvement in their financial literacy score
- Also reduce their gambling expenditure significantly, and
- Show more trust in digital payment system.

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National Bureau of Economic Research

Thank you very much