Online Appendix
Central Bank Digital Currency and Banking Choices

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June 28, 2025

OA   Constructing Key Variables

This section explains how we use the estimated parameters to calculate the value $V_{i,j}^b$ from the liquid asset portfolio and the expected value $\mathbb{E}V_{i,j}^k$ from financial products. Both will enter the deposit bank choice estimation, together with the branch network and the bank fixed effects.

OA.1   Value from Liquid Asset Portfolios

This section shows how we use the estimated parameters from (15) to calculate the value $V_{i,j}^b$ from liquid asset portfolios. This variable enters in the deposit bank choice estimation. According to (6),

$$V_{i,j}^b = \frac{1-\sigma}{\sigma}\ln\left[1 + \left(u_{i,j}^b\right)^{\frac{\sigma}{1-\sigma}}\right] + \ln w_i. \tag{OA1}$$

Note that the household wealth $\ln w_i$ does not vary across banks and thus would not affect the deposit bank choice. The term $\frac{1-\sigma}{\sigma}$ will be estimated together with the parameter θ shown in (2). Therefore, we only need to calculate $\tilde{V}_{i,j}^b$ below for the deposit bank choice estimation:

$$\tilde{V}_{i,j}^b = \ln[1 + (u_{i,j}^b)^{\frac{\sigma}{(1-\sigma)}}], \tag{OA2}$$

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which has the cross-bank variation through $u_{i,j}^b$. Using (4), $(u_{i,j}^b)^{\frac{\sigma}{(1-\sigma)}}$ can be written as:

$$(u_{i,j}^b)^{\frac{\sigma}{(1-\sigma)}} = \exp\left(\frac{\sigma}{1-\sigma}(\alpha^b r_{i,j} + \boldsymbol{X}_{i,j}\boldsymbol{\beta}^b + \boldsymbol{Z}_i\boldsymbol{\gamma}^b + \eta_j^b + \zeta^b + \varepsilon_i^b)\right). \qquad \text{(OA3)}$$

With the estimates of $\tilde{v} = \frac{\sigma v}{1-\sigma}$, for every $v \in \{\alpha^b, \boldsymbol{\beta}^b, \boldsymbol{\gamma}^b, \boldsymbol{\eta}^b, \zeta^b, \varepsilon_i^b\}$, we can calculate $(u_{i,j}^b)^{\sigma/(1-\sigma)}$ for every bank j that is present in a household's choice set.

OA.2 Expected Value from Financial Products

This section explains how we use the parameters estimated from (16) to calculate the expected value $\mathbb{E}V_{i,j}^k$, which will enter the deposit bank choice estimation. According to (10),

$$\mathbb{E}V_{i,j}^k = \ln\left(\sum_{n \in \mathcal{J}_i^k} \exp\left(\kappa^k \mathbb{1}(n = j) + \boldsymbol{X}_{i,n}\boldsymbol{\beta}^k + \eta_n^k\right)\right) + C. \qquad \text{(OA4)}$$

Note that the constant C can be neglected because it does not have the cross-bank variation and will not affect the deposit bank choice. With the estimated parameters $(\kappa^k, \boldsymbol{\beta}^k, \boldsymbol{\eta}^k)$, we can calculate $\mathbb{E}V_{i,j}^k$ for every bank that is present in a household's choice set.

To visualize this, Table OA1 uses one fictitious household to show how we calculate $\mathbb{E}V_{i,j}^k$. For simplicity, only one household is considered and assume that household only has three banks in its choice set. As can be seen, for each bank in the choice set, there is a different $\mathbb{E}V_{i,j}^k$. Intuitively, when the household chooses which bank to go to for deposits, it considers the expected value from other financial products that a given bank can provide in the future.

Based on (OA4), for household 1, the expected value from getting a financial product k in the future from bank 1 is

$$\begin{aligned}
\mathbb{E}V_{1,1}^k &= \ln\left(\exp\left(\kappa^k \mathbb{1}(n = 1) + \boldsymbol{X}_{i,1}\boldsymbol{\beta}^k + \eta_1^k\right) + \exp\left(\boldsymbol{X}_{i,2}\boldsymbol{\beta}^k + \eta_2^k\right) + \exp\left(\boldsymbol{X}_{i,3}\boldsymbol{\beta}^k + \eta_3^k\right)\right) \\
&= \ln\left(\exp\left(\kappa^k + \boldsymbol{X}_{i,1}\boldsymbol{\beta}^k + \eta_1^k\right) + \exp\left(\boldsymbol{X}_{i,2}\boldsymbol{\beta}^k + \eta_2^k\right) + \exp\left(\boldsymbol{X}_{i,3}\boldsymbol{\beta}^k + \eta_3^k\right)\right)
\end{aligned}$$
$$\text{(OA5)}$$

which is the log sum of the utility of getting the product k from each of the three potential banks in the choice set in exponential terms. It depends on κ^k because the household knows if it goes to bank 1 for product k later on, it can get some extra utility when bank 1 is the deposit bank. Similarly, the expected value that bank 2 or bank 3 can provide to household 1 is

$$\mathbb{E}V_{1,2}^k = \ln\left(\exp\left(\boldsymbol{X}_{i,1}\boldsymbol{\beta}^k + \eta_1^k\right) + \exp\left(\kappa^k + \boldsymbol{X}_{i,2}\boldsymbol{\beta}^k + \eta_2^k\right) + \exp\left(\boldsymbol{X}_{i,3}\boldsymbol{\beta}^k + \eta_3^k\right)\right) \qquad \text{(OA6)}$$

$$\mathbb{E}V_{1,3}^k = \ln\left(\exp\left(\boldsymbol{X}_{i,1}\boldsymbol{\beta}^k + \eta_1^k\right) + \exp\left(\boldsymbol{X}_{i,2}\boldsymbol{\beta}^k + \eta_2^k\right) + \exp\left(\kappa^k + \boldsymbol{X}_{i,3}\boldsymbol{\beta}^k + \eta_3^k\right)\right) \qquad \text{(OA7)}$$

Table OA1: Illustration Chart for the Expected Value

household i	bank j	expected value $\mathbb{E}V_{i,j}^k$
1	1	$\mathbb{E}V_{1,1}^k$
1	2	$\mathbb{E}V_{1,2}^k$
1	3	$\mathbb{E}V_{1,3}^k$

OB   Estimation Results

This section shows all the estimated demand-side parameters, including the ones that are not shown in the main text.

Parameters in the Value from Liquid Asset Portfolios.   Table OB2 shows all the estimated parameters in the portfolio allocation choice.

As discussed Section 3.1, in the baseline analysis, we used OLS to estimate the parameters in the value from liquid asset portfolios. We show the estimation results using the instrumental variable approach in Table OB3. Following Egan, Hortaçsu and Matvos (2017), we use the bank-specific pass-through of the policy rates (captured by the interaction terms between the policy rates and the bank indicators) into deposit rates as the instruments. The idea is to use the variation in deposit rates that is driven by the changes in input costs (i.e., policy rates), which is uncorrelated with the unobserved time-varying bank quality or demand shocks.

As discussed in Section 4.1, use the average demand deposit rates across the big five banks and National Bank to impute the deposit rates of those banks with unobserved demand deposit rates. As a robustness check, we use short-term GIC rates (30–60 days) available for 14 banks to construct alternative imputed deposit rates. Specifically, we assume the average GIC-deposit rate spread for the big five banks and National Bank applies to the other banks—i.e., the markup between the two products is similar. We calculate this average spread for each year and then subtract it from the other banks' GIC rates to impute their deposit rates. Table OB4 shows the results using the subsample of households that deposit with the 14 banks, seven with observed demand deposit rates (i.e., big five banks, National Bank, and Laurentian Bank) and seven with the imputed rates using the GIC-deposit rate spread.

Parameters in the Value from Financial Products.   Table OB5 shows the estimated parameters in the bank choices of different financial products (i.e., credit card, mortgage loan, guaranteed investment certificates).

Parameters in the Deposit Bank Choice.   Table OB6 shows the estimated parameters in the deposit bank choice.

Other Estimation Results.   In addition, this section shows the estimation results for a few alternative model specifications. Table OB7 shows that adding the posted mortgage rates into the estimation of mortgage bank choices does not change the estimate for the

preference for complementarity much. Table OB8 shows that the estimate for preference for complementarity is robust to controlling for bank fixed effects interacted with the old age indicator ($\geqslant 55$ years old), which partly capture the consumer tastes for banks that may be correlated across products. Similarly, controlling for interactions between bank fixed effects and high education indicators or high income indicators does not notably change the estimate for complementarity preference either. Table OB9 shows the results in the deposit bank choice estimation when allowing the preferences for branch networks to vary by age. It can be seen that older households tend to value the branch networks more.

Table OB2: Estimated Parameters in Portfolio Allocation Choice

Dependent variable: Log of deposit-to-cash ratio	coefficients	se
Post-tax deposit rate	0.522***	(0.193)
ln(Distance to branch)	0.004	(0.010)
ln(Distance to branch) × Live in rural area	-0.053***	(0.015)
ln(Number of branches + 1)	0.024***	(0.008)
ln(Number of branches + 1) × Live in rural area	-0.026	(0.017)
Dislike investing in stock market	0.019***	(0.003)
Having difficulty in paying off debt	-0.063***	(0.003)
Behind debt obligations in the past year	-0.280***	(0.036)
Household income $15,000 - $19,999	0.183***	(0.053)
Household income $20,000 - $24,999	0.289***	(0.052)
Household income $25,000 - $29,999	0.339***	(0.052)
Household income $30,000 - $34,999	0.473***	(0.049)
Household income $35,000 - $44,999	0.457***	(0.046)
Household income $45,000 - $54,999	0.474***	(0.046)
Household income $55,000 - $59,999	0.510***	(0.050)
Household income $60,000 - $69,999	0.512***	(0.047)
Household income $70,000 - $99,999	0.577***	(0.044)
Household income $100,000 - $149,999	0.632***	(0.046)
Household income $\geqslant$ $15,000	0.677***	(0.051)
Grade 9-13	0.092	(0.057)
Community College	0.141**	(0.058)
Diploma	0.230***	(0.057)
Undergraduate	0.387***	(0.058)
Post-graduate	0.498***	(0.061)
Household head age 35–44	-0.225***	(0.031)
Household head age 45–54	-0.331***	(0.029)
Household head age 55–64	-0.291***	(0.028)
Household head age $\geqslant$ 65	-0.079***	(0.028)
Household size = 2	-0.083***	(0.021)
Household size = 3	-0.123***	(0.029)
Household size $\geqslant$ 4	-0.127***	(0.029)
Household has a female head=1	0.295***	(0.025)
Rent a home=1	-0.266***	(0.021)
Live in rural area=1	0.088*	(0.053)
Alberta	0.029	(0.032)
Saskatchewan	0.042	(0.043)
Manitoba	0.006	(0.039)
Ontario	-0.053**	(0.024)
Quebec	-0.200***	(0.033)
New Brunswick	-0.158***	(0.056)
Prince Edward Island	-0.109	(0.112)
Nova Scotia	-0.377***	(0.042)
Newfoundland	-0.335***	(0.066)
Year 2011	-0.021	(0.028)
Year 2012	-0.030	(0.029)
Year 2013	0.001	(0.030)
Year 2014	0.016	(0.029)
Year 2015	0.061*	(0.032)
Year 2016	0.022	(0.031)
Year 2017	0.033	(0.031)
Big 5 bank indicator	-0.133***	(0.026)
Small bank indicator	-0.196***	(0.048)
Online bank indicator	-0.098**	(0.042)
Desjardins Credit Union indicator	-0.025	(0.044)
Constant	2.473***	(0.088)
Observations	62,504	

Robust standard errors in parentheses.   * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website
Note: The table shows the estimated parameters from the OLS regression of the log of deposit-to-cash ratio on the post-tax deposit rates, bank branch network, grouped bank fixed effects, and household characteristics (including region and year fixed effects). The "Observations" shows the number of households in the CFM sample from 2010 to 2017.

Table OB3: Estimated Parameters in Portfolio Allocation Choice Using Instruments

Dependent variable: Log of deposit-to-cash ratio	OLS coefficients	se	IV coefficients	se
Post-tax deposit rate	0.522***	(0.193)	0.714***	(0.216)
ln(Distance to branch)	0.004	(0.010)	0.004	(0.010)
ln(Distance to branch) × Live in rural area	-0.053***	(0.015)	-0.053***	(0.015)
ln(Number of branches)	0.024***	(0.008)	0.024***	(0.008)
ln(Number of branches) × Live in rural area	-0.026	(0.017)	-0.026	(0.017)
Dislike investing in stock market	0.019***	(0.003)	0.019***	(0.003)
Having difficulty in paying off debt	-0.063***	(0.003)	-0.063***	(0.003)
Behind debt obligations in the past year	-0.280***	(0.036)	-0.280***	(0.036)
Household income $15,000 - $19,999	0.183***	(0.053)	0.183***	(0.053)
Household income $20,000 - $24,999	0.289***	(0.052)	0.289***	(0.052)
Household income $25,000 - $29,999	0.339***	(0.052)	0.339***	(0.052)
Household income $30,000 - $34,999	0.473***	(0.049)	0.473***	(0.049)
Household income $35,000 - $44,999	0.457***	(0.046)	0.458***	(0.046)
Household income $45,000 - $54,999	0.474***	(0.046)	0.476***	(0.046)
Household income $55,000 - $59,999	0.510***	(0.050)	0.512***	(0.050)
Household income $60,000 - $69,999	0.512***	(0.047)	0.514***	(0.047)
Household income $70,000 - $99,999	0.577***	(0.044)	0.580***	(0.044)
Household income $100,000 - $149,999	0.632***	(0.046)	0.635***	(0.046)
Household income $\geqslant$ $15,000	0.677***	(0.051)	0.681***	(0.051)
Grade 9-13	0.092	(0.057)	0.092	(0.057)
Community College	0.141**	(0.058)	0.142**	(0.058)
Diploma	0.230***	(0.057)	0.230***	(0.057)
Undergraduate	0.387***	(0.058)	0.387***	(0.058)
Post-graduate	0.498***	(0.061)	0.498***	(0.061)
Household head age 35–44	-0.225***	(0.031)	-0.225***	(0.031)
Household head age 45–54	-0.331***	(0.029)	-0.331***	(0.029)
Household head age 55–64	-0.291***	(0.028)	-0.291***	(0.028)
Household head age $\geqslant$ 65	-0.079***	(0.028)	-0.079***	(0.028)
Household size = 2	-0.083***	(0.021)	-0.083***	(0.021)
Household size = 3	-0.123***	(0.029)	-0.123***	(0.029)
Household size $\geqslant$ 4	-0.127***	(0.029)	-0.127***	(0.029)
Household has a female head=1	0.295***	(0.025)	0.295***	(0.025)
Rent a home=1	-0.266***	(0.021)	-0.266***	(0.021)
Live in rural area=1	0.088*	(0.053)	0.087	(0.053)
Alberta	0.029	(0.032)	0.030	(0.032)
Saskatchewan	0.042	(0.043)	0.043	(0.043)
Manitoba	0.006	(0.039)	0.006	(0.039)
Ontario	-0.053**	(0.024)	-0.054**	(0.024)
Quebec	-0.200***	(0.033)	-0.199***	(0.033)
New Brunswick	-0.158***	(0.056)	-0.156***	(0.056)
Prince Edward Island	-0.109	(0.112)	-0.107	(0.112)
Nova Scotia	-0.377***	(0.042)	-0.375***	(0.042)
Newfoundland	-0.335***	(0.066)	-0.332***	(0.066)
Year 2011	-0.021	(0.028)	-0.020	(0.028)
Year 2012	-0.030	(0.029)	-0.028	(0.029)
Year 2013	0.001	(0.030)	0.005	(0.030)
Year 2014	0.016	(0.029)	0.021	(0.029)
Year 2015	0.061*	(0.032)	0.070**	(0.032)
Year 2016	0.022	(0.031)	0.034	(0.032)
Year 2017	0.033	(0.031)	0.045	(0.032)
Big 5 bank indicator	-0.133***	(0.026)	-0.132***	(0.026)
Small bank indicator	-0.196***	(0.048)	-0.208***	(0.049)
Online bank indicator	-0.098**	(0.042)	-0.099**	(0.042)
Desjardins Credit Union indicator	-0.025	(0.044)	-0.024	(0.044)
Constant	2.473***	(0.088)	2.453***	(0.089)
Observations	62,504		62,504	

Robust standard errors in parentheses.   * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website

Note: The table shows the estimated parameters from regressing the log of deposit-to-cash ratio on the post-tax deposit rates, bank branch network, grouped bank fixed effects, and household characteristics (including region and year fixed effects) using both the OLS and the instrumental variable IV approaches. The IV regression uses the bank-specific pass-through of the policy rates into the deposit rates as the instruments. More details can be found at the beginning of Appendix OB. The "Observations" shows the number of households in the CFM sample from 2010 to 2017.

Table OB4: Estimated Parameters in Portfolio Allocation Choice Using Imputed Rates

Dependent variable: Log of deposit-to-cash ratio	Baseline coefficients	Baseline se	7 Banks Only coefficients	7 Banks Only se	More Banks coefficients	More Banks se
Post-tax deposit rate	0.522***	(0.193)	0.560***	(0.196)		
Post-tax deposit rate (incl. imputed rates)					0.476***	(0.178)
ln(Distance to branch)	0.004	(0.010)	-0.002	(0.012)	-0.000	(0.011)
ln(Distance to branch) × Live in rural area	-0.053***	(0.015)	-0.041**	(0.019)	-0.053***	(0.017)
ln(Number of branches + 1)	0.024***	(0.008)	0.036***	(0.009)	0.034***	(0.008)
ln(Number of branches + 1) × Live in rural area	-0.026	(0.017)	-0.051**	(0.022)	-0.049***	(0.018)
Dislike investing in stock market	0.019***	(0.003)	0.021***	(0.003)	0.019***	(0.003)
Having difficulty in paying off debt	-0.063***	(0.003)	-0.064***	(0.003)	-0.065***	(0.003)
Behind debt obligations in the past year	-0.280***	(0.036)	-0.287***	(0.042)	-0.276***	(0.039)
Household income $15,000 - $19,999	0.183***	(0.053)	0.191***	(0.064)	0.236***	(0.058)
Household income $20,000 - $24,999	0.289***	(0.052)	0.289***	(0.063)	0.337***	(0.057)
Household income $25,000 - $29,999	0.339***	(0.052)	0.332***	(0.063)	0.387***	(0.057)
Household income $30,000 - $34,999	0.473***	(0.049)	0.470***	(0.060)	0.547***	(0.054)
Household income $35,000 - $44,999	0.457***	(0.046)	0.433***	(0.056)	0.497***	(0.050)
Household income $45,000 - $54,999	0.474***	(0.046)	0.480***	(0.055)	0.538***	(0.050)
Household income $55,000 - $59,999	0.510***	(0.050)	0.543***	(0.061)	0.546***	(0.055)
Household income $60,000 - $69,999	0.512***	(0.047)	0.515***	(0.057)	0.562***	(0.051)
Household income $70,000 - $99,999	0.577***	(0.044)	0.582***	(0.054)	0.627***	(0.048)
Household income $100,000 - $149,999	0.632***	(0.046)	0.617***	(0.056)	0.671***	(0.051)
Household income ⩾ $15,000	0.677***	(0.051)	0.659***	(0.061)	0.717***	(0.056)
Grade 9-13	0.092	(0.057)	0.118*	(0.070)	0.109*	(0.060)
Community College	0.141**	(0.058)	0.194***	(0.071)	0.172***	(0.061)
Diploma	0.230***	(0.057)	0.263***	(0.071)	0.244***	(0.061)
Undergraduate	0.387***	(0.058)	0.436***	(0.071)	0.410***	(0.061)
Post-graduate	0.498***	(0.061)	0.560***	(0.075)	0.536***	(0.065)
Household head age 35–44	-0.225***	(0.031)	-0.213***	(0.037)	-0.220***	(0.034)
Household head age 45–54	-0.331***	(0.029)	-0.303***	(0.035)	-0.327***	(0.031)
Household head age 55–64	-0.291***	(0.028)	-0.288***	(0.033)	-0.301***	(0.030)
Household head age ⩾ 65	-0.079***	(0.028)	-0.079**	(0.034)	-0.088***	(0.031)
Household size = 2	-0.083***	(0.021)	-0.084***	(0.024)	-0.088***	(0.022)
Household size = 3	-0.123***	(0.029)	-0.099***	(0.034)	-0.111***	(0.032)
Household size ⩾ 4	-0.127***	(0.029)	-0.117***	(0.034)	-0.131***	(0.032)
Household has a female head=1	0.295***	(0.025)	0.319***	(0.030)	0.318***	(0.027)
Rent a home=1	-0.266***	(0.021)	-0.274***	(0.025)	-0.274***	(0.023)
Live in rural area=1	0.088*	(0.053)	0.147**	(0.063)	0.159***	(0.058)
Alberta	0.029	(0.032)	-0.017	(0.038)	0.011	(0.035)
Saskatchewan	0.042	(0.043)	0.091*	(0.054)	0.111**	(0.054)
Manitoba	0.006	(0.039)	-0.112**	(0.048)	-0.102**	(0.048)
Ontario	-0.053**	(0.024)	-0.083***	(0.028)	-0.066**	(0.027)
Quebec	-0.200***	(0.033)	-0.232***	(0.037)	-0.219***	(0.035)
New Brunswick	-0.158***	(0.056)	-0.069	(0.063)	-0.065	(0.063)
Prince Edward Island	-0.109	(0.112)	-0.046	(0.128)	-0.024	(0.127)
Nova Scotia	-0.377***	(0.042)	-0.363***	(0.047)	-0.354***	(0.046)
Newfoundland	-0.335***	(0.066)	-0.316***	(0.070)	-0.299***	(0.069)
Year 2011	-0.021	(0.028)	-0.010	(0.033)	-0.011	(0.030)
Year 2012	-0.030	(0.029)	-0.015	(0.034)	-0.028	(0.032)
Year 2013	0.001	(0.030)	0.007	(0.035)	-0.008	(0.032)
Year 2014	0.016	(0.029)	0.017	(0.034)	0.011	(0.032)
Year 2015	0.061*	(0.032)	0.019	(0.038)	0.040	(0.035)
Year 2016	0.022	(0.031)	0.032	(0.036)	0.022	(0.034)
Year 2017	0.033	(0.031)	0.042	(0.036)	0.026	(0.034)
Big 5 bank indicator	-0.133***	(0.026)	0.072	(0.047)	-0.108*	(0.057)
Small bank indicator	-0.196***	(0.048)	0.000	(.)	-0.162**	(0.066)
Online bank indicator	-0.098**	(0.042)	0.000	(.)	0.001	(0.099)
Desjardins Credit Union indicator	-0.025	(0.044)	0.000	(.)	0.009	(0.067)
Constant	2.473***	(0.088)	2.179***	(0.116)	2.362***	(0.110)
Observations	62,504		44,645		52,790	

Robust standard errors in parentheses.   * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website

Note: The table shows the estimation results using three different samples. The "Baseline" column reports the baseline results using all households. "7 Banks Only" uses the subsample of households that have deposit accounts at the seven banks with observed demand deposits rates, covering around 71% of the sample. "More Banks" adds households that deposit with seven additional banks with unobserved demand deposit rates but observed short-term GIC rates, covering around 84% of the sample. We impute their demand deposit rates using the average spread between GIC and demand deposit rates from the big five banks and National Bank. See Appendix OB for more details. "Observations" shows the number of households in the CFM sample from 2010 to 2017.

Table OB5: Estimated Parameters in Bank Choices of Different Financial Products

	(1) Credit Card		(2) Mortgage		(3) GIC	
Preference for Complementarity	2.351***	(0.010)	2.671***	(0.016)	2.916***	(0.018)
ln(Distance to branch)	-0.117***	(0.008)	-0.123***	(0.015)	-0.156***	(0.015)
ln(Distance to branch) × Live in rural area	0.003	(0.013)	-0.026	(0.024)	-0.055**	(0.025)
ln(Number of branches + 1)	0.083***	(0.007)	0.132***	(0.014)	0.086***	(0.014)
ln(Number of branches + 1) × Live in rural area	0.030**	(0.014)	0.044*	(0.026)	-0.026	(0.026)
TD indicator	0.768***	(0.029)	0.032	(0.041)	-0.318***	(0.043)
RBC indicator	1.161***	(0.028)	0.078**	(0.038)	-0.387***	(0.042)
Scotiabank indicator	0.688***	(0.030)	0.388***	(0.039)	-0.281***	(0.043)
BMO indicator	1.519***	(0.029)	-0.356***	(0.041)	-0.713***	(0.044)
CIBC indicator	1.345***	(0.029)	0.110***	(0.040)	-0.635***	(0.044)
National Bank indicator	0.324***	(0.035)	-0.099**	(0.046)	-1.052***	(0.055)
Laurentian Bank indicator	-0.042	(0.059)	-0.298***	(0.079)	-1.215***	(0.091)
HSBC indicator	-1.043***	(0.064)	-1.383***	(0.081)	-1.805***	(0.089)
Canadian Western Bank indicator	-5.677***	(1.000)	-2.618***	(0.247)	-1.412***	(0.127)
Desjardins Credit Union indicator	0.976***	(0.032)	0.062	(0.047)	-0.832***	(0.054)
Vancity Credit Union indicator	-0.057	(0.075)	-0.643***	(0.105)	-0.672***	(0.124)
ATB Financial indicator	-0.295***	(0.073)	-0.469***	(0.095)	-0.546***	(0.093)
Coast Capital Credit Union indicator	-0.969***	(0.097)	-0.532***	(0.099)	-0.226**	(0.094)
Envision Credit Union indicator	-1.548***	(0.212)	-1.166***	(0.195)	-0.988***	(0.196)
Prospera Credit Union indicator	-2.638***	(0.352)	-1.050***	(0.148)	-1.265***	(0.191)
Meridian Credit Union indicator	-2.421***	(0.170)	-1.212***	(0.094)	-1.098***	(0.093)
Tangerine indicator	-1.128***	(0.061)	-0.694***	(0.060)	0.303***	(0.046)
PC Financial indicator	1.517***	(0.030)	-1.206***	(0.058)	-1.815***	(0.073)
Other bank indicator	0.770***	(0.045)	0.025	(0.073)	-0.804***	(0.090)
AMEX indicator	1.578***	(0.031)				
MBNA indicator	1.185***	(0.033)				
Canadian Tire indicator	1.564***	(0.031)				
Capital One indicator	1.595***	(0.031)				
Other financial institutions indicator			1.353***	(0.038)	1.708***	(0.038)
Trust companies indicator			-0.125**	(0.053)	-0.229***	(0.055)
Observations	1,075,719		314,230		292,732	
Number of choice sets	72,449		24,603		22,858	

Robust standard errors in parentheses

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

Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website

Note: Each column in the table shows the estimated parameters from a conditional logistic regression of the bank choice of a given financial product (i.e., credit card, mortgage loan, guaranteed investment certificate [GIC]) on the deposit bank indicator, branch network, and all bank fixed effects. The "Number of choice sets" denotes the number of households in the sample, while "Observations" represents the cumulative total of alternatives/banks within each household's choice set.

Table OB6: Estimated Parameters in Deposit Bank Choice

Variables	Estimates
Utility from liquidity holding	1.661***
	(0.179)
Sum of expected utilities from financial products	1.368***
	(0.038)
ln(Distance to branch)	-0.175***
	(0.008)
ln(Distance to branch) × Live in rural area	0.113***
	(0.015)
ln(Number of branches + 1)	0.439***
	(0.011)
ln(Number of branches + 1) × Live in rural area	0.229***
	(0.021)
Big 5 bank indicator	-0.259***
	(0.033)
Small bank indicator	-0.454***
	(0.033)
Online bank indicator	0.389***
	(0.027)
Desjardins Credit Union indicator	0.109***
	(0.026)
Observations	674,536
Number of choice sets	62,504

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website
Note: The table shows the estimated parameters from a conditional logistic regression of the deposit bank choice on the utilities from liquidity holding $\tilde{V}_{i,j}^{b}$, the sum of expected utilities from financial products $\sum_{k \in \mathcal{K}} \omega^k \mathbb{E} V_{i,j}^k$, the branch network measures, and grouped bank fixed effects. The "Number of choice sets" denotes the number of households in the sample, while "Observations" represents the cumulative total of alternatives/banks within each household's choice set.

Table OB7: Including Posted Mortgage Rates in Bank Choices for Mortgage Loans

	(1) No price	(2) With price	(3) With price
Preference for Complementarity	2.671***	2.671***	2.675***
	(0.016)	(0.016)	(0.016)
ln(Distance to branch)	-0.123***	-0.123***	-0.110***
	(0.015)	(0.015)	(0.015)
ln(Distance to branch) × Live in rural area	-0.026	-0.026	-0.034
	(0.024)	(0.024)	(0.024)
ln(Number of branches + 1)	0.132***	0.132***	0.159***
	(0.014)	(0.014)	(0.014)
ln(Number of branches + 1) × Live in rural area	0.044*	0.044*	0.043
	(0.026)	(0.026)	(0.026)
Posted mortgage rate		0.071	-1.574***
		(0.207)	(0.140)
Observations	314,230	314,230	314,230
Number of choice sets	24,603	24,603	24,603
Bank fixed effects	yes	yes	
Grouped bank fixed effects			yes

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website
Note: Each column in the table shows the estimated parameters from a conditional logistic regression of the bank choice of mortgage loan on different set of variables, including the deposit bank indicator, branch network, posted mortgage rates, and bank fixed effects. Column (1) is identical to the baseline results in Table 3, where mortgage rates are not included but bank fixed effects are included to absorb part of the variation in prices. Column (2) adds the posted mortgage rates (5-year closed mortgage rates available for the big six banks) to the specification in column (1). Column (3) also includes the posted mortgage rates, but instead of controlling for all bank fixed effects, grouped bank fixed effecs are included so that the price coefficient can be estimated using the cross-bank variation. The "Number of choice sets" denotes the number of households in the sample, while "Observations" represents the cumulative total of alternatives/banks within each household's choice set.

Table OB8: Including Bank Fixed Effects Interacted with Household Characteristics

	(1) Credit Card	(2) Credit Card	(3) Mortgage	(4) Mortgage	(5) GIC	(6) GIC
Preference for Complementarity	2.351***	2.347***	2.671***	2.665***	2.916***	2.909***
	(0.010)	(0.010)	(0.016)	(0.016)	(0.018)	(0.018)
ln(Distance to branch)	-0.117***	-0.116***	-0.123***	-0.121***	-0.156***	-0.153***
	(0.008)	(0.008)	(0.015)	(0.015)	(0.015)	(0.015)
ln(Distance to branch) × Live in rural area	0.003	0.003	-0.026	-0.028	-0.055**	-0.060**
	(0.013)	(0.013)	(0.024)	(0.024)	(0.025)	(0.025)
ln(Number of branches + 1)	0.083***	0.090***	0.132***	0.141***	0.086***	0.089***
	(0.007)	(0.007)	(0.014)	(0.015)	(0.014)	(0.014)
ln(Number of branches + 1) × Live in rural area	0.030**	0.026*	0.044*	0.037	-0.026	-0.031
	(0.014)	(0.014)	(0.026)	(0.026)	(0.026)	(0.026)
Observations	1,075,719	1,075,719	314,230	314,230	292,732	292,732
Number of choice sets	72,449	72,449	24,603	24,603	22,858	22,858
Bank fixed effects	yes	yes	yes	yes	yes	yes
Bank fixed effects interacted with characteristics		yes		yes		yes

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website
Note: Each column in the table shows the estimated parameters from a conditional logistic regression of the bank choice of a given financial product (i.e., credit card, mortgage loan, guaranteed investment certificate [GIC]) on the deposit bank indicator, branch network, and all bank fixed effects. On top of these variables, columns (2), (4), and (6) control for bank fixed effects interacted with the old age indicator ($\geqslant$ 55 years old) to partly capture the household tastes for a given bank that are correlated across products. Controlling for interactions between bank fixed effects and high education indicators or high income indicators does not notably change the estimate for the preference for complementarity either. Columns (1), (3), and (5) are identical to the baseline results in Table 3. The "Number of choice sets" denotes the number of households in the sample, while "Observations" represents the cumulative total of alternatives/banks within each household's choice set.

Table OB9: Deposit Bank Choice Allowing Preferences for Branch Networks to Vary by Age

Variables	Estimates
Utility from liquidity holding	1.449***
	(0.188)
Sum of expected utilities from financial products	1.364***
	(0.040)
ln(Distance to branch)	-0.104***
	(0.017)
ln(Distance to branch) $\times$ Live in rural area	0.110***
	(0.015)
ln(Distance to branch) $\times$ I(age between 35-44)	-0.058**
	(0.024)
ln(Distance to branch) $\times$ I(age between 45-54)	-0.066***
	(0.022)
ln(Distance to branch) $\times$ I(age between 55-64)	-0.113***
	(0.020)
ln(Distance to branch) $\times$ I(age greater than 64)	-0.075***
	(0.020)
ln(Number of branches + 1)	0.330***
	(0.020)
ln(Number of branches + 1) $\times$ Live in rural area	0.207***
	(0.019)
ln(Number of branches + 1) $\times$ I(age between 35-44)	-0.029
	(0.025)
ln(Number of branches + 1) $\times$ I(age between 45-54)	0.072***
	(0.024)
ln(Number of branches + 1) $\times$ I(age between 55-64)	0.167***
	(0.024)
ln(Number of branches + 1) $\times$ I(age greater than 64)	0.314***
	(0.024)
Observations	674,536
Number of choice sets	62,504

Robust standard errors in parentheses

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

Data sources: CFM 2010–2017, CANNEX 2010–2017, FCAC 2010–2017, Government of Canada website

Note: The table shows the estimated parameters from a conditional logistic regression of the deposit bank choice on the utilities from liquidity holding $\tilde{V}_{i,j}^b$, the sum of expected utilities from financial products $\sum_{k \in \mathcal{K}} \omega^k \mathbb{E} V_{i,j}^k$, the branch network measures and their interaction terms with the rural indicator and household head age categories. The grouped bank fixed effects are also included but not shown in the table. The "Number of choice sets" denotes the number of households in the sample, while "Observations" represents the cumulative total of alternatives/banks within each household's choice set.

OC Counterfactual Results

This section shows some additional counterfactual results from the baseline setup. Figure OC1 shows the aggregate CBDC shares when the interest rate paid on CBDC is 1.5% or 4%, which is substantially higher than the average deposit rate of 10 basis points during 2010–2017. Figure OC2 shows the percentage changes in aggregate deposits and aggregate cash under different designs of a CBDC. Figures OC3 and OC4 show the aggregate effects of a CBDC on the equilibrium outcomes and the impact of the CBDC on different banks when assuming the CBDC fixed effect equals the estimated fixed effect for small banks. Figure OC5 shows that the results on CBDC holding limits are robust to different assumptions on the values of σ, ranging from 0.1 to 0.9.

We also show the counterfactual results using a different set of estimated parameters from a model specification that allows the preferences for branch network to vary by household head age. Figure OC6 shows that when allowing the preferences for branch network to vary by age, the aggregate CBDC shares are slightly higher than those in the baseline analysis. Figure OC7 shows that applying the branch network preferences of the youngest group (below 35 years old) to all households in the counterfactual analysis leads to smaller impacts of CBDC service locations. As a result, the aggregate CBDC shares under the extensive network of service locations are lower than those in the baseline analysis.

Figure OC1: Aggregate CBDC Shares under Different CBDC Interest Rates

(a) CBDC rate equals 0% or 1.5%   (b) CBDC rate equals 0% or 4%
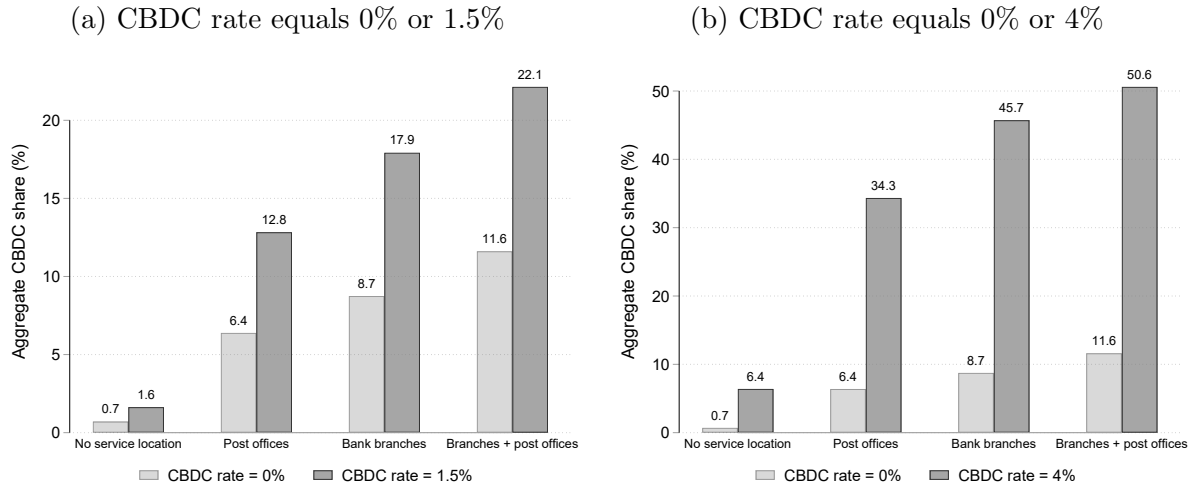
Data sources: CFM 2017, FCAC 2017, Canada Post 2021, Government of Canada website
Note: Each figure plots the aggregate CBDC share, calculated as the share of liquid assets allocated in equilibrium by households to the CBDC, under four designs of branch network for CBDC (i.e., no service location, all Canada Post offices as service locations, all bank branches as service locations, and all bank branches plus all Canada Post offices as service locations), combined with two different remuneration for CBDC. Here, we assume the CBDC fixed effect is identical to that of the big five banks.

Figure OC2: Impact of CBDC Designs on Aggregate Cash and Aggregate Deposits
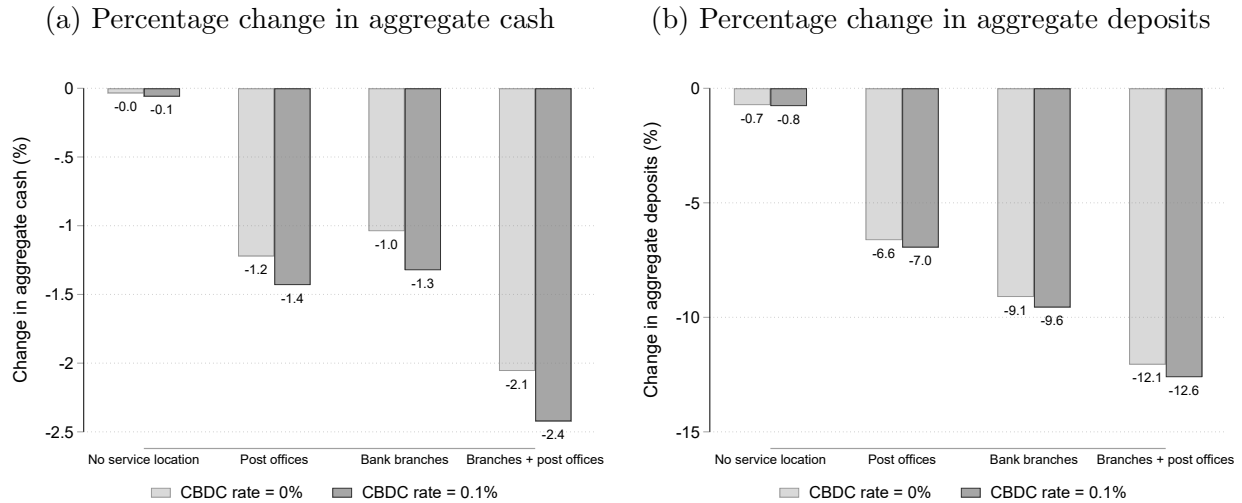
(a) Percentage change in aggregate cash   (b) Percentage change in aggregate deposits

Data sources: CFM 2017, FCAC 2017, Canada Post 2021, Government of Canada website
Note: This figure plots the percentage changes in the aggregate cash and the aggregate deposit holdings relative to their pre-CBDC values, under four designs of branch network for CBDC (i.e., no service location, all Canada Post offices as service locations, all bank branches as service locations, and all bank branches plus all Canada Post offices as service locations), combined with two different remuneration for CBDC. Here, we assume the CBDC fixed effect is identical to that of the big five banks. Before CBDC issuance, the aggregate cash share is around 4.5% and the aggregate deposit share is around 95.5%.

Figure OC3: Impact of CBDC Designs on Equilibrium Outcomes When CBDC Fixed Effect Equals the Small Bank Fixed Effect
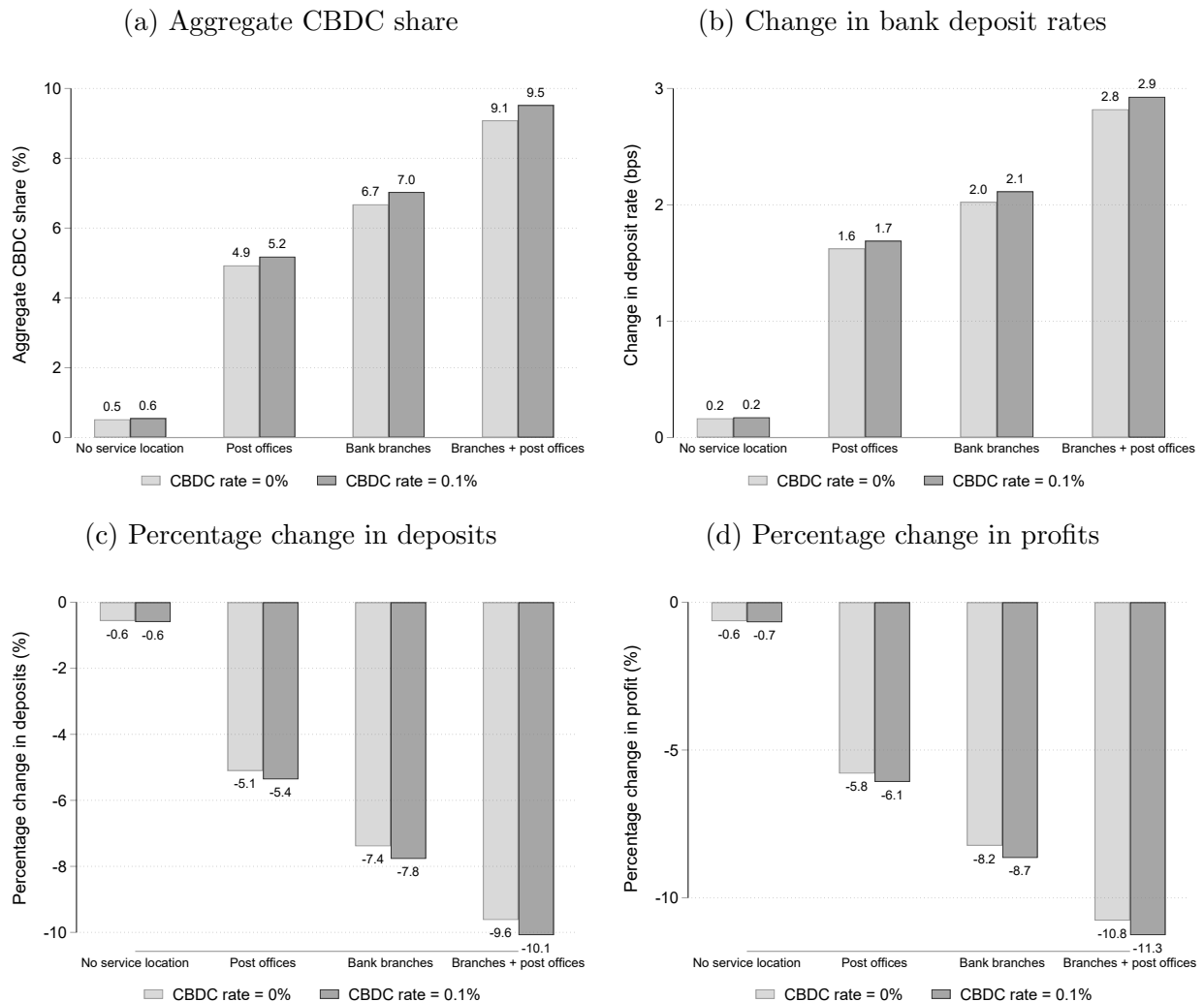
(a) Aggregate CBDC share

(b) Change in bank deposit rates

(c) Percentage change in deposits

(d) Percentage change in profits

Data sources: CFM 2017, FCAC 2017, Canada Post 2021, Government of Canada website
Note: This figure plots (a) the aggregate CBDC share calculated as the share of liquid assets allocated in equilibrium by households to the CBDC, (b) the average endogenous change in deposit rate (in basis points) across banks, (c) the average percentage drop in deposits across banks, and (d) the average percentage drop in profits across banks relative to the pre-CBDC equilibrium. In each graph, the given equilibrium outcome is plotted under four designs of service locations for CBDC (i.e., no service location, all Canada Post offices as service locations, all bank branches as service locations, and all bank branches plus all Canada Post offices as service locations), combined with two different remuneration for CBDC: 0 and 10 basis points. In this figure, we use the fixed effect for the small banks as the CBDC fixed effect.

Figure OC4: Impact of CBDC on Different Banks Under Small Bank Fixed Effect
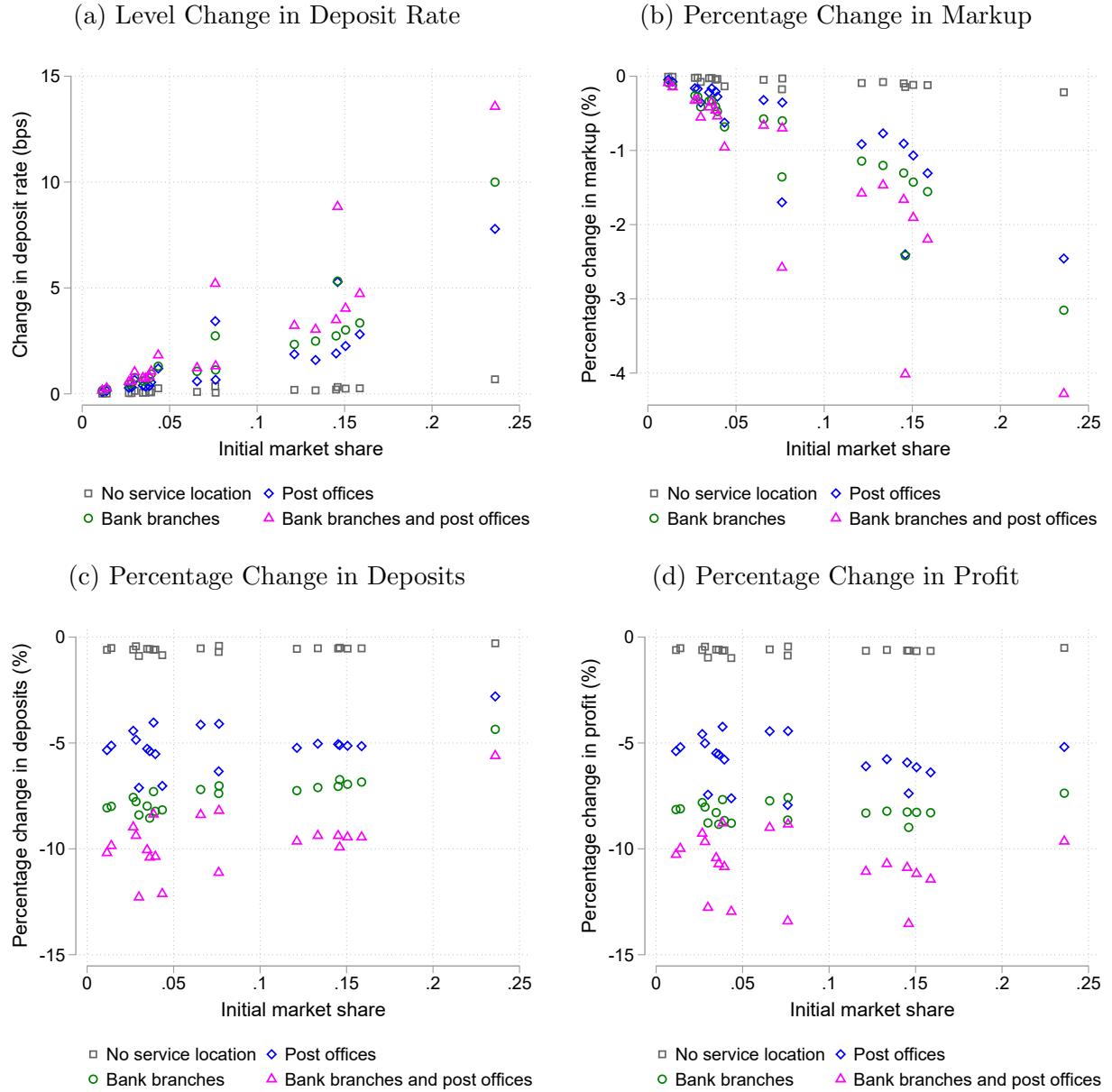
(a) Level Change in Deposit Rate

(b) Percentage Change in Markup

(c) Percentage Change in Deposits

(d) Percentage Change in Profit

Data sources: CFM 2017, FCAC 2017, Canada Post 2021, Government of Canada website

Note: This figure plots each bank's optimal response in deposit rates (in basis points), the percentage changes in markups, deposits, and profits for four different CBDC network designs (i.e., no service location, all Canada Post offices, all bank branches, both bank branches and Canada Post offices). The x-axis is the bank's initial market share, calculated by averaging the estimated probabilities of households choosing the bank across all local markets (around households' residences) in which the bank operates. Here, we assume the CBDC is non-interest-bearing and has a fixed effect that is identical to that of the small banks.

Figure OC5: Impacts of CBDC Holding Limits under Different σ Values
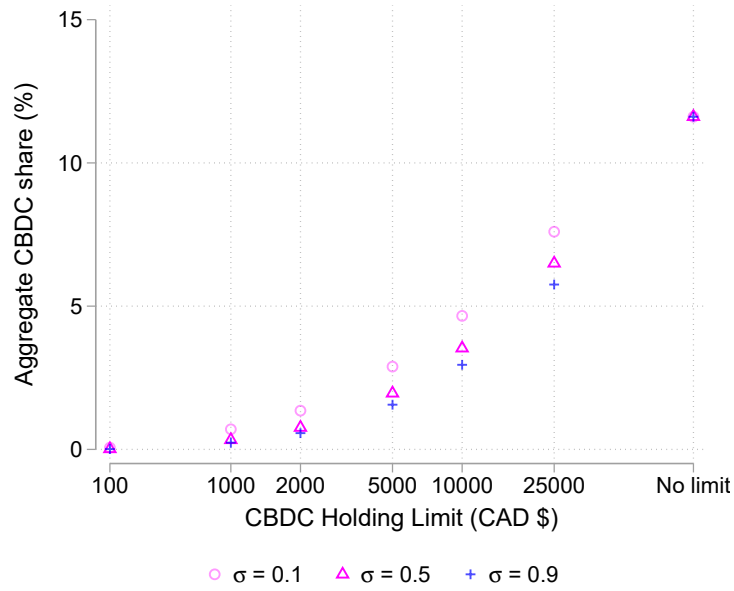
Data sources: CFM 2017, FCAC 2017, Canada Post 2021, Government of Canada website
Note: This figure shows the impacts of the CBDC holding limits on the aggregate CBDC share under different assumed values of σ, the substitution parameter between cash and digital balance. The aggregate CBDC share is the share of households' total liquid assets allocated into the CBDC in equilibrium. The x-axis is displayed on a log scale for clarity. Here, we assume the CBDC is non-interest-bearing, provides a service location network that consists of all Canada Post offices and bank branches, and has a fixed effect that is identical to that of the big five banks.
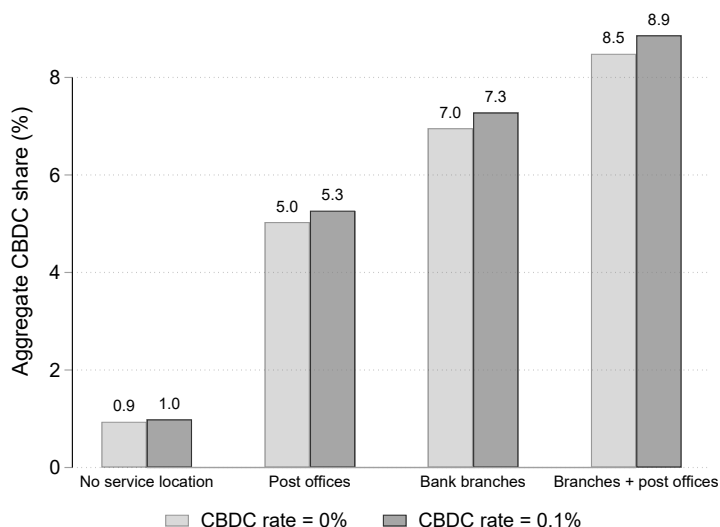
Figure OC6: Allowing Preferences for Branch Network to Vary by Age
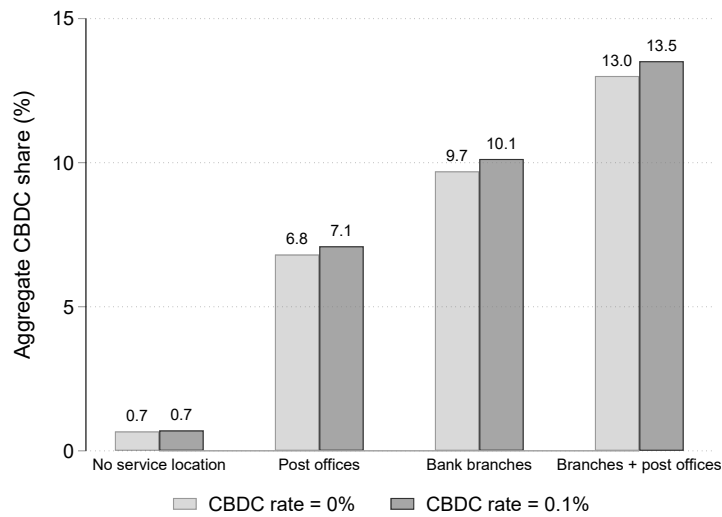
Data sources: CFM 2017, FCAC 2017, Canada Post 2021, Government of Canada website

Note: This figure plots the aggregate CBDC share under a different model specification where the interaction terms between the branch network measures and the household head age categories are included in estimating the household problem. Table OB9 in Internet Appendix OB shows the estimates in the deposit bank choice. The aggregate CBDC share is calculated as the share of liquid assets allocated in equilibrium by households to the CBDC, under four designs of branch network for CBDC (i.e., no service location, all Canada Post offices as service locations, all bank branches as service locations, and all bank branches plus all Canada Post offices as service locations), combined with two different remuneration for CBDC. Here, we assume the CBDC fixed effect is identical to that of the big five banks.

Figure OC7: Applying Young Households' Preferences for Branch Network to All


Data sources: CFM 2017, FCAC 2017, Canada Post 2021, Government of Canada website

Note: This figure plots the aggregate CBDC share under a different model specification where the interaction terms between the branch network measures and the household head age categories are included in estimating the household problem. Table OB9 in Internet Appendix OB shows the estimates in the deposit bank choice. The difference from Figure OC6 above is that the youngest group's (below 35 years old) preferences for branch network are applied to all households in the counterfactual analysis. The aggregate CBDC share is calculated as the share of liquid assets allocated in equilibrium by households to the CBDC, under four designs of branch network for CBDC (i.e., no service location, all Canada Post offices as service locations, all bank branches as service locations, and all bank branches plus all Canada Post offices as service locations), combined with two different remuneration for CBDC. Here, we assume the CBDC fixed effect is identical to that of the big five banks.

OD   Distribution of Household Liquid Assets

Figure OD8 shows the distribution of households' liquid assets which are defined as the sum of cash and demand deposit holdings.

Figure OD8: Distribution of Household Liquid Assets

(a) Empirical CDF

(b) Percentage of total liquid assets by decile
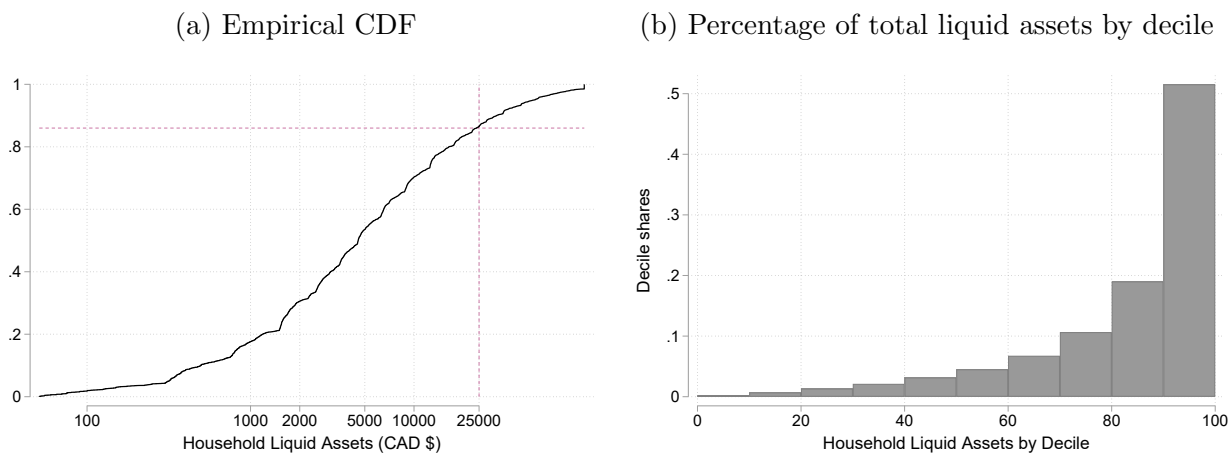
Data sources: CFM 2017

Note: This figure shows the distribution of households' liquid assets, defined as the sum of cash and demand deposit holdings. Panel (a) shows the empirical cumulative distribution function for 2017 from the CFM. For a given level of assets on the x-axis, the corresponding level on the y-axis refers to the percentage of households holding less than that amount. Panel (b) shows the percentage of total liquid assets held by each decile. For example, the height of the 10th bar shows that households from the 90th to 100th percentile hold 51% of total liquid assets.