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This work was performed under a pre-analysis plan, registered with the Open Science Framework. The Online Appendix explains where to find the plan and contains all planned analysis that did not make it into this paper.

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Abstract

This paper explores the merits of introducing a retail central bank digital currency (CBDC) in Australia, focusing on the extent to which consumers would value having access to a digital form of money that is even safer and potentially more private than commercial bank deposits. To conduct our exploration we run a discrete choice experiment, which is a technique designed specifically for assessing public valuations of goods without markets. The results suggest that the average consumer attaches no value to the added safety of a CBDC. This is consistent with bank deposits in Australia already being perceived as a safe form of money, and physical cash issued by the Reserve Bank of Australia continuing to be available as an alternative option. Privacy settings of a CBDC, which can take various forms, look more consequential for the CBDC value proposition. We find no clear relationship between safety or privacy valuations and the degree of consumers' cash use.

JEL Classification Numbers: C90, E42, E50, G21

Keywords: central bank digital currency, data privacy, financial safety, willingness to pay

Table of Contents

1. Introduction

Policymakers in Australia and elsewhere are considering the potential benefits and costs associated with introducing a retail central bank digital currency (CBDC). This is a digital version of physical currency issued by the central bank, which would complement, not replace, the circulation of physical currency in the form of notes (and coins). It would be available for use by all consumers and businesses, as opposed to 'wholesale' forms of CBDC, which would typically be restricted to transactions between large financial entities.

An obstacle to forming a position on the merits of a retail CBDC is uncertainty about the value that consumers and businesses would place in having access to one. The main concern here is the potential to introduce a retail CBDC that few people would want. A strong CBDC value proposition could also create challenges, if the resulting take-up displaces a lot of commercial bank funding. While some of these challenges could be addressed with policies that restrain CBDC holdings (Bank of England and HM Treasury 2023; European Central Bank 2023), it remains unclear as to how many potential CBDC benefits would be foregone by restricting its use.

In this paper we aim to deepen policymaker understanding of the CBDC value proposition by investigating how much Australian consumers value two features that could differentiate CBDC from other existing or emerging forms of digital money. In particular, we investigate:

1. How much would Australian consumers value access to a digital form of money that represents a claim on the Reserve Bank of Australia (RBA), rather than a commercial bank? This is one of the main value propositions of a CBDC, since money issued by the RBA has no credit risk.

2. How much does the perceived value proposition of a CBDC depend on design choices about privacy? Policymakers probably could not introduce a retail CBDC with complete anonymity, on account of the financial crime implications. But it could be designed in such a way that it restricts data sharing to different entities compared to existing forms of digital money, or even allow for anonymity for small transactions (European Central Bank 2023).

The available evidence from other jurisdictions on the first question is mixed. For example, most consumers in recent CBDC focus group consultations conducted for the European Central Bank did not see a difference between central bank and commercial bank money (Kantar Public 2022), a view that Brainard (2022) opines would also be true for the average US consumer. Evidence from a Dutch survey, however, shows that many consumers there do see the difference and would value it (Bijlsma *et al* 2021). Cash holdings in advanced economies do increase during times of economic uncertainty (Guttmann *et al* 2021), but it is unclear to what extent that owes to confidence derived from the physical nature of cash, as opposed to its status as a claim on the central bank.

Existing research has also investigated the strength of privacy preferences for CBDC, again with mixed results. For example, people responding to CBDC consultation papers have generally expressed strong preferences for complete anonymity (Bank of England 2021; European Central Bank 2021; RBNZ 2022), while focus group consultations, which use more representative samples, tend to reveal far weaker preferences (Kantar Public 2022). A more consistent message emerges from research on the topic of potential CBDC uptake, with privacy settings often arising as important determinants (see a survey by Chapman *et al* (2023), and extensions by Choi, Kim, Kim and

Kwon (2023) and Choi, Kim, Kim, Kwon and Park (2023)). Moving beyond only CBDC, participants in a representative Australian survey state that they put high importance on privacy when choosing goods or services and are generally more comfortable sharing data with government agencies than with financial institutions (Office of the Australian Information Commissioner 2023). But the broader privacy literature also shows that people regularly forego privacy even when stating strong preferences for it. For example, Acquisti, Taylor and Wagman (2016) explain that, while surveys repeatedly highlight privacy as a major concern for internet users, most consumers continue to use information technologies that track personal information, even when more private alternatives exist. This paradox makes privacy a challenging area to study.

A novel feature of our work is that we use a discrete choice experiment to estimate people's willingness to pay for the potential safety and privacy characteristics of CBDC. Although more commonly used in applications of health and environmental economics, the discrete choice experiment technique has been designed explicitly for the purpose of assessing public valuations of goods or services that do not have markets. It does so in such a way that addresses common concerns with analyses of stated preferences, which matters in our application because no advanced economy has introduced a CBDC that might generate data relating to revealed preferences. Moreover, the few CBDCs that do exist are in their infancy and have a way to go before reaching informative levels of maturity. We favour the willingness-to-pay metric not because we take a position on whether CBDCs would or should have fees, but because the metric has an objective interpretation and a format that is useful for cost-benefit analysis.

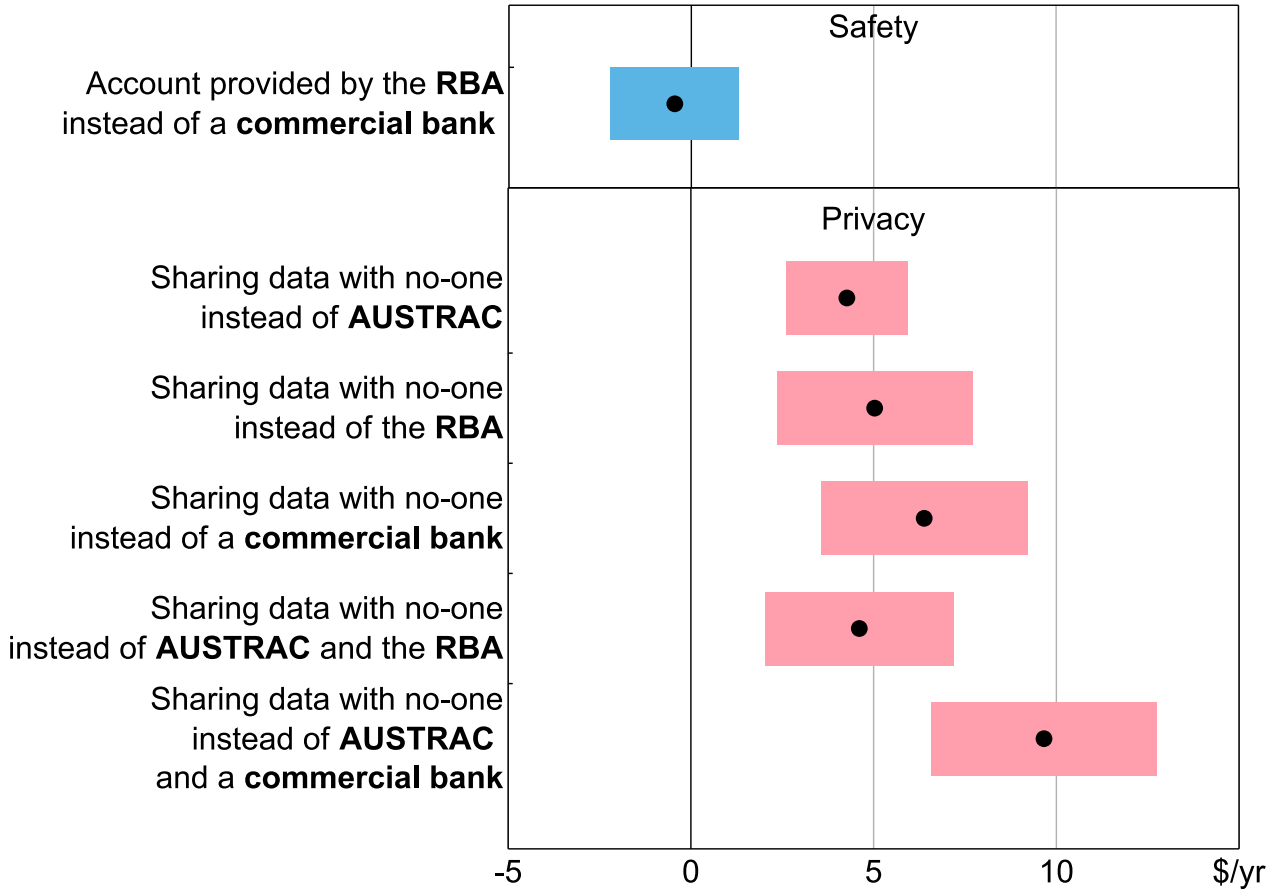
A second key feature of our work is its focus on CBDC attitudes of Australians. These attitudes might resemble those in other jurisdictions, but the available evidence suggests generalisations would be risky. For example, European Central Bank (2021) shows that stated preferences for privacy can differ materially even across culturally similar, neighbouring countries. Moreover, regarding safety, data from the OECD shows that trust in government differs markedly across OECD countries (with Australia around the middle of the distribution).[1] We run our experiment using the 2022 RBA Consumer Payments Survey (CPS), which is a large, nationally representative survey of payments behaviour in the Australian household sector. As it is a consumer survey, we are unable to comment on the CBDC attitudes of businesses.

Overall, our work is closest to the research of Choi, Kim, Kim, Kwon and Park (2023), which was conducted concurrently with ours. They too use a discrete choice experiment to examine valuations of CBDC characteristics. Their focus is, however, on South Korea, and in many other respects our research designs are very different. Notably, we study the safety benefits of CBDC as they would be perceived by the public, rather than attempting to specify any risks of losses ourselves, and we explore the extent to which consumers differentiate between the types of entities that could have access to transaction information, rather than only on the degree of information access overall. We also focus on consumers' willingness to pay for different safety and privacy characteristics in a CBDC account (or 'wallet'), rather than in specific payment scenarios.

1 See the OECD data site for the indicator 'Trust in government', available at <https://data.oecd.org/gga/trust-in-government.htm> and accessed on 2 December 2023.

Our results suggest that Australians on average are not willing to pay anything for the added safety of digital central bank money (Figure 1). This is consistent with the range of government measures already in place in Australia to make commercial bank deposits safe, such as deposit insurance, depositor preference, bank supervision (all described in Turner (2011)), and the RBA's role as lender of last resort (Jones 2023). For Australians to value a retail CBDC enough to justify issuance, our results suggest the CBDC would need to deliver a value proposition other than safety.

Figure 1: Estimates of Average Willingness to Pay
2022



Note: Shading shows 95 per cent confidence intervals, calculated using the delta method.
Source: RBA calculations, based on data from Ipsos.

Privacy settings appear a more consequential issue. The average consumer values transaction anonymity and, to the extent that transaction data do need to be shared with other entities, the average consumer cares about who those entities are. For example, we estimate that Australian consumers are willing to pay an average of $5 (roughly US$3) per year more for access to an account that makes transaction data available to the RBA instead of a commercial bank, assuming that Australia's financial crime authority, AUSTRAC (Australian Transaction Reports and Analysis Centre), can access transaction data in both cases (the difference between the final two bars in Figure 1). Aggregated over the adult population, this equates to $100 million (roughly US$60 million) per year, a figure that would rise a little further if the account also offered anonymity for small transactions.[2] Though material, we do not judge this to be an amount that would easily overwhelm the range of

2 We estimate that the Australian consumer is willing to pay a further $5 (aggregated to another $100 million) for full anonymity. We assume that partial anonymity would deliver part of this estimated benefit.

other considerations relevant to the CBDC issuance decision. There is also an open question about whether this privacy configuration is compatible with other policymaker expectations that central banks would 'develop the technology to issue CBDC to private sector entities with those entities then responsible for all customer-facing activities' (Richards, Thompson and Dark 2020).

When investigating the heterogeneity of preferences, we find that valuations of safety and privacy are stable across ages and common ranges of cash usage. Lower income individuals do appear to put slightly higher valuations on safety than higher income individuals though.

2. Survey Question for the Discrete Choice Experiment

Readers of this paper might not be familiar with the discrete choice experiment technique, as it is used rarely in the literature on money and central banking.[3] We offer an introduction here, as it pertains to our specific application, and highlight important features and our rationale along the way. This necessarily involves a heavy focus on the survey question that forms the basis for the discrete choice experiment, since the question wording has a significant impact on the validity of our conclusions (as is the case with all surveys). The statistical methods used for the analysis of discrete choice experiment responses are typically far less controversial. For readers looking for a comprehensive outline of the discrete choice experiment technique, we recommend Fiebig and Hall (2005).

We asked CPS respondents the following question, randomising the entries in the table shown to each respondent. The full set of choices is shown in the table below, with the respondent only seeing one option for each account.

> There is a debate about whether people should be allowed to have bank accounts at the Reserve Bank of Australia, which is government-owned. People would be able to access their money using mobile phones, computers, or cards, just like they can at other banks already offering bank accounts.
>
> This question seeks to understand how much you would value this option.
>
> Assume that you are opening a new bank account. You have found two options, both offering the same functionality for making withdrawals, deposits, and electronic payments. The only differences are described in the table below.
>
> Which account looks more attractive to you?

3 On the topic of Australian payments, one example is Lam and Ossolinski (2015), who estimate willingness to pay surcharges to use debit cards and credit cards, rather than cash.

	Account A	Account B
What is the account fee? (Each cell contains 1 of 2 possible entries, randomised)	1. [$20] or 2. [$25] per year	1. [$20] or 2. [$25] per year
Who provides the account and is responsible for protecting the money in it? (Each cell contains 1 of 2 possible entries, randomised)	1. [The Reserve Bank of Australia] or 2. [One of the large banks already offering accounts in Australia]	1. [The Reserve Bank of Australia] or 2. [One of the large banks already offering accounts in Australia]
Who could potentially access my transaction data? (Each cell contains 1 of 4 possible entries, randomised)	1. [No-one. The transactions are encrypted and anonymous.] or 2. [Australia's financial crime authority only] or 3. [Only {insert account providing entity}] or 4. [Only Australia's financial crime authority and {insert account providing entity}]	1. [No-one. The transactions are encrypted and anonymous.] or 2. [Australia's financial crime authority only] or 3. [Only {insert account providing entity}] or 4. [Only Australia's financial crime authority and {insert account providing entity}]

Several features of the question warrant explanation:

- **Preamble.** The first paragraph of the question is a preamble designed to convey that answers given by survey respondents are consequential. The intention is to discourage respondents from giving little or no thought to their answer, on account of perceptions that there is nothing much at stake. Preambles performing this purpose are central features of discrete choice experiments and are often far more extensive than a single paragraph of text (the survey question underlying Bishop *et al* (2017) is a good example). We use a short preamble to accommodate concerns about respondent fatigue in the CPS (which has 46 other questions in the module containing the experiment), relying more on the RBA branding and introductory material of the survey to convey the importance of responses. We also check the attentiveness of survey respondents, using a technique described in Section 4.2.

- **Bank account analogy.** It is challenging to write a question about CBDCs without taking a lot of time to explain to survey participants what CBDCs are. For this reason, we avoid the term CBDC altogether, instead relying on more accessible analogies with bank accounts. We have set up the question as a choice between two new bank accounts, rather than having one of them be a respondent's existing account, to give us full flexibility over the account characteristics, and to protect our results from distortions arising from the inconvenience of shifting accounts.

- **Cash availability.** The Australian Government is committed to ensuring Australians maintain adequate access to physical currency (Australian Government 2023). By setting up the bank account scenario as a choice to be made today, our question deliberately implies that physical currency continues to be available. This matters for the interpretation of our results because cash offers an alternative option that is also a central bank claim and offers high levels of transaction privacy.

- **Randomisation.** The randomisation of the account characteristics is a strategy aimed at supporting credible statistical analysis, in the same way that medical trials or other controlled trials tend to randomise the allocation of treatments to experimental subjects. Randomisation of this kind is a central feature of the discrete choice experiment technique.

- **Fees.** We include fees in the account characteristics, so that we can communicate our results in terms of dollar amounts that respondents would be willing to pay to switch account characteristics. Unlike other common measures of preferences in the CBDC literature, willingness to pay has an objective interpretation, and a format that is useful for cost-benefit analysis. We construct these willingness-to-pay estimates using statistical techniques outlined in Section 4.

  Expressing preferences in terms of willingness to pay is another central feature of the discrete choice experiment technique. An associated challenge is that any differences in fees seen by survey participants must be set to levels that do not dwarf, or are not dwarfed by, the valuations put on the differences in other product characteristics. Otherwise, the researcher encounters scenarios in which, say, survey participants always choose the cheapest products, no matter what the other product differences are. In that case it becomes impossible to identify the average willingness to pay to switch product characteristics. It is therefore common to calibrate fees with a pilot survey. We conducted two pilots: one on internal RBA staff and another via our survey provider. Both pilots were also used to identify opportunities to simplify the language of the survey question.

- **Privacy possibilities**. Our privacy options do not capture the full range of entities that might see data in transactions involving commercial bank deposits. The exact set of entities typically depends on the payment system used for transacting (see Amiri *et al* (2023) for a useful discussion). Our privacy options do not capture the complete set of possibilities for retail CBDC either. Our simpler list of options is designed to improve statistical power and streamline our survey question, while retaining enough resolution to usefully inform policymakers.

- **Anchoring.** Since each participant chooses between the accounts displayed, they reveal only whether their valuation of the combined difference in safety and privacy characteristics is higher or lower than the difference in fees. There is no opportunity for individuals to offer their exact valuation. This higher/lower set-up is a deliberate feature of discrete choice experiments, to circumvent any potential problems associated with 'anchoring'. For example, a respondent's latent valuation of the difference in safety and privacy might be $13 in favour of account A, and seeing it is only $5 more expensive might drag their perceived valuation down. But unless their perceived valuation crosses to below $5 after seeing that is the fee difference (unlikely), the respondent will answer the question the same way irrespective of whether they have been anchored or not. It is partly for their effectiveness at handling anchoring issues that discrete choice experiments are relied on for some high stakes research scenarios, such as calculating legal damages arising from oil spills for lost environmental amenity (Bishop *et al* 2017).[4]

4 Another way to circumvent anchoring issues is to ask respondents to offer a valuation, without giving them any sense of what a reasonable response might be, such as bins in which to place their valuation. But this technique tends to cause indecision in survey respondents (see Carson and Hanemann (2005) for further discussion).

3. The Consumer Payments Survey

We included the above question in the RBA's Consumer Payments Survey, which is based on a sample of the Australian adult population that is representative by age, sex, income, location, household internet access, and credit card usage. The survey asked 9,100 Australians to join via random phone number dialling and they were incentivised to participate with a $100 gift card. About 1,900 people agreed to participate, and 997 of those completed the full survey and entered our final sample. Around 95 per cent of participants completed the survey online or via mobile devices, while the rest responded in paper format because they did not use the internet regularly. Respondents completed the survey between October 2022 and December 2022.

For a partial gauge of whether sample attrition might affect the representativeness of the survey, we ran some tests on the degree to which the age, sex, and income composition of the sample changed between the agreed-to-participate sample (1,900 people) and the final sample (997 people). The results show only very slight compositional changes (see Appendix A). We correct for any sample imbalances relative to the population benchmarks (age, sex, income, location etc) using survey weights. But as we discuss with our results, there might be some other imbalances that we cannot correct for.

Livermore *et al* (2023) provide more detail on the construction of the survey, including the methods used to recruit participants and calculate the survey weights.

4. Statistical Method for Estimating Willingness to Pay

To estimate willingness to pay, we use the standard statistical method from the discrete choice experiment literature. Our explanation of the method begins with the core elements. The technical details follow in a separate section.

4.1 Core elements

Our method models the probability of a person choosing account A over account B as a function of the differences in utilities between the two accounts. In stylised form, that model is:

$$\begin{aligned} Probability\ of\ choosing\ account\ A = f\big(&\beta_0 + \beta_1\, Fee\ difference \\ &+ \beta_2 Account\ provider\ difference \\ &+ \beta_3 Privacy\ difference\big) \end{aligned} \tag{1}$$

The parameters β_1, β_2 and β_3 measure respondents' average sensitivity to the difference in the accounts' fees, provider, and privacy settings. We can thus compare our estimate of β_1 (sensitivity to price) with our estimates for β_2 and β_3 (sensitivity to account provider and privacy settings, respectively) to gauge the extent to which people are willing to forego lower account fees for more safety and privacy. This gives us estimates of willingness to pay for safety and privacy.

To explore heterogeneity in willingness to pay, we also estimate the coefficients of two extended models. In one, we interact all the initial right-hand-side variables with a respondent's age and household income, observing how willingness to pay changes along those dimensions. The other

model is the same, except that instead of age and household income we interact the right-hand-side variables with a measure of cash use.[5]

Our motivation for including age helps us to form a partial picture of generational differences in preferences, which are interesting to the extent that they help to forecast changes in aggregate privacy preferences over time. We say the picture is only partial because, without observing the same generations across multiple surveys, including age cannot help us to distinguish between differences that occur across generations and differences that occur within generations as people age.

Household income has a well-documented relationship to financial literacy (Stolper and Walter 2017) which, in turn, could be related to awareness of the various protections in place that make deposits safe already. Consistent with this, lower income people in the United States have a higher tendency to express concern over the safety of their bank deposits (Brenan 2023). But there are a range of other potential mechanisms at play here as well. For example, working in the other direction, household income could also be considered a proxy for a person's likelihood of having bank account balances over the deposit insurance threshold in Australia of $250,000 per account holder, per bank.[6]

Finally, cash use could be related to privacy and safety valuations because cash offers an alternative option that is also a claim on the RBA and offers almost complete user anonymity. We have included cash in a separate model to age and household income, to preserve the intended interpretation of our results (more details on this in the next section).

Since we generate random variation in the account characteristics, we have the benefit of not having to worry about the most common statistical challenge in estimating causal relationships: bias from omitted variables. As with discrete choice experiments more generally, credibility concerns in our work are more likely to come from the set-up of the survey question generating the data and from problems in the sampling. We discuss what we judge to be the most likely areas of concern when presenting our findings.

4.2 Technical details

We model the utility derived by individual $i \in \{1,\ldots,N\}$ from account $j \in \{A,B\}$ as a linear function of the account characteristics and a random error term. For our baseline model this has the form

$$\begin{aligned} Utility_{ij} = {} & \alpha_0 + \alpha_1 HighFee_{ij} + \alpha_2 CommercialAcct_{ij} + \alpha_3 AustracVis_{ij} + \alpha_4 RbaVis_{ij} \\ & + \alpha_5 CommercialVis_{ij} + \alpha_6 AustracRbaVis_{ij} + \alpha_7 AustracCommercialVis_{ij} + \varepsilon_{ij} \end{aligned} \tag{2}$$

5 Exploring age and income relationships was included in our pre-analysis plan, although the set-up of the model has changed somewhat. The Online Appendix explains the rationale for the changes and includes the initially planned analysis. We conducted the cash use exercise in response to seminar feedback.

6 Deposit insurance in Australia is provided under the Financial Claims Scheme (FCS), which is:

> an Australian Government scheme that provides protection to deposit-holders with Australian incorporated banks, building societies and credit unions (known as authorised deposit-taking institutions or ADIs), … in the unlikely event that one of these financial institutions fails.
>
> The FCS is a government-backed safety net for deposits of up to $250,000 per account holder per ADI. (APRA nd)

See APRA (nd) for further details of the policy. According to the latest (albeit dated) public estimates in Turner (2011), there are relatively few accounts in Australia with balances over the threshold.

where $HighFee_{ij}$ is a dummy variable equal to one if account j has high fees ($25), and zero if it has low fees ($20). $CommercialAcct_{ij}$ is a dummy variable equal to one if a commercial bank is the provider of account j, and zero if the RBA is the provider. $AustracVis_{ij}$ is a dummy variable equal to one if transaction data for account j are visible to only AUSTRAC, and zero for all other privacy settings account j could have. More generally, all variables of the form $\{X\}Vis_{ij}$ are dummies equal to one if transaction data for account j are shared only with entity (or entities) X, and zero for all other privacy settings. Finally, ε_{ij} is a random component to utility and α_0 represents the utility derived from an a low-fee account, provided by the RBA, with full transaction privacy.

The probability of person i choosing account A (conditional on the account characteristics in the table presented to person i) equals the conditional probability that the utility derived from account A exceeds that of account B. That is,

$$\Pr\left[Choice_i = A\right] = \Pr\left[U_{iA} - U_{iB} > 0\right] \tag{3}$$

$$= \Pr\begin{bmatrix} \alpha_1\left(HighFee_{iA} - HighFee_{iB}\right) + \alpha_2\left(CommercialAcct_{iA} - CommercialAcct_{iB}\right) + \ldots \\ +\alpha_7\left(AustracCommercialVis_{iA} - AustracCommercialVis_{iB}\right) \\ > \varepsilon_{iB} - \varepsilon_{iA} \end{bmatrix} \tag{4}$$

We assume that $\varepsilon_{iB} - \varepsilon_{iA} \sim N\left(0, \sigma^2\right)$, and since the overall scale of utility does not matter, we normalise the variance to $\sigma^2 = 1$. The implied model for the conditional probability of choosing account A thus has the standard probit form

$$\Pr\left[Choice_i = A\right] = \Phi\begin{pmatrix} \alpha_1\left(HighFee_{iA} - HighFee_{iB}\right) \\ +\alpha_2\left(CommercialAcct_{iA} - CommercialAcct_{iB}\right) + \ldots \\ +\alpha_7\left(AustracCommercialVis_{iA} - AustracCommercialVis_{iB}\right) \end{pmatrix} \tag{5}$$

where $\Phi(\ )$ is the cumulative standard normal density function. In our specification we also include a constant, and test whether it differs from the predicted value of zero, to gauge the extent of 'donkey voting'. A positive constant would, for example, indicate that respondents show some favouritism towards account A, which would be consistent with typical patterns of respondent inattention. (Note that Equation (5), with the constant added, is the detailed form of Equation (1).)

In any case, the corresponding willingness to pay for, say, having a claim on the RBA rather than a commercial bank, holding the other account characteristics constant, equals $5\alpha_2 / \alpha_1$ (where the 5 comes from the difference in account fees). Likewise, the willingness to pay for full privacy, relative to sharing data with only AUSTRAC, is $5\alpha_3 / \alpha_1$. We estimate these quantities by substituting in the individual parameter estimates generated by the standard maximum likelihood procedure for probit. Confidence intervals are produced via the delta method. The same techniques apply to all the estimates of willingness to pay presented in this paper. Those willingness-to-pay estimates are invariant to decisions about whether one models the probability of choosing account A or account B.

For our first extended model, we take the utility specification from Equation (2) and add interactions with age and income for each of the variables. Those interactions carry through the probit specification in predictable ways. We present the full list of variables with the probit estimation results. We copy this approach for the second extended model, except we interact with a measure of cash use instead of age and income. Cash use is explored in a separate model to age and income because it is a bad control for the age effects we intend to capture; some of the age effects could occur via preferences for cash, and we do not want to remove those effects from our estimates. Note also that the income variable we use is an approximation, since respondents only report income ranges, and 10 per cent of the sample has its income top-coded.

There is a growing tendency in the economics literature to favour linear probability models over probit, on account of the simplicity of their interpretation (Angrist and Pischke 2009). This simplicity comes at the expense of specifying marginal effects as being constant, when this cannot literally be true; there is an inherent nonlinearity due to the boundedness of probabilities that cannot be captured by the linear probability model. Being able to accommodate this feature becomes important in models where interaction effects are a focus (Ai and Norton 2003), as in our extension models. This argument motivates our preference for estimation using probit.

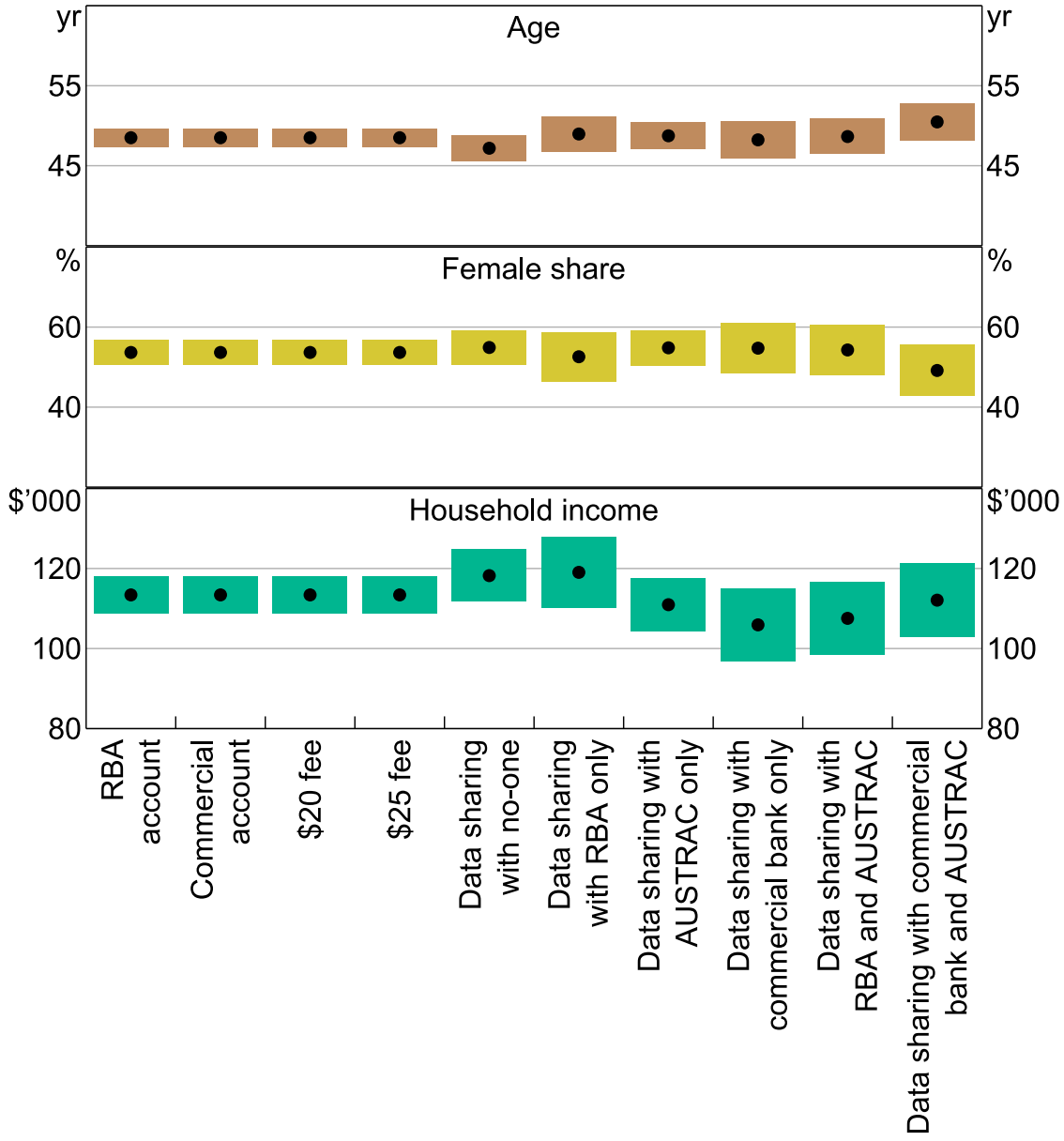
5. Diagnostic Tests

The merit of our empirical strategy depends heavily on the successful randomisation of options in the table shown to the survey participants. To gauge the success of the randomisation we compare the mean age, sex, and income of respondents who saw the various account possibilities (Figure 2). The results are consistent with effective randomisation, the measured means all being very similar relative to their natural ranges.

Since the estimates of the parameters in our model of account choice are secondary in importance to the derived estimates of willingness to pay, we leave those parameter estimates to Appendix B. The key takeaway is that all the estimates have plausible signs and magnitudes. The 95 per cent confidence interval for the intercept estimates are (–0.15, 0.04) for the baseline model, and (–0.17, 0.03) and (–0.18, 0.02) for the extensions, and so are consistent with attentive survey respondents.

Livermore *et al* (2023) produce a comprehensive set of descriptive statistics relating to the survey. We do not repeat them here.

Figure 2: Randomisation Testing
Sample mean, by account options shown to survey participants, 2022



Note: Shading shows 95 per cent confidence intervals.
Source: RBA calculations, based on data from Ipsos.

6. Main Results

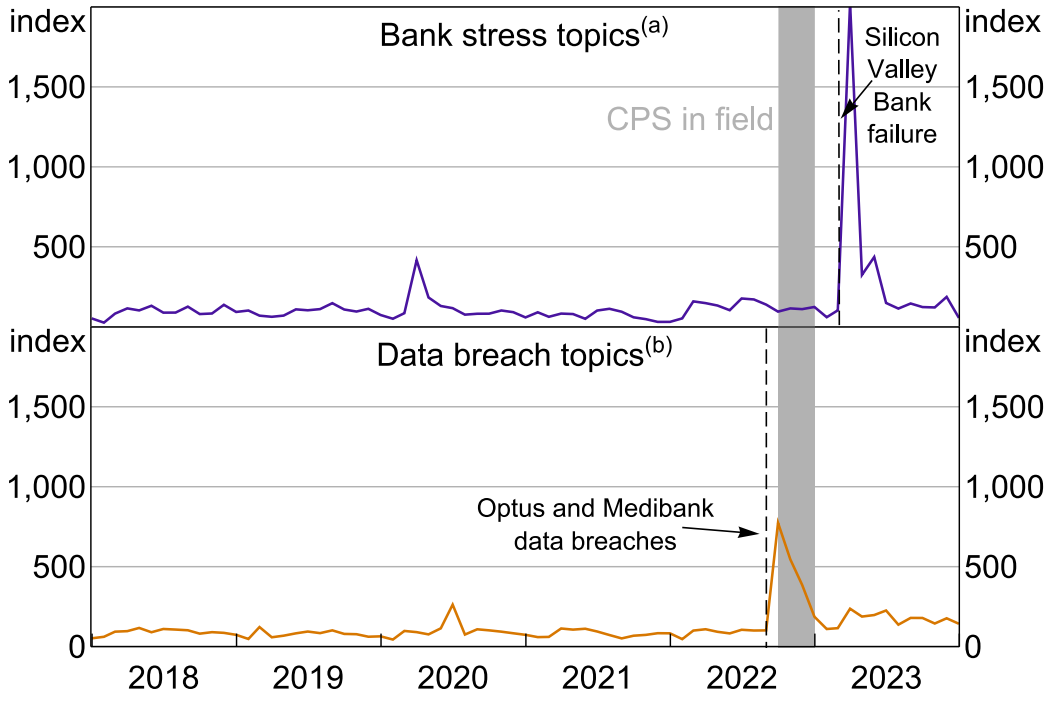
6.1 Willingness to pay for an RBA claim

Our results suggest that Australians on average are unwilling to pay for the added safety of central bank money. In particular, the top panel in Figure 1 shows an estimated willingness to pay of approximately $0 per year for an account provided by the RBA instead of a commercial bank, holding all other features of the account constant. We find the result unsurprising, given the range of measures in Australia that make commercial bank deposits safe already. Moreover, there have been few recent events of banking stress in Australia that might cause Australians to question the safety of their deposits.

A few caveats to this result:

- **Timing.** The survey is a snapshot of preferences during a particular period. The survey was also conducted a few months before commercial banking stresses in the United States and Europe, which appeared to increase public concern about the safety of bank deposits (Brenan 2023) and increased web search interest for banking stress topics in Australia (Figure 3, top panel). If our experiment was at that time, we might have found somewhat stronger preferences for safety.

Figure 3: Web Search Interest in Australia
October 2017 to September 2022 average = 100



Notes: (a) 'bank failure', 'deposit insurance', 'bank default', 'bank crisis' and 'bank run'.
(b) 'privacy breach', 'data breach', 'data hack' 'stolen data' and 'cyber attack'.
Sources: Authors' calculations; Google Trends (https://www.google.com/trends).

- **Confounds.** There is some chance that our estimated willingness to pay for safety captures views or perceptions unrelated to safety. Our survey question was careful to hold other account features constant, but some respondents might still have been sceptical that a central bank account could realistically match the useful features of a commercial bank deposit account. For example, Li, Usher and Zhu (2023) use a Canadian survey to conclude that households have 'strong preferences for bundling additional financial products with deposits', which is unlikely to be possible with a central bank. Respondents might also be using the survey to convey a discomfort with this expanded role for the government in the financial system. If true, both mechanisms would cause us to understate the valuation of safety, and would justify a broader (but still policy-relevant) interpretation of our willingness-to-pay estimates.

- **Optionality.** Our survey design focuses on the valuation Australians put on having an RBA account. It does not tell us how much Australians value the *option* of having an RBA account, which is also a relevant policy question when assessing the case for CBDC. People might value the option to hold and use digital central bank money, to exercise only if there were to be a

financial crisis or other stress event, as seems to be the case with physical central bank money (Guttmann *et al* 2021).

- **Fee levels.** For behavioural reasons, people could have reacted differently to a lower or higher set of fee options in the survey question, even if the difference in the fee options was still $5. For example, we could have used fees of $40 and $45, rather than (or in addition to) $20 and $25. We suspect that these base effects would be minimal but cannot be sure. For more clarity on this issue, future work might consider repeating the question in the next Consumer Payments Survey, randomly showing respondents different fee levels (all with a $5 difference).

6.2 Willingness to pay for transaction privacy

Privacy settings for CBDC look to be more consequential for uptake than any incremental safety benefits. We estimate that Australians' average willingness to pay for sharing transaction data with no-one (full anonymity), as opposed to sharing data with either AUSTRAC, the RBA or a commercial bank, are in all cases around $5 per person per year, with the estimates for AUSTRAC lowest (Figure 1, bars 1 to 3 of the privacy panel). These results imply that a CBDC that offers transaction anonymity, even if only for small transactions, would deliver some value for consumers (probably less than our $5 estimate though, given that is for anonymity applied to whole accounts rather than anonymity that is conditional on transaction size).

To be consistent with the intent of Australian financial crime regulation, a CBDC would probably need to allow for ad hoc data sharing with AUSTRAC, at least for accounts making large transactions or holding large amounts of CBDC. Therefore, also relevant to policymakers are our estimates that consider an aversion to sharing data with the combination of AUSTRAC and the RBA, or the combination of AUSTRAC and a commercial bank, which are calculated as follows:

- We estimate that the average willingness to pay for full privacy, compared to sharing data with both AUSTRAC and the RBA jointly, is around $5 per person per year (Figure 1, bar 4 of the privacy panel). Being roughly the same as the individual AUSTRAC and RBA estimates, this estimate is consistent with Australians taking an all-or-nothing approach to sharing data with public entities.

- The average willingness to pay for full privacy, compared to sharing data with both AUSTRAC and a commercial bank jointly, is estimated to be around $10 per person per year (Figure 1, bottom bar of the privacy panel). Being roughly the sum of the individual AUSTRAC and commercial bank estimates, this result is consistent with Australians being averse to incremental reductions in privacy when that involves giving visibility to a commercial entity in addition to a public one.

These two estimates imply that Australians are willing to pay $5 per person more for an account that makes transaction data available to RBA instead of a commercial bank, assuming AUSTRAC can access the data in both cases. Aggregated over the adult Australian population, this equates to about $100 million per year. This is a potential value proposition for CBDC, although, as discussed in more detail in the summary and discussion, there is a tension here with prevailing presumptions about how a retail CBDC would be distributed to the public.

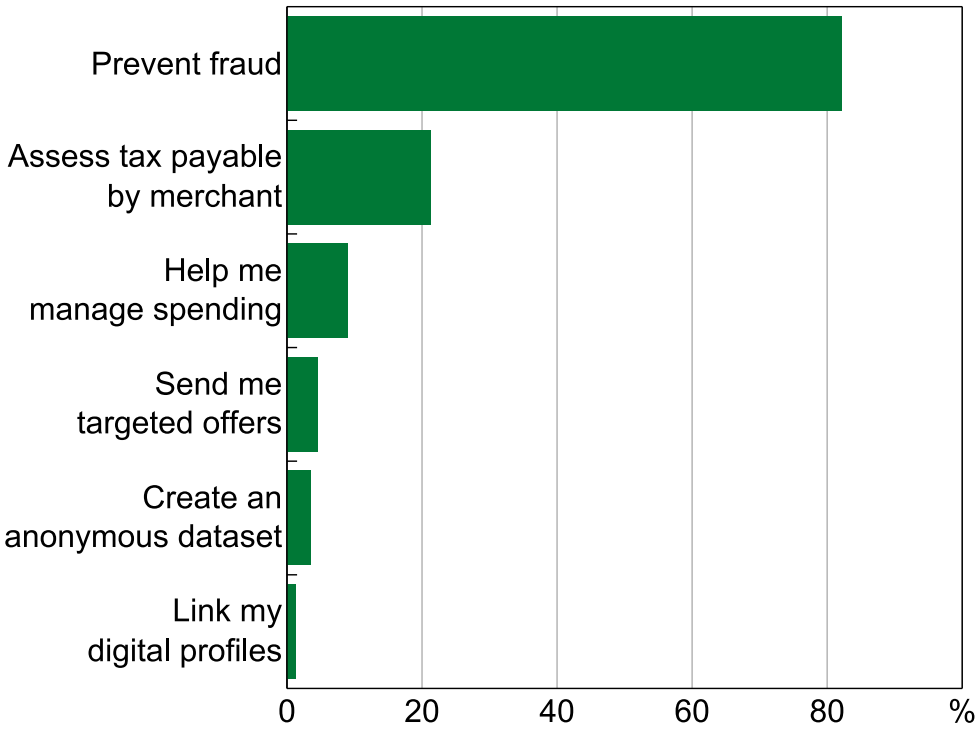
Some caveats to these results that also deserve mentioning:

- **Timing.** As with the safety estimates, the timing of the survey is relevant for interpreting the privacy estimates. Most notably, the survey was conducted very soon after highly publicised data breaches at private companies Medibank and Optus (Figure 3, bottom panel).

- **Sample selection.** Even though the responses of individual survey participants are anonymised, refusing to participate in our survey could be correlated with having stronger privacy preferences. If true, this would introduce a form of sample selection that downwardly biases our estimates of privacy. Not all the privacy estimates would necessarily be equally affected. For example, people that are most averse to sharing data with government agencies might be those that are most likely to refuse to participate in an RBA-branded survey. These issues are likely to arise in all survey-based investigations of privacy, to varying degrees.

Although we caution about studying privacy attitudes with direct survey questions, there is one such question in the Consumer Payments Survey that we do show results for here to demonstrate the types of data uses that consumers are most averse to. Consumers on average report being least comfortable with their data being used for profiling, where transaction details are linked with other data sources for the purposes of targeted advertising, for example. Consumers are most comfortable with their data being used for preventing fraud (Figure 4). This is consistent with our results, which suggest that consumers are least averse to sharing data with AUSTRAC.

Figure 4: Permitted Uses of Transaction Data
2022

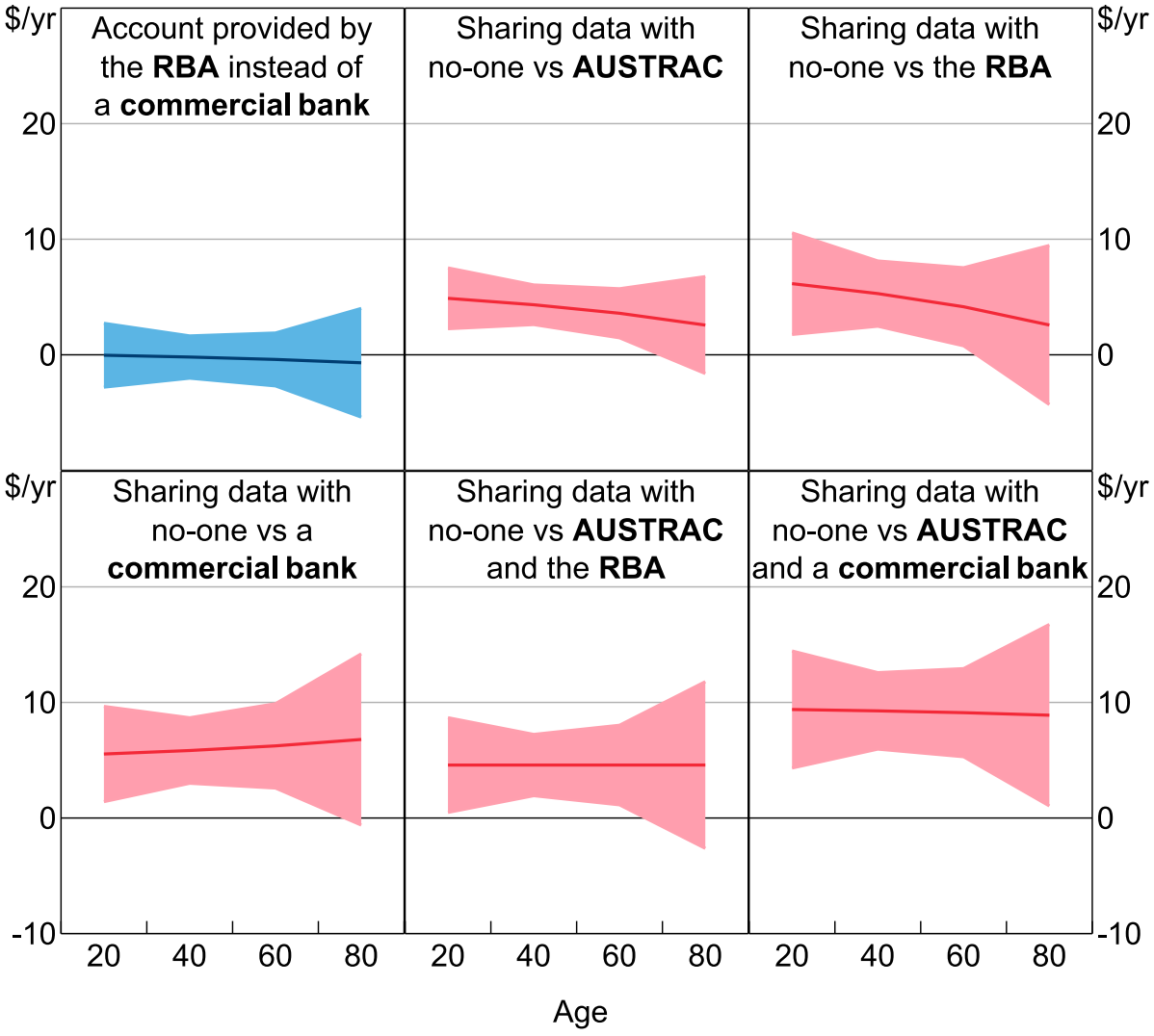


Notes: Share of respondents answering 'If asked, I would give permission for my transaction details (the amount, payment method used, store location) to be used to …?' Bars do not sum to 100 per cent as respondents could choose more than one answer.
Source: RBA calculations, based on data from Ipsos.

6.3 Heterogeneity in preferences

We find no evidence that willingness to pay for either safety or privacy differs materially by age, holding income constant (Figure 5). Higher age groups are ostensibly a little less averse to sharing data with AUSTRAC and the RBA individually, but that pattern is not repeated in the result regarding the possibility of sharing data with AUSTRAC and the RBA simultaneously. Moreover, the difference is small in the context of the broader uncertainty around our estimates. We see little in these results to suggest that community privacy attitudes are likely to change with natural generational turnover.

Figure 5: Estimates of Average Willingness to Pay
By age, 2022

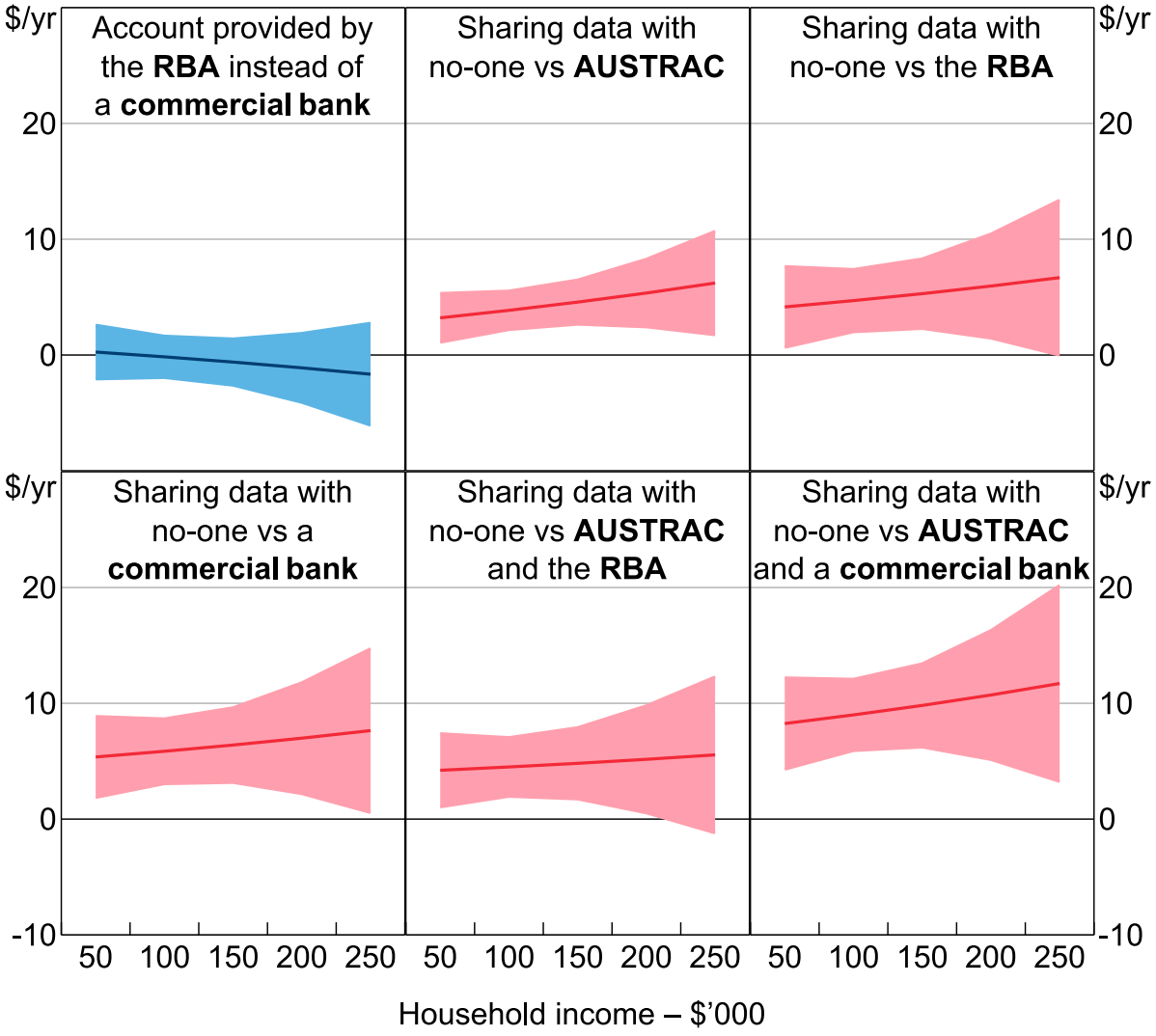


Notes: The analysis of these age relationships was not pre-specified in this particular form; see the Online Appendix for further details. Holding household income at its mean of $113,400. Shading shows 95 per cent confidence intervals, calculated using the delta method.

Source: RBA calculations, based on data from Ipsos.

We find more noticeable differences in willingness to pay by household income, holding age constant (Figure 6); our point estimates suggest that higher income individuals tend to put a *slightly* lower valuation on the account provided by the RBA. Regarding privacy, in all cases higher income individuals appear willing to pay a little more.

Figure 6: Estimates of Average Willingness to Pay
By household income, 2022

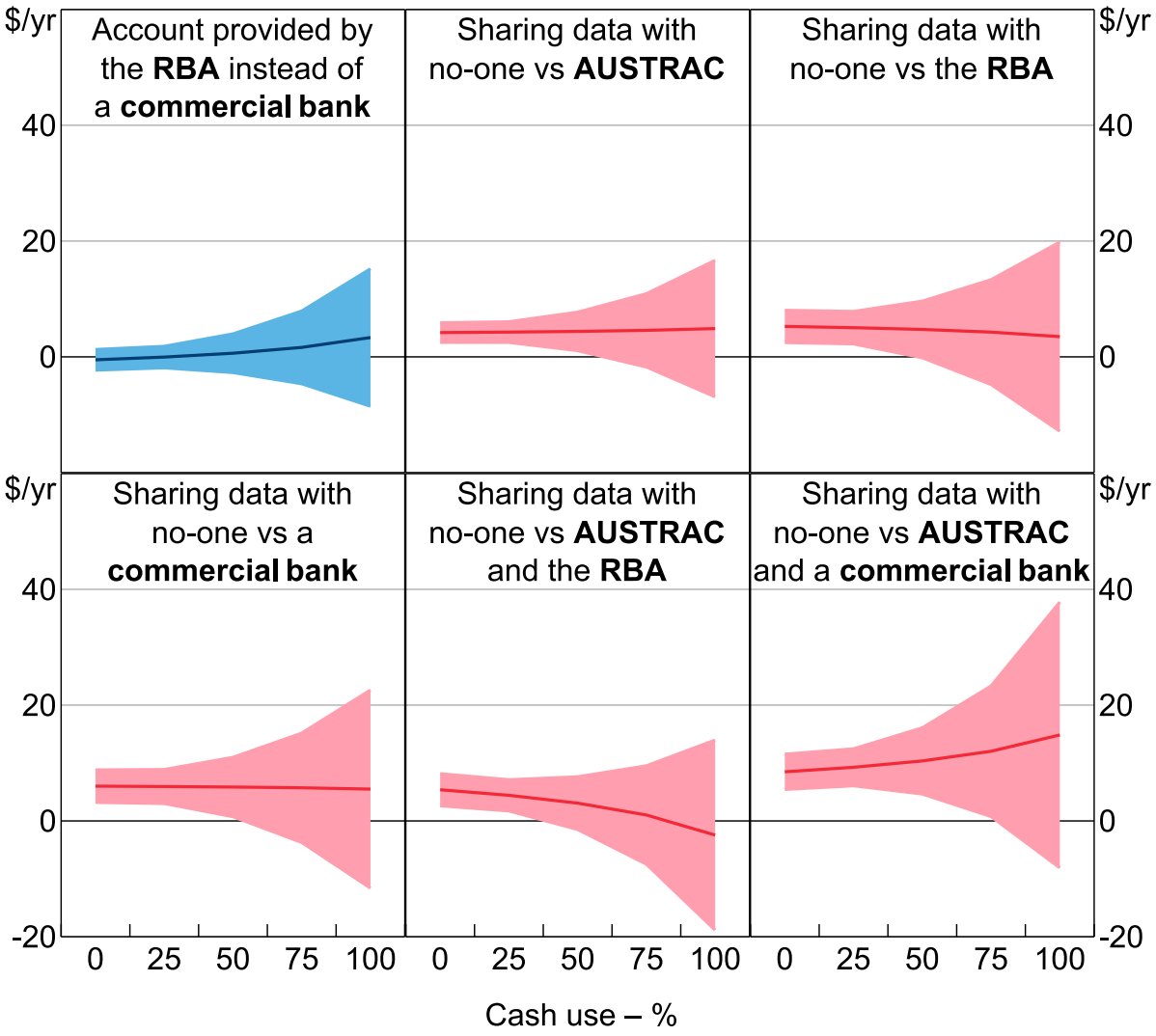


Notes: The analysis of these household income relationships was not pre-specified in this particular form; see the Online Appendix for further details. Holding age at its mean of 48 years. Shading shows 95 per cent confidence intervals, calculated using the delta method.

Source: RBA calculations, based on data from Ipsos.

In the second extension model, the estimated safety and privacy valuations vary materially for those with medium to high rates of cash use (Figure 7). But because high rates of cash use are uncommon in the sample, the confidence we can assign to the estimated variation in valuations is poor (as indicated by the widening confidence intervals). Consistent with this, the estimated variations in the privacy valuations are not always easily reconcilable across the different privacy configurations. Over the cash use ranges for which we have most confidence – where, say, less than 50 per cent of a respondent's in-person transactions are made with cash – valuations for safety and privacy are stable.

Figure 7: Estimates of Average Willingness to Pay
By cash use, 2022



Notes: Share of the number of in-person payments made with cash. Shading shows 95 per cent confidence intervals, calculated using the delta method. This analysis was never pre-specified.
Source: RBA calculations, based on data from Ipsos.

7. Summary and Discussion

Our results suggest Australians do not seem to value the added safety of a claim on the RBA instead of a commercial bank, holding privacy and other characteristics of the claim constant. This is consistent with bank deposits already being perceived by the public as a safe form of money. Reasons beyond safety could also be contributing, such as views about whether it is appropriate for the government to perform this expanded role. In any case, without any changes to these potential drivers of public attitudes, giving the public access to a digital claim on the RBA appears unlikely to be a strong value proposition for retail CBDC.

Privacy settings for a retail CBDC – though it is not yet clear what they would be in practice – look more consequential. The average consumer values transaction anonymity and, to the extent that transaction data do need to be shared with other entities, the average consumer cares about who those entities are. For example, we estimate that, on average, Australian consumers would pay

$5 per year more for access to an account that makes transaction data available to the RBA instead of a commercial bank, assuming that AUSTRAC can access transaction data in both cases. Aggregated over the adult population, this equates to around $100 million per year, a figure that would likely rise a little further if the account also offered anonymity for small transactions. This result is consistent with survey evidence from the Office of the Australian Information Commissioner (2023) about attitudes of Australians to privacy in a more general context. Respondents to that survey placed a lot of importance on their privacy when choosing a product or service and were generally more comfortable sharing data with federal government agencies than with private financial institutions.

A potential challenge to this privacy-based value proposition for retail CBDC is that it is somewhat in tension with prevailing views of the RBA and other central banks about the most likely CBDC issuance model. The RBA has expressed 'a strong presumption that any issuance of CBDC in a market economy like Australia would be via a two-tier system', whereby private entities are involved in the distribution of CBDC (Richards *et al* (2020), with Jones (2022) repeating this sentiment). The logic here is that central banks are unlikely to have a comparative advantage in delivering customer-facing services directly to households and businesses, especially in an environment where technology changes rapidly. CBDCs issued under such a two-tier model would either involve commercial entities having access to transaction data, or presumably at least the appearance of them doing so. Some proposed CBDC designs do involve a more direct relationship between the central bank and users, with European Central Bank (2023) discussing the potential for a Eurosystem-developed wallet, for example. But even in that case, private payment service providers may be given responsibility for onboarding, verifying customer credentials, and performing any necessary measures to mitigate financial crime. Further work is required to understand the different privacy possibilities under different potential issuance models.

Even if the privacy-based value proposition could be fulfilled, that alone would not be justification enough to issue one. Other trade-offs would also need to be considered. For example, the costs of setting up and running a new CBDC infrastructure would be significant and potentially large enough to offset some of the privacy benefits identified here.

Appendix A: Sample Attrition

Here we measure how the average age, sex, and income of survey participants changes over four stages of the 2022 Consumer Payments Survey. Those stages are:

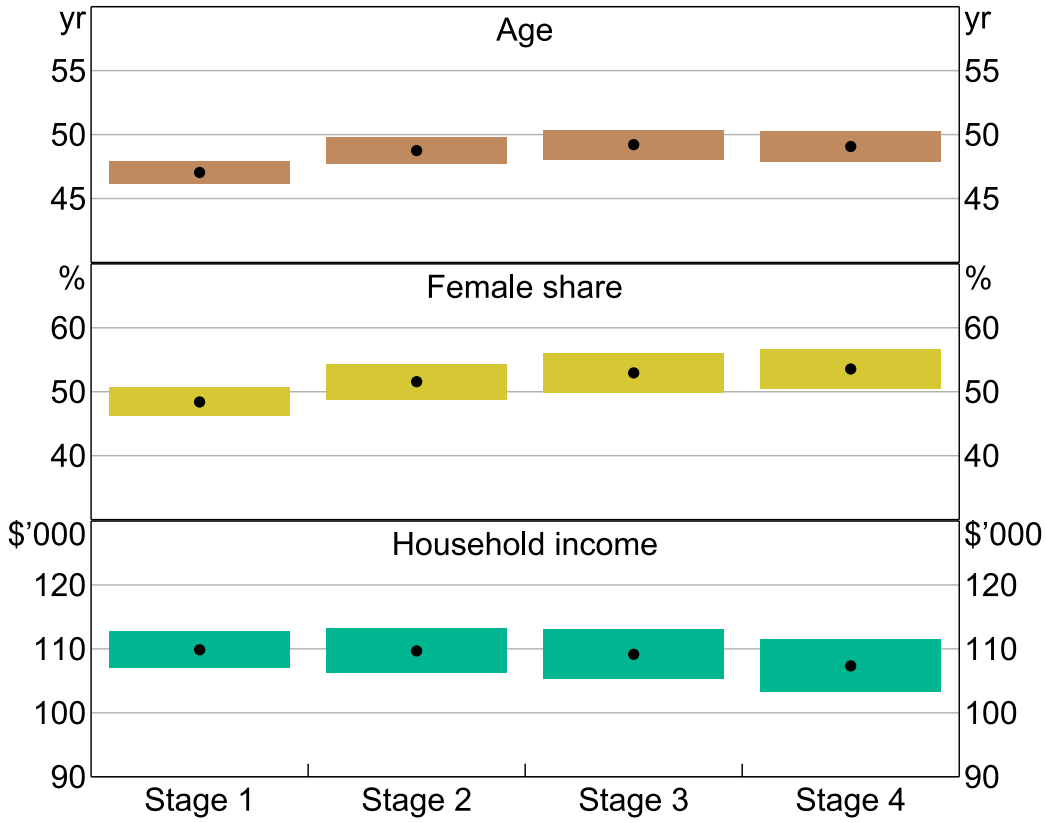
1. 'Post recruitment', in which 1,903 individuals completed a brief recruitment questionnaire.

2. 'Pre-diary', in which 1,270 individuals completed a questionnaire focused on their demographic characteristics.

3. 'Payments diary', in which 1,018 individuals recorded details about transactions they made over a seven-day period.

4. 'Post-diary', in which 999 individuals completed a supplementary set of questions, including the question for our discrete choice experiment.

Figure A1: Survey Attrition Testing
Sample mean, by survey stage participants completed, 2022



Note: Shading shows 95 per cent confidence intervals.
Source: RBA calculations, based on data from Ipsos.

Appendix B: Regression Results

Table B1: Probit Model Regression Results

(*continued next page*)

Variable	(1)		(2)		(3)	
	Baseline probit model	Average marginal effects[a]	Extension probit model (age, income)	Average marginal effects[a]	Extension probit model (cash use)	Average marginal effects[a]
$\Delta HighFee_i$	–0.48	–0.15	–0.49	–0.16	–0.50	–0.16
	(–0.56, –0.39)	(–0.18, –0.13)	(–0.58, –0.41)	(–0.18, –0.13)	(–0.59, –0.41)	(–0.18, 0.14)
$\Delta CommercialAcct_i$	0.07	0.02	0.03	0.01	0.02	0.01
	(–0.09, 0.23)	(0.03, 0.08)	(–0.15, 0.20)	(–0.05, 0.06)	(–0.15, 0.19)	(–0.05, 0.06)
$\Delta RbaVis_i$	–0.48	–0.16	–0.48	–0.15	–0.51	–0.16
	(–0.73, –0.23)	(–0.24, –0.08)	(–0.74, –0.23)	(–0.23, –0.07)	(–0.77, –0.26)	(–0.24, –0.08)
$\Delta CommercialVis_i$	–0.61	–0.20	–0.59	–0.19	–0.60	–0.19
	(–0.85, –0.37)	(–0.27, –0.12)	(–0.85, –0.34)	(–0.27, –0.11)	(–0.85, –0.34)	(–0.27, –0.11)
$\Delta AustracVis_i$	–0.41	–0.13	–0.40	–0.13	–0.43	–0.13
	(–0.56, –0.27)	(–0.18, –0.09)	(–0.55, –0.25)	(–0.17, –0.08)	(–0.58, –0.28)	(–0.18, –0.09)
$\Delta AustracRbaVis_i$	–0.44	–0.14	–0.45	–0.14	–0.48	–0.15
	(–0.68, –0.21)	(–0.22, –0.07)	(–0.20, –0.20)	(–0.22, –0.07)	(–0.73, –0.22)	(–0.23, –0.07)
$\Delta AustracCommercialVis_i$	–0.95	–0.31	–0.91	–0.29	–0.90	–0.29
	(–1.19, –0.71)	(–0.38, –0.24)	(–1.16, –0.66)	(–0.36, –0.22)	(–1.15, –0.66)	(–0.36, –0.21)
$\left(Age_i - \overline{Age}\right) \times \Delta HighFee_i$			0.04 (–0.02, 0.09)			
$\left(Age_i - \overline{Age}\right) \times \Delta CommercialAcct_i$			–0.01 (–0.11, 0.09)			
$\left(Age_i - \overline{Age}\right) \times \Delta RbaVis_i$			0.09 (–0.06, 0.24)			
$\left(Age_i - \overline{Age}\right) \times \Delta CommercialVis_i$			0.03 (–0.12, 0.17)			
$\left(Age_i - \overline{Age}\right) \times \Delta AustracVis_i$			0.07 (–0.02, 0.15)			
$\left(Age_i - \overline{Age}\right) \times \Delta AustracRbaVis_i$			0.04 (–0.11,0.18)			
$\left(Age_i - \overline{Age}\right) \times \Delta AustracCommercialVis_i$			0.07 (–0.08, 0.22)			
$\left(HhInc_i - \overline{HhInc}\right) \times \Delta HighFee_i$			0.05 (–0.08, 0.18)			
$\left(HhInc_i - \overline{HhInc}\right) \times \Delta CommercialAcct_i$			–0.08 (–0.33, 0.17)			

Table B1: Probit Model Regression Results

(*continued*)

Variable	(1)		(2)		(3)	
	Baseline probit model	Average marginal effects[(a)]	Extension probit model (age, income)	Average marginal effects[(a)]	Extension probit model (cash use)	Average marginal effects[(a)]
$\left(HhInc_i - \overline{HhInc}\right) \times \Delta RbaVis_i$			–0.08 (–0.46, 0.29)			
$\left(HhInc_i - \overline{HhInc}\right) \times \Delta CommercialVis_i$			–0.05 (–0.40, 0.30)			
$\left(HhInc_i - \overline{HhInc}\right) \times \Delta AustracVis_i$			–0.10 (–0.32, 0.12)			
$\left(HhInc_i - \overline{HhInc}\right) \times \Delta AustracRbaVis_i$			–0.01 (–0.37, 0.36)			
$\left(HhInc_i - \overline{HhInc}\right) \times \Delta AustracCommercialVis_i$			–0.10 (–0.48, 0.28)			
$\left(CashUse_i - \overline{CashUse}\right) \times \Delta HighFee_i$					0.03 (0.00, 0.06)	
$\left(CashUse_i - \overline{CashUse}\right) \times \Delta CommercialAcct_i$					–0.02 (–0.08, 0.04)	
$\left(CashUse_i - \overline{CashUse}\right) \times \Delta RbaVis_i$					0.04 (–0.04, 0.13)	
$\left(CashUse_i - \overline{CashUse}\right) \times \Delta CommercialVis_i$					0.04 (–0.04, 0.13)	
$\left(CashUse_i - \overline{CashUse}\right) \times \Delta AustracVis_i$					0.02 (–0.03, 0.08)	
$\left(CashUse_i - \overline{CashUse}\right) \times \Delta AustracRbaVis_i$					0.07 (–0.02, 0.16)	
$\left(CashUse_i - \overline{CashUse}\right) \times \Delta AustracCommercialVis_i$					0.03 (–0.06, 0.11)	
Constant	–0.06 (–0.15, 0.04)		–0.07 (–0.17, 0.03)		–0.08 (–0.18, 0.02)	
No of observations	997		997		983[(b)]	

Notes: 95 per cent confidence intervals are in parentheses. The delta symbol ' Δ ' represents a difference between dummy variables for accounts A and B, e.g. $\Delta HighFee_i = HighFee_{iA} - HighFee_{iB}$. Age variables are scaled by 10 (to represent decades), $HhInc$ variables are scaled by \$100,000, and $CashUse$ variables are scaled by 10, for presentational purposes. The income interactions should be treated as approximations, since respondents only report income ranges and 10 per cent of the sample has its income top-coded.

(a) Average marginal effects are marginal effects evaluated at true observations for all individuals in the sample and averaged, using Stata's 'margins, dydx(*)' command.

(b) The $CashUse$ variable has 14 missing observations for Consumer Payments Survey respondents who did not record any in-person transactions in the week of the payments diary.

Source: RBA calculations, based on data from Ipsos.

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