Understanding the Post-pandemic Demand for Australia's Banknotes

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Photo: pamspix – Getty Images

Abstract

Banknotes can be used to make legitimate payments, but they can also be hoarded, lost or used to facilitate transactions in the shadow economy. Understanding how banknotes are used can assist policymakers in responding to changes in payment behaviour and demand for cash. This article examines the value of banknotes used for each component of cash demand and how it has changed since the COVID-19 pandemic. The share of banknotes used for transactional purposes is estimated to have fallen by 5 percentage points since early 2020, while cash use in the shadow economy has increased slightly and the proportion of banknotes that are lost has remained unchanged. Overall, the majority of banknotes on issue are currently used for non-transactional purposes, consistent with pre-pandemic trends.

Introduction

Demand for banknotes grew substantially over the COVID-19 pandemic period in many advanced economies. In Australia, the value of banknotes in circulation increased by 22 per cent, or $19 billion, between March 2020 and its peak in December 2022. This followed a period of already-strong banknote demand; in the decade prior to the pandemic, banknote demand was growing faster than GDP (Flannigan and Parsons 2018; Flannigan and Staib 2017). Banknote demand has since declined but remains close to its historical high. This strength, relative to growth in prices and the economy, is despite the ongoing decline in the use of cash for day-to-day transactions over many years (Mulqueeney and Livermore 2023). The dichotomy of strong banknote demand alongside falling transactional use suggests banknotes are being hoarded, likely for store-of wealth or precautionary savings purposes.

Changes in the denominational mix of banknotes that are on issue can provide insight into the

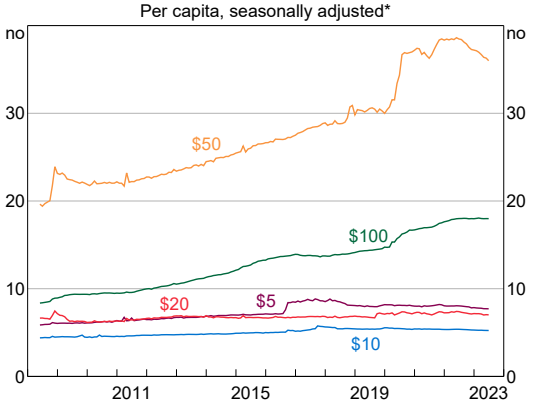
diverging trends of lower transactional versus higher hoarding demand for banknotes. Growth in low-denomination banknotes ($5, $10 and $20) has been slow, increasing at around 1 per cent annualised on a per capita basis since 2007 (Graph 1). Low denominations are typically used for in-person transactions and for merchants to provide change, so subdued demand for these banknotes indicates a reduced use of cash for consumer spending. By contrast, demand for high-denomination banknotes ($50 and $100) has been strong and the key driver of growth in overall banknote demand; high denominations have grown by almost 5 per cent on an annualised per capita basis since 2007. This is consistent with an increased desire in the community to hold banknotes as a precaution or store-of-wealth, especially during times of economic uncertainty (Guttmann *et al* 2021).

This article quantifies the sources of demand for Australian banknotes to further understand the differences in transactional and hoarding demand, particularly since the pandemic. In doing so, we update estimates from Finlay, Staib and Wakefield (2018) to June 2023.[1] Understanding the relative importance of each source of demand can assist the Reserve Bank in forming expectations about likely future developments in banknote demand, which is a key part of determining the Bank's annual banknote print orders. It can also assist in policymaking regarding cash access and distribution and contributes to our understanding of the amount of cash used in Australia's shadow economy.

Graph 1

Banknotes in Circulation

Per capita, seasonally adjusted*



* Monthly population data estimated with cubic splines.

Sources: ABS; RBA.

At a single point of time, banknotes in circulation will fall into one of the following categories:[2]

- Banknotes that are used to facilitate **legitimate day-to-day transactions** in Australia.
- Banknotes that have been **lost or destroyed**.
- Banknotes that are used in the **shadow economy** (either to conceal legal transactions to avoid tax, to pay for illegal goods and services or to store wealth generated by the sale of illegal goods and services).
- Banknotes that are **hoarded** – that is, held, either domestically or overseas, as a store-of-value, for emergency liquidity or for other such purposes.

While individual banknotes on issue move between these categories every day, the share of banknotes attributed to each category is likely to be relatively stable over the short run. However, it is important to acknowledge that cash is an anonymous bearer instrument and so difficult to trace and analyse. To overcome this, where possible, we use a variety of techniques to estimate the share of banknotes attributed to each category, thereby producing a range of estimates rather than a single point estimate. Each estimation technique naturally relies on a range of assumptions, some of which are more realistic than others. While we cannot be definitive or exact about how banknotes are used in the economy, our confidence in broad trends is strengthened if we see similar results emerging across the various techniques.

Banknotes used for legitimate transactions

Australians typically use cash to complete everyday transactions, such as at the grocery store. This source of banknote demand – which we call 'transactional demand' – is difficult to estimate as the Bank does not track banknotes once issued into circulation. So, while we cannot directly observe or measure transactional demand, we use four different methods to approximate its size to obtain a range of estimates, based on Finlay, Staib and Wakefield (2018):

Table 1: Physical Locations of the Transactional Stock of Cash

Location	Description
Wallets	Cash held by consumers on their person.
Financial institution holdings	Cash held by financial institutions in bank branches, ATMs or cash depots.
Tills and self-checkouts	Cash held in cash registers, safes and self-serve checkouts at the start of the day. This is the minimum stock of banknotes that is held in cash registers at all times. It does not include cash held due to an increase in stocks from consumers' cash expenditure.
Unbanked business takings	Cash held by businesses that has not been banked.
Gaming machines	Cash held in gaming machines (e.g. poker machines) and associated safes.
Tourists	Cash held by tourists in Australia or about to enter Australia. This includes cash sourced overseas prior to entering Australia, cash sourced domestically after entering Australia and cash held by overseas foreign exchange businesses that service tourists about to enter Australia.

1. the counting method
2. the velocity method
3. the banknote processing method
4. the seasonality method.

Each of these methods is discussed in turn, before a final assessment on the proportion of banknotes used for legitimate transactions is made based on all these approaches.

Counting method

The first approach estimates the stock of cash across six physical locations that are commonly used to exchange or store cash for transactional purposes (Table 1). We aggregate these locations to form an economy-wide estimate of how much cash is used for legitimate transactions. While this approach is a useful and tangible method to estimate this stock, it relies on several assumptions and does not account for any cash not captured in these categories.

We estimate the stock of cash held in each of these locations by:

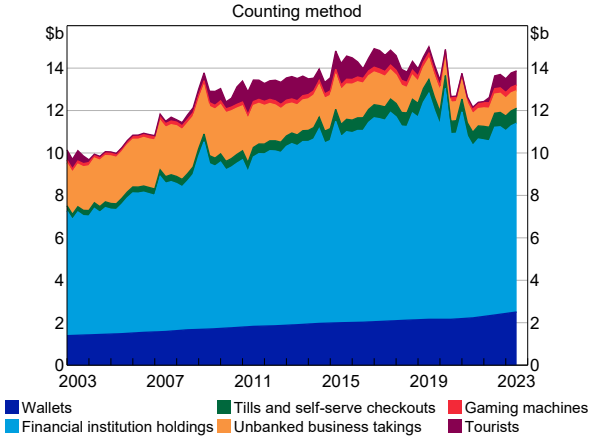
1. estimating the number of a given location (e.g. the number of tills and self-checkouts) and multiplying it by an average amount held per location (e.g. the amount of cash held in each till or self-checkout)
2. converting flow data to a stock by making assumptions about the velocity of cash (the number of times a banknote is used in a given period) through a particular location.

The counting method suggests that the transactional stock of cash fell from around $15 billion in March 2020 to just below $14 billion at the end of June 2023 (Graph 2). Over the first 18 months of the pandemic, the transactional stock fell to $12 billion; while it has picked up slightly over the past two years, it remains around $1 billion below its pre-pandemic peak. The estimated fall was mainly due to large declines in the cash holdings of financial institutions and unbanked business takings. This was partly offset by modest increases in wallet holdings, tills and self-checkouts, gaming machines and tourist cash holdings.

The decline in transactional demand has occurred alongside a significant increase in the value of banknotes on issue. As a share of banknotes on

Graph 2

Transactional Banknote Stock Estimates



Sources: ABS; Australian Payments Network; Queensland Treasury; RBA calculations, based on data from Colmar Brunton, Ipsos, RBA and Roy Morgan Research; Tourism Research Australia; Wesfarmers; Woolworths Group.

issue, the transactional stock has fallen by around 4 percentage points since the pandemic to around 13 per cent.

Velocity method

A single banknote can be used for many transactions, so another way to approximate the stock of cash used for transactions is to estimate the flow of cash payments and convert this flow into a stock. The two concepts are defined in the following equation:

$$\text{Value of transactional stock} = \text{Value of cash payments} \div \text{Velocity of transactional stock}$$

The domestic flow of cash payments is estimated by multiplying the value of total card payments from the Bank's Retail Payment Statistics by the cash-to-card payment ratio recorded in the Bank's Consumer Payments Survey (CPS) (Graph 3, top and middle panels). Cash payments made with cash sourced overseas is approximated by subtracting the value of card payments and ATM withdrawals made with an international card in Australia from total tourist spending estimates from the Australian Bureau of Statistics (ABS) and Tourism Research Australia. Through this method, we estimate that cash facilitated around $8 billion worth of transactions in June 2023 – a decline of around 70 per cent since its peak in December 2008 (Graph 3, bottom panel). Cash has been used much less frequently since the pandemic; our estimates suggest that monthly cash payments have fallen by around $1 billion.

We then estimate the velocity of transactional cash, which is the number of times the transactional stock is used to make a payment in a month. This is approximated by mapping out cash movements through the cash cycle. Banknotes start at a cash depot and are transported to an ATM or bank branch, before eventually ending up in a consumer's wallet or purse. Next, consumers spend these banknotes at a business before they are returned to a cash depot or bank branch and begin the cycle again. We calculate the average number of days it takes for cash to pass through a point in the cash cycle. For some legs of this journey we have accurate data, such as the number of banknotes entering and leaving cash depots each day, and so can calculate the average time a banknote spends in a depot. For other aspects we need to use judgement.[3]

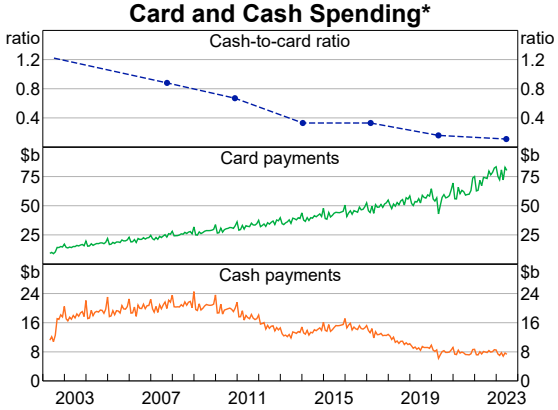
We estimate that the velocity of cash has steadily declined since 2008 and fell sharply following the onset of the pandemic; lockdowns across Australia and the limited ability to spend cash were key drivers of this fall. Our estimates suggest that it takes almost six weeks for the entire transactional stock of cash to turn over; that is, the transactional velocity of cash is around 0.7 when measured on a turnover-per-month basis (Graph 4, top panel). Combining these two components suggests that the transactional stock of cash was in the range of $9–12 billion at the end of June 2023, or 9–12 per cent of all banknotes on issue (Graph 4, bottom panel). This method suggests that since March 2020, the transactional stock has fallen by around $1.5 billion, or 4 percentage points, which is consistent with results from the counting method above.

Banknote processing method

Our third approach quantifies the transactional stock of cash by estimating the rate at which banknotes pass from retailers and banks to cash depots. Since depots only process banknotes that are actively circulating and do not handle banknotes that are hoarded or lost, it can be used to approximate the transactional stock of cash.

Graph 3

Card and Cash Spending*



* Card payments includes payments made by businesses using credit and debit cards; dashed line indicates points that have been interpolated or extrapolated; dots indicate direct estimates from the CPS.

Sources: RBA calculations, based on data from Colmar Brunton, Ipsos, RBA and Roy Morgan Research; Tourism Research Australia.

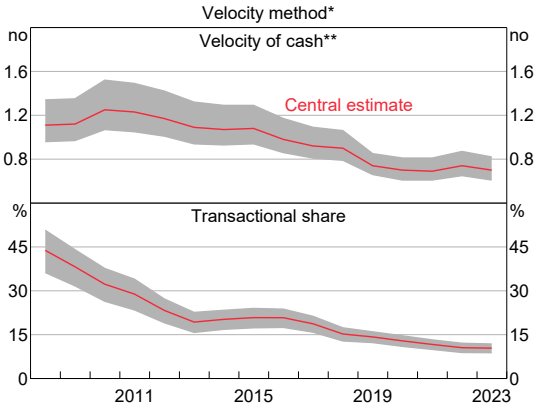
The processing frequency of all denominations has declined over the past decade, reflecting a shift in consumer preferences away from using cash as a means of payment (Graph 5). The decline was particularly sharp over 2020 and has remained relatively steady thereafter. The processing frequency of $5 and $10 banknotes is low as retailers tend to keep these denominations as change, such that they cycle through cash depots less frequently. The $50 denomination processing frequency has converged to that of the small denominations, which may suggest an increasing use for hoarding relative to transactional use.

We can then estimate the transactional stock of cash by making two assumptions. First, we assume the non-transactional stock of cash consists only of $50 and $100 banknotes, and so the lower denominations are only used for transactional purposes. Second, the processing frequency of the transactional stock of $50 and $100 banknotes is equal to the processing frequency of the $20 denomination. Finally, this approach does not account for cash demand from the shadow economy, so we subtract estimates of the stock of cash used for that purpose (discussed further below).

The processing method suggests that around 26 per cent of banknotes in circulation were used for transactional purposes in June 2023. Since the pandemic began, the transactional stock of cash has fallen by 7 percentage points according to this method, which is a little larger than other estimates. However, it is likely that this method overestimates transactional demand, as it relies on strong assumptions about the use of each denomination. For example, the higher denominations that are used in transactions may be processed more often than the $20 note. Almost all $50 and $100 banknotes received by retailers are likely to be banked and returned to cash depots, while the $20 note is more likely to be given as change. This will result in higher transactional stock estimates.

Graph 4

Transactional Banknote Stock Estimates



* Shaded region represents the upper and lower bounds using the range of velocity assumptions.

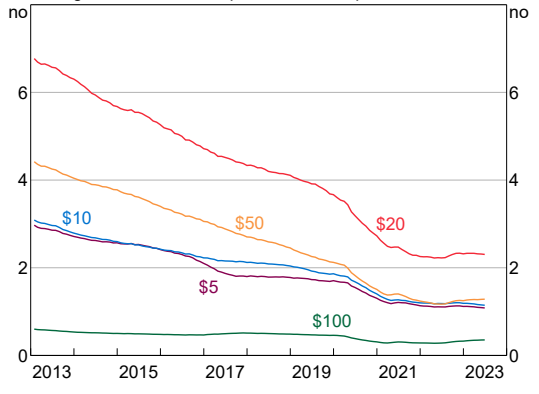
** Velocity of cash is the average turnover of the transactional stock per month.

Source: RBA calculations, based on data from Colmar Brunton, Ipsos, RBA and Roy Morgan Research; Tourism Research Australia.

Graph 5

Banknote Processing Frequency

Average number of times processed over previous 12 months



Source: RBA.

Seasonality method

The final approach for estimating the share of cash used in transactions is the seasonality of banknote demand method. Demand for cash displays a predictable (but weakening) seasonal pattern, with a peak around Christmas and a trough in the winter months. This mirrors the seasonality of consumer spending. As such, we can estimate the transactional share of cash by attributing all the seasonality of banknote demand to transactional purposes. Non-transactional cash demand is unlikely to exhibit a seasonal pattern.

To measure the seasonality of the transactional component of banknote demand, we use a proxy for cash spending – the value of banknotes lodged in cash depots each month. Banknote lodgements measure cash flowing from retailers into depots, which is a direct measure of cash spending. As such, seasonality present in banknote lodgements should also be present in cash spending.[4] We adjust the

seasonality of the lodgement data with three estimates of the seasonality present in the velocity of transactional cash, and then average over the three estimates.

We estimate that 9–12 per cent of banknotes in circulation were used for legitimate transactional purposes in June 2023 under this method (Graph 6). Since the pandemic began, the transactional share of banknotes on issue declined by 2–3 percentage points, which is a little less than the decline suggested by other methods.[5] In value terms, around $9 billion of cash was used for transactions – a fall of $1 billion since the pandemic began.

Overall assessment

Taken together, these four methods suggest that between 9 per cent and 26 per cent of banknotes in circulation are used for legitimate transactions in Australia (Graph 7). On average since the pandemic began, the share of banknotes used for this purpose has fallen by around 5 percentage points, which is consistent with the pre-pandemic trend decline in cash use. Although each method presented above has limitations, the trends – and indeed the estimates from three of the four estimation methods – are broadly similar.

Lost banknotes

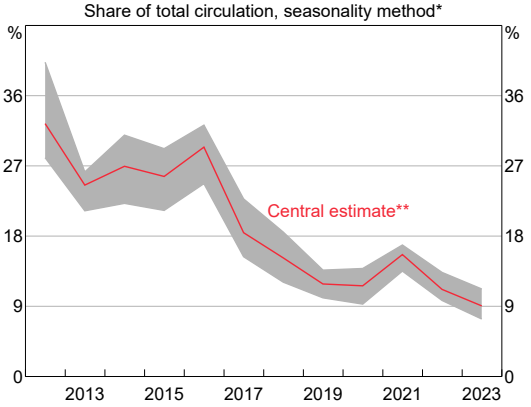
There will inevitably be some banknotes that have been lost, destroyed, forgotten about or are sitting in numismatic currency collections, both domestically and internationally. While these are still considered as banknotes on issue, they are unavailable for spending. To estimate the value of these 'lost banknotes', we exploit the fact that some paper banknotes – which were last issued in the early to mid-1990s but are still legal tender – have yet to be returned to the Bank for destruction. We assume that these outstanding banknotes are lost, calculate an implied annual loss rate, and then apply this rate to the amount of outstanding polymer banknotes. Note that paper banknotes are still being returned to the Bank, despite being replaced by polymer banknotes more than 25 years ago, and so our measure is inherently uncertain.

The loss rate is greatest for the lowest denominations ($5 and $10), followed by the highest denominations ($50 and $100) and is smallest for the middle denomination ($20) (Graph 8). This may be due to people showing less care towards banknotes of lower value, while high-denomination banknotes may be hoarded and eventually forgotten about or misplaced. Although the loss rate of paper banknotes serves as an indicator for polymer banknotes, it may not be an accurate reflection. For instance, polymer banknotes are more durable than paper banknotes, which implies that fewer polymer banknotes would be destroyed. On the other hand, greater international

Graph 6

Transactional Banknote Stock Estimates

Share of total circulation, seasonality method*



* Seasonality of cash payments is proxied by banknote lodgements at cash depots.

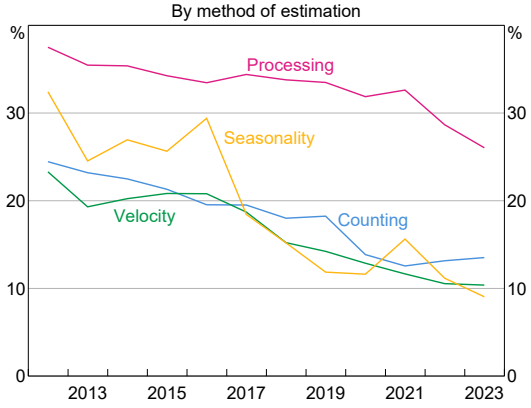
** Shaded region represents the upper and lower bounds from three estimates of the seasonality present in the velocity of transactional cash. Central estimate is the average across each of the proxies.

Sources: ABS; RBA calculations, based on data from Colmar Brunton, Ipsos, RBA and Roy Morgan Research; Tourism Research Australia.

Graph 7

Transactional Share of Banknotes on Issue

By method of estimation



Source: RBA calculations.

demand for Australian banknotes over recent decades may result in a greater flow of banknotes leaving the country, some of which may be lost.

We use the minimum and maximum loss rates of the paper denomination to estimate a range for the amount of lost banknotes. This suggests that $5–9 billion, or roughly 5–9 per cent of banknotes in circulation, were lost, destroyed, forgotten or sitting in numismatic currency collections as of June 2023. Unsurprisingly, the share of banknotes that are lost has remained broadly unchanged in recent years and was not affected by the pandemic.

Banknotes used in the shadow economy

As physical cash is difficult to trace, it can be used to facilitate activity in the 'shadow' economy. The ABS defines the shadow economy as consisting of both underground production (concealing of legal activities to avoid taxation) and illegal production (such as illegal drug production and sale) (ABS 2013). To estimate the stock of banknotes used in the shadow economy, we first estimate the size of the shadow economy and then use the estimates of banknote velocity described above to convert this flow into the amount of cash used to facilitate these transactions. For simplicity, we assume that all shadow economy transactions are made with cash.

Using ABS estimates of the shadow economy from 2012, and scaling it to more recent GDP figures, we estimate that the stock of cash used in underground production was $4.2 billion and the stock of cash used on illegal drugs was around $1.1 billion in June 2023. This implies that the stock of cash used to facilitate shadow economy transactions was $5.3 billion, which is just above 5 per cent of the total banknotes on issue at that time. The Black Economy Task Force estimates that the size of the shadow economy is twice as large as estimated by the ABS (BETF 2017). Using this data source suggests that $10.5 billion of cash, or around 10 per cent of banknotes on issue, is used to facilitate shadow economy activities. Note, these estimates assume that the share of the economy devoted to underground and illicit activities, as well as the proportion of such activities that are facilitated by cash, has remained unchanged over time.[6]

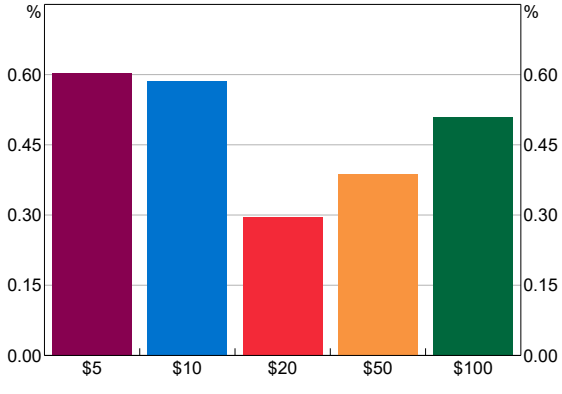
We also calculate the stock of cash based on estimates of the size of the drug market. Expenditure on drugs is calculated based on data from the Australian Criminal Intelligence Commission (ACIC) on the volume of drugs consumed via wastewater analysis and from the 2019 Australian Institute of Health and Welfare National Drug Strategy Household Survey (ACIC 2023; AIHW 2020). These results suggest that $14.1 billion was spent on illicit drugs in 2022/23, so dividing by the transactional velocity implies that the stock of cash used to facilitate purchases of illicit drugs was $1.6 billion, or almost 2 per cent of cash-in-circulation in June 2023. In addition, drug suppliers are also likely to hold large volumes of cash in reserve; ACIC (2022a) data suggest that this is 2 per cent of total sales. These results suggest that total cash hoarding by the illicit drug supply chain is up to $800 million, which is up to roughly 1 per cent of all banknotes on issue.

In sum, we estimate the stock of cash used in the shadow economy in June 2023 was around $7–11 billion, or 7–11 per cent of total banknotes in circulation. This has edged up slightly since the pandemic, although these estimates have a high degree of uncertainty.

Graph 8

Paper Banknote Loss Rate

Per cent outstanding, June 2023



Source: RBA.

Hoarding

Hoarding, both domestically and internationally, is the most significant component of banknote demand. Hoarding is usually done for store-of-wealth or precautionary motives. We define

hoarded banknotes as those held for legitimate reasons other than financing everyday transactions or those that are lost. Given the difficulty in quantifying the stock of cash that is hoarded domestically or internationally, we apply three methods to directly estimate the stock of hoarded banknotes:

1. Using fire-damaged banknote claims data from the Bank's damaged banknote facility suggests that 2 per cent of banknotes in circulation were hoarded domestically in June 2023.
2. Scaling cash holdings data from the Bank's 2022 CPS to economy-wide levels estimates that 7–15 per cent of cash in circulation was hoarded domestically in June 2023.
3. Aggregating wholesale currency shipments to and from Australia suggests that 0–20 per cent of cash in circulation was likely to be hoarded internationally in June 2023.

Each of these approaches is inherently limited: the first approach assumes that fire-damaged households are representative of all households across Australia; and the second approach relies on respondents accurately reporting the amount of cash they store at home (respondents with large physical cash holdings may be less likely to participate in the survey or report the true value of their holdings). The third approach is subject to significant uncertainty and does not capture all international flows of Australian banknotes.

While these direct methods suggest hoarded banknotes account for up to 35 per cent of all banknotes outstanding, this is likely to be an underestimate. Alternatively, we can compute the share of banknotes that are hoarded as the residual of other estimates discussed above. Assuming there are no other locations that cash could be, we take the residual of our transactional estimates and subtract the stock of cash that is lost and the stock of cash that is used in the shadow economy. This suggests that roughly 55–80 per cent of banknotes in circulation in June 2023 were hoarded, either domestically or internationally. This is closer to international estimates of hoarding in Germany and the euro area, for example (Bartzsch and Uhl 2017; Zamora-Pérez 2021). In value terms, the hoarding component of banknote demand accounted for between $56 billion and $81 billion. This share has grown since the onset of the pandemic by around 5 percentage points, which indicates that much of the increase in banknote demand over this period was for hoarding purposes.[7]

Conclusion

Against the backdrop of declining cash use for day-to-day transactions, it is useful to understand how banknote use has changed in recent years. We estimate that of all the banknotes currently in circulation:

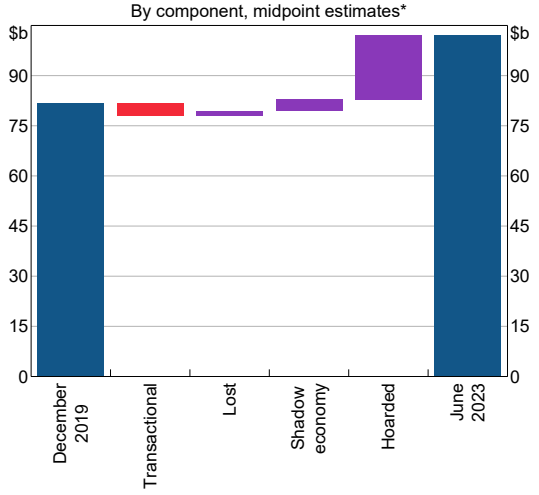
- 9–26 per cent are used for transactional purposes
- 5–9 per cent are lost
- 7–11 per cent are used in the shadow economy
- 55–80 per cent are hoarded domestically or internationally.

The estimated share of banknotes used for transactions has declined by around 5 percentage points since the onset of the pandemic and is consistent with the decline in cash payments, as shown in the Bank's latest CPS. Non-transactional banknote demand, particularly from hoarding, appears to have driven the significant increase in the value of banknotes on issue since the pandemic began (Graph 9).

Graph 9

Value of Banknotes in Circulation

By component, midpoint estimates*



* Red bars indicate a decline in this component. Purple bars represent an increase in this component.

Source: RBA calculations.

This analysis allows us to draw some broader conclusions. First, declining transactional velocity of cash and an increased share of banknotes that are hoarded means that most Australian banknotes will have a longer lifespan compared with the past. Second, fewer banknotes used for transactions will lead to lower cash processing volumes, which further increases financial pressures across the wholesale banknote distribution industry (RBA 2021). And finally, these results provide further evidence that the pandemic has had a lasting effect on payment behaviour in Australia (Mulqueeney and Livermore 2023; Guttmann *et al* 2021).

Endnotes

[*] Patrick Elkington is from Note Issue Department and Rochelle Guttmann completed this work while in Note Issue Department.

[1] We use the same methodology, data sources and assumptions as Finlay, Staib and Wakefield (2018). Accordingly, the technical details underlying the analysis in this article, as well as a more detailed discussion of the assumptions and limitations of the analysis, can be found in that paper.

[2] Banknotes that are stored at the Reserve Bank – either because they are newly printed or have been returned via a commercial bank – or are deemed unfit and have been destroyed are considered 'out-of-circulation' and are not included in the calculations.

[3] We have made some small changes to the methodology. For instance, liaison with banks and ATM deployers suggest that some cash replenishments occur less frequently, and ATM refills are larger than prior to the pandemic.

[4] Estimating the transactional stock using retail sales to proxy cash spending leads to similar results. Nonetheless, not all retail sales are conducted with cash, so the seasonality of retail sales may not accurately approximate the seasonality of cash payments. For instance, consumers could be more likely to use credit cards around Christmas, which would lead to a higher seasonal peak than cash payments.

[5] Zamora-Pérez (2021) uses the seasonality method to estimate the share of euro banknotes used for transactions and shows that the transactional share has steadily fallen since 2003.

[6] The use of electronic forms of payment (such as cryptocurrencies) to facilitate transactions in the shadow economy has grown over recent years (ACIC 2022b). This suggests that the proportion of such activities paid with cash may have declined.

[7] Results from the 2022 CPS show that the distribution of hoarded cash is likely to be highly skewed, with 60 per cent of respondents indicating they do not hold any cash outside of their wallet. Instead, large amounts of cash are likely hoarded among a relatively small number of individuals (Mulqueeney and Livermore 2023).

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