Going Beyond

2nd Quarter 2022

DeLaRue

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Introduction

As travel restrictions ease, we are delighted to be able to connect again with so many of you face to face. The month of May saw the Global Currency Forum take place in Tarragona, Spain. It was an honour to be a part of team that made this possible. We hope those of you who were able to attend found the event to be beneficial.

De La Rue's full year results were shared on the 25th May, for year ended 26 March 2022, revealing an adjusted operating profit growth of 30% year-on-year for the combined Authentication and Currency divisions, along with a strong operating cash flow of £18.3m. This growth was achieved despite unprecedented global events and supply chain challenges which are disrupting and devasting companies around the world. All of us face a difficult year ahead but I'm proud of the strong and sustainable division that we've built in De La Rue.

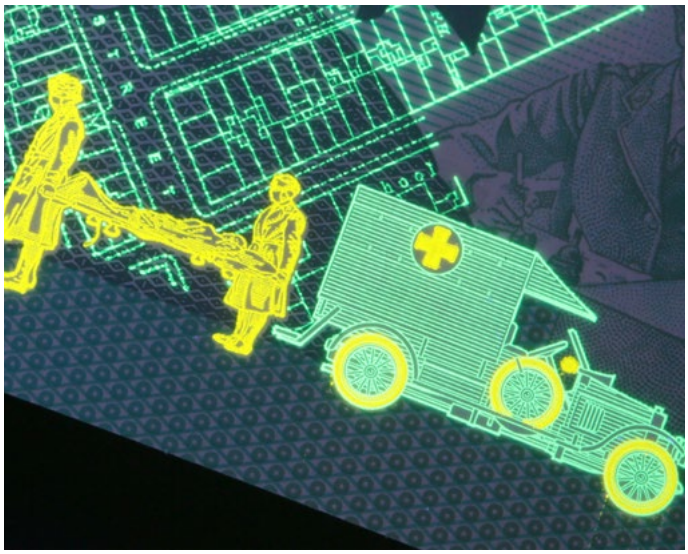
Finally, I would like to offer my congratulations to the Bank of Scotland and the Bank of Thailand on the issuance of their new polymer banknotes. You can read more about these notes in this edition of Going Beyond.

If you would like any more information about anything in this newsletter or would like to register for future webinars, please contact us at currency@delarue.com.

Ruth Euling, Executive Director and Managing Director, Currency

New Banknotes

Bank of Scotland issue polymer £100



The new £100 entered circulation 9th May 2022 and features medical pioneer Dr Flora Murray CBE. The £100 completes the series of polymer notes issued by the Bank of Scotland.

The new note was designed and printed by De La Rue on SAFEGUARD® substrate and features a clear window with an intricate De La Rue holographic foil stripe. It is our first polymer foil to run the full length of the note.

The De La Rue hologram is uniquely customised for the £100 and combines two origination methods which double the security: direct write lithography (an advanced digital "hologram") and a highly evolved form of Benton (H1-H2) holography ("classical" holography). PUREIMAGE™ animation, microtext, DEPTH™ effects on different levels and a full colour portrait of Dr Murray combine to create an engaging and striking security feature that is fully integrated into the note design.

The notes include enhanced security features including GEMINI™ and ROTATE™. As with the £10, £20 and £50 notes, the £100 has a tactile emboss feature for the visually impaired.

The public education messaging from Bank of Scotland can be found here.

#NEWNOTES

Bank of Thailand issue polymer 20 Baht

From the 24th March the Bank of Thailand began issuing its first polymer banknote, the 20 Baht.

The design of the new polymer note retains familiar themes from the previous cotton series for ease of public recognition. The new design contains two secure transparent windows, a feature unique to polymer. The note contains distinctive artwork, with a portrait of the King created using advanced intaglio printing techniques.

The 20 Baht will be printed on De La Rue SAFEGUARD® polymer and CCL's Guardian substrate.

Ulster Bank to issue polymer £50 in June

On the 8th March Ulster Bank announced their intention to issue a new polymer £50 on June 15th 2022.

The new notes were designed by O Street before being passed to De La Rue to turn into a functional banknote. The £50 is printed on SAFEGUARD® substrate and features a portrait design with themes of nature on the front with the reverse celebrating women who have contributed to Northern Ireland, with Dame Jocelyn Bell Burnell foremost.

The note will contain a see through window, holographic stripe and tactile emboss feature for visually impaired users.

More details about the note and its security features will be available here following issuance.

Bank of Jamaica and Central Bank of Barbados announce new polymer series

The Bank of Jamaica announced the forthcoming series of polymer banknotes on 8th March 2022. The new series is comprised of six denominations, with the introduction of a new $2000 note. The notes will enter circulation toward the end of 2022 and will gradually replace the existing notes in circulation.

The new series was designed and printed by De La Rue on SAFEGUARD® substrate and features see through windows, holographic stripes, UV effects and a tactile emboss feature for the visually impaired.

To learn more about the new series click here.

On the 5th May the Central Bank of Barbados announced their forthcoming polymer series which is due to be issued on the 5th December 2022.

The new series is designed and printed by De La Rue on SAFEGUARD® substrate and features see through windows, holographic stripes, UV effects and a tactile emboss feature for the visually impaired.

The new series consists of six denominations and uses a portrait orientation for their design.

To learn more about the new series, click here.

#NEWNOTES

Central Bank Digital Currencies and Financial Inclusion

Dr Ole Rummel
Director of the Macroeconomic and Monetary Policy Management Pillar
SEACEN Centre

In January 2022, the UK's House of Lords added to the growing discussion on the viability of, and prospects for, a domestic central bank digital currency (CBDC). Joining a long line of earlier commentators (such as Waller (2021) for the US), the august body agreed with others before it that CBDCs were 'a solution in search of a problem'. In addition to the UK and the US, no real case for a CBDC has been made in Singapore and Japan will not issue a CBDC anytime soon either. But even after conventional arguments in favour of CBDCs have been shown to fall short, CBDC proponents still have an ace up their sleeve: financial inclusion, i.e., facilitating access to financial services for the under- or unbanked. Currently, 1.7 billion people either do not have access to a transaction account operated by an authorised and/or regulated payment service provider (World Bank (2018)) or are excluded from the formal financial system. Who could seriously argue against providing access to the financial sector and all the benefits this entails, such as a transaction account to safely store some value, send and receive payments and perform most, if not all, payment needs, especially as a CBDC is apparently all that is needed? How would a CBDC enhance financial inclusion? The implicit assumption seems to be that the under- or unbanked primarily need a better way to access financial services and would therefore readily use a CBDC for that purpose. But many of the details are left unspecified. It appears that everyone with a mobile phone will simply download the necessary digital wallet and app and be instantly financially included. By doing so, everyone would have the equivalent of a bank account into which funds could be deposited by the government and from which utility companies and others could be paid.

While the case for introducing a CBDC differs around the world to reflect the prevailing economic circumstances and the efficiency of national payments systems, for many emerging market economy central banks financial inclusion is one of the key drivers for considering CBDCs (Boar et al. (2020)). But many of the required policies for enhancing financial inclusion are well-known and centre around a basic and low-cost bank account, a robust digital identification (ID), a method of storing balances and some form of payment infrastructure. All of these could be tackled by bolstering the digital financial tools already available and do not require a CBDC. Rather than the promised instant panacea, a CBDC would – at best – be a complement to what is required. Once these policies have been put into place, a CBDC could be introduced towards the end of the process to safeguard the steps towards financial inclusion already achieved.

Causes of financial exclusion

The reasons for financial exclusion are well-known and diverse, with some being involuntary and others voluntary. In no particular order, these can be summarised by:

- Geography: In countries with remote or sparsely populated areas, parts of the population may be geographically distant from the nearest bank branch.
- Regulatory requirements: One of the biggest hurdles to financial inclusion has to do with compliance in the form of verifiable personal ID. Auer et al. (2020, p. 4), citing research by the McKinsey Global Institute (2019), report that an estimated 1 billion people worldwide do not have basic identification credentials, and many more have IDs that cannot be trusted because they are of poor quality or cannot be reliably verified. Roughly another 3.4 billion people have some form of ID but with limited ability to use it in the digital world. And even the 3.2 billion people with a legally recognised identity may not be able to use that ID effectively and efficiently online.
- Bank requirements: In order to offer profitable services, banks may impose excessive minimum balance requirements and too high or too unpredictable bank account fees, while some customers may have previous credit or bank account problems that prevent them from being able to open a bank account.
- Access problems: An increasingly digital world may result in an inability to access digital services due to the cost of obtaining connection devices and data, lack of mobile or internet coverage and a lack of digital and financial literacy (Klapper et al. (2015)). An additional factor for access is an uninterrupted electricity supply.
- Trust and privacy concerns: In many surveys of the under- or unbanked, a lack of trust in banks features prominently. The same is true for privacy concerns. Finally, many have never had a bank account and do not feel that they need one, making this a matter of personal choice rather than economic or financial sense.

Whether in advanced economies such as the US (49 per cent according to the FDIC (2019)), emerging market economies like the Philippines (45 per cent according to the BSP (2019)) or the world more generally (two-thirds of unbanked respondents in the World Bank's (2017) Global Findex survey), surveys show that the predominant reason for financial exclusion from the above list is the hurdle of meeting minimum balance requirements.

What needs to be done?

Policies to deal with financial exclusion and enhance financial inclusion are well-known and many of the required payment system requirements are addressed by PAFI (2017). As outlined in the study, certain financial and other relevant infrastructures that are necessary for an efficient national payment system also form the basic foundations for financial inclusion:

- a large-value interbank settlement system;
- an interbank system for retail payments, in specific electronic funds transfers;
- a payment card processing platform or platforms;
- an effective and efficient identification infrastructure;
- credit reporting and other data-sharing platforms also play an important role; and
- a robust communications infrastructure and power supply system.

CBDC design

Now that we know about some of the financial exclusion issues and potential remedies, we can turn to the question of how a CBDC can help financial inclusion, which naturally leads to the issue of CBDC design. As implied by its name, the general-purpose CBDC that seems to be favoured by policymakers will have to be 'all things to all men'. As such, it will need to address several domestic (and potentially one or two international) objectives simultaneously. These objectives, motivations and risks will differ across jurisdictions, and advanced

and emerging economies will undoubtedly see the case for CBDCs differently based on variations in financial systems, economic structures, societies and legal structures. In fact, there is no single overarching objective that a majority of central banks is trying to achieve: the most prominent ones are increases in efficiency, robust and secure payment systems, modernisation or digitisation, efficient cross-border transfers, lower costs and financial inclusion (AMRO (2022, p. 2)). This leads to trade-offs in CBDC design (Auer and Böhme (2020)), meaning that it is unlikely that a future CBDC will be created to meet just the financial inclusion objective. As a result, a CBDC does not exist in a vacuum and will have to form part of larger changes to enhance financial inclusion.

The conviction of CBDC proponents concerning the important role of CBDCs in financial inclusion is puzzling, seeing that we have not yet converged on a CBDC blueprint. It is impossible to evaluate how a CBDC might help the unbanked without precisely defining the CBDC and seeing the unbanked problem clearly in conjunction with CBDC design. Specifically, a general purpose CBDC could enhance financial inclusion only to the extent thatinclusion features prominently in its design from the outset.

In terms of the CBDC path ahead, we seem to be converging to an account-based system built on digital ID. Under this preferred model, CBDCs are '…best designed as part of a two-tier system, where the central bank and the private sector each play their respective role (BIS (2021, p. 79))'. In this scenario, the central bank operates the system's core, ensuring the safety and efficiency, while the private sector, such as banks and payment service providers, innovates and actually serves customers by providing digital wallets and apps for the public to use. This account-based approach allows for verifying users' identity 'rooted' in a digital ID scheme, and thus preserves privacy, but does not provide the full anonymity of cash in payments.

How would a CBDC address the causes of financial exclusion? The portents are not good. For a start, a CBDC will be an imperfect substitute for cash. There are those in society who value the physical nature of cash, perhaps on account of concerns around security or fraud. The introduction of a CBDC is therefore unlikely to impact their payment behaviour. These agents use cash for reasons that will not be affected by the creation of a CBDC. Equally, those that do not have an account because of their concerns about privacy or lack of trust in either financial institutions or the government will not be convinced to use a government-issued and private-sector managed CBDC with a much lower degree of anonymity than cash. Finally, some percentage of the public is simply not at all or not very interested in having a bank account as a matter of personal preference. Why should this suddenly change with a CBDC?

Important role of government

We have seen that CBDC design cannot be separated from the environment in which it will operate. To a large extent, a CBDC is as much a social issue as it is an economic one and financial inclusion is frequently one of the stated objectives of government policy. This means that the government plays – and will have to play – an important role. To enhance financial inclusion, it is essential that public bodies (rather than the private sector) determine the architecture of the system. For example, the government's role should be to find the right balance between promoting innovation and managing risks.

In particular, the government should provide an equal foundation for everyone – the private sector can then add innovation to a level playing field. As such, the government could provide a payment infrastructure on top of which private payment providers can innovate and provide efficient payment services with a guarantee of interoperability and easy access. This is especially important because the small merchants that the underbanked deal with are of the the last to go digital. They may not understand or be able to offer the new technology, or they may not wish to go digital in order to keep transactions and income invisible from the tax administration or other authorities.

One could easily imagine additional important enabling roles for government, such as the provision of a verifiable digital ID, ensuring open and affordable access to the digital infrastructure, providing regulatory and legal frameworks that do not impede access to payment services, and enhancing financial and digital literacy. Along those lines, a widely used general purpose CBDC could complement efforts by government or private sector entities (under public oversight) to establish a universal digital ID system leading to greater financial inclusion. Given the novelty of CBDC product and the related complexities of the digital world (nicely described in Tett (2021)), a CBDC can be expected to invite financial and/or online fraud, security breaches and data theft, trying to capitalise on financial and digital illiteracy. The most vulnerable in poorer countries to such are undoubtedly going to be the worst affected. A universal and verifiable digital ID issued by some combination of the government and the private sector would counteract such problems.

That being said, a digital ID raises a number of issues that must be resolved for it to work, especially around governance. A digital ID built around a private sector's product and service offerings creates a closed-loop system that does not contribute to financial inclusion. National ID systems may raise questions of trust, e.g., how will the government use the data and information and will such data be safely stored? Furthermore, how will migrants, refugees, stateless and other displaced people be included because they are unable to present any ID or unable to procure a qualifying ID in the country in which they are currently located.

A CBDC can worsen financial exclusion

Advocates of a CBDC in support of financial inclusion often forget the adverse implications of more digital payment innovations. The latter undoubtedly offer

convenience, but they also raise concerns about how they may further exclude a population already marginally attached to the economy. One concern is that a future CBDC might have the perverse effect of helping to aggravate financial exclusion.

Even in the absence of a CBDC, the economy in general, and the financial system in particular, have become increasingly digital. This increasing digitalisation and reliance on mobile banking services has left some sections of society behind as potential barriers around trust, digital literacy, access to IT and data privacy concerns have created a digital divide or gap. The latter has been laid bare even in advanced economies, where the COVID-19 pandemic has illustrated the problems associated with providing access to online education for students at all levels during the various lockdowns. The digital gap in emerging market and developing economies is a similar issue in the digitalisation of the economy and the ensuing consequences for inclusion.

Financial inclusion as envisaged by the proponents of a CBDC presupposes digital inclusion, such as access to infrastructure (digital devices and the internet), skills (the knowledge and confidence to use the devices and an understanding of how the internet works) and accessibility (assistive technology and accessible design for those with disabilities or additional needs). The increasingly digital nature of the economy means that people who are not digitally literate need a simple means of making payments and it is not clear whether a CBDC is the simplest way of fulfilling that role.

Finally, as outlined in Eichengreen (2021), many public and private-sector companies provide more favourable terms to the banked because they can be expected to be paid more promptly and regularly. The unbanked pay more because credit providers see possession of a commercial bank account as a signal of financial stability, probity, literacy and reliability. This signalling value of a bank account would be lost under a CBDC that is available to everyone unconditionally.

Conclusions

It is worth keeping in mind that financial inclusion is ultimately a promise and not a guarantee (Duffie (2021)). The idea that a complex social problem like financial inclusion can be solved by technology is certainly seductive, if a bit simple. A CBDC may be a solution to the problem of financial inclusion, but it is unlikely to be the only one. For a CBDC to increase financial inclusion, it must address the causes of exclusion, which vary by jurisdiction and are often complex. Given the complexity of this issue and possible underlying obstacles to digital inclusion (e.g., financial and digital illiteracy), any CBDC initiative would likely need to be embedded in a wider set of reforms, such as the ones outlined by the CPMI-World Bank (2020). In consequence, a general purpose CBDC will enhance inclusion in the medium term only if the inclusion dimension features prominently in its design from the very start. In that way, a widely used general purpose CBDC would lock in government and private sector efforts to enhance financial inclusion. And it goes without saying that a CBDC system should avoid reinforcing barriers to financial access and should not introduce any unintended sources of exclusion.

A case can be made for the introduction of a CBDC at the end of the financial inclusion process rather than at the beginning, i.e., avoiding putting the technological cart before the horse (Fanusie (2021)). A CBDC could thus reinforce a framework through which the provision of simple, affordable, non-bank alternatives could be provided to households and individuals without bank accounts. While a CBDC is not a prerequisite for such services, it is likely that this functionality would be a feature of any CBDC that the central bank designed.

Even though, more can be done to exploit the opportunities that are still to be seized in many countries by bolstering the digital financial tools available and rolling out a robust digital financial infrastructure on a large scale. In other words, the solution may not be a CBDC but the wider range of successful technology in the payments area that could achieve the same ends. This also argues against the myth of leapfrogging. One often-heard rationale for the use of a CBDC is the prospect of leapfrogging to the head of the queue in terms of financial inclusion. But it is unlikely that one can avoid doing the hard work, as set out in the principles for payment infrastructure design by PAFI (2017). It may therefore be apt to close with the House of Lords as well, who stated that 'It is likely that there are more straightforward and targeted ways to support access to financial services than to launch a CBDC (p. 19)'.

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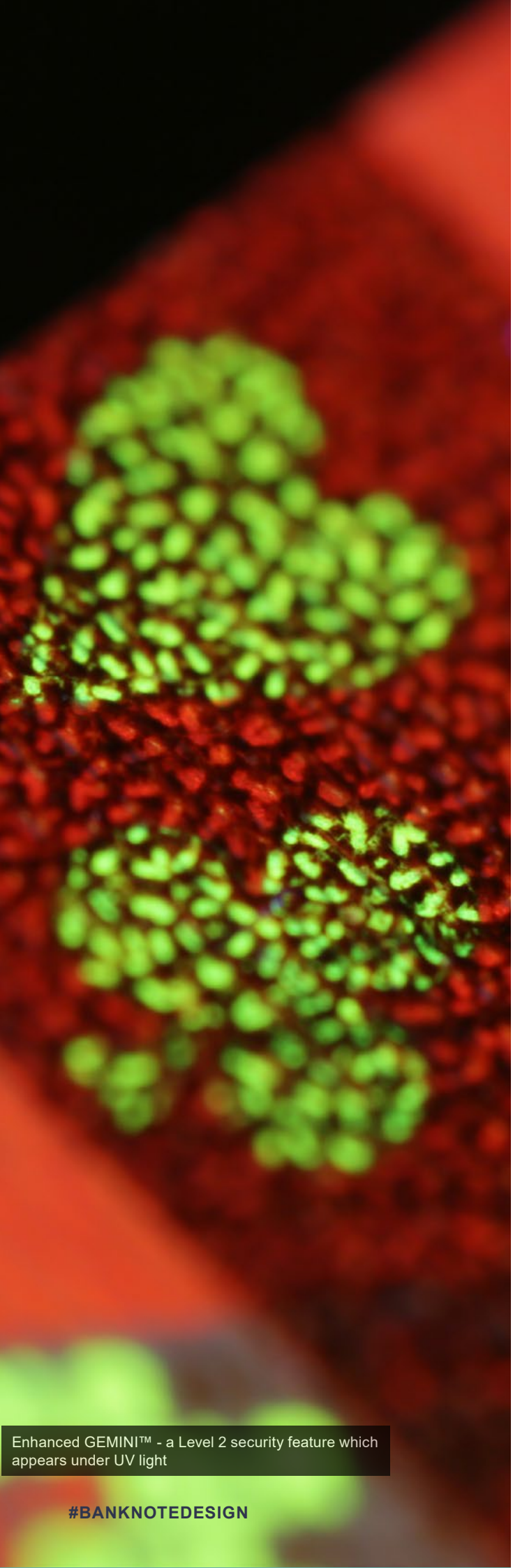
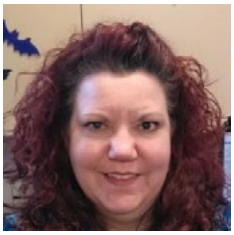


Enhanced GEMINI™ - a Level 2 security feature which appears under UV light

#BANKNOTEDESIGN

Designing a secure banknote



Kerre Corbin, Circulation, Authentication & Counterfeit Expert De La Rue Currency

The foundations of a secure banknote are strong security features that are well integrated into an engaging design and supported by public education.

The definition of a "strong security feature" is frequently debated, with suppliers and studies associated with suppliers leaning towards specific products or technologies. Perception studies can provide valuable insight into how a specific demographic interacts with banknotes or what they notice in a controlled experiment. But other factors also need to be considered when designing a secure banknote because the factors that combine to make a banknote secure are typically more subtle than often messaged.

Banknotes must meet the requirements of ALL users of the cash cycle, balancing aesthetics with security, functionality, capability to manufacture, machine readability, durability and cost. The security of a banknote is more than a single public recognition feature. Ultimately, the user considers the banknote holistically, which makes the design of the banknote incredibly important. There is a trend towards more security features per banknote – paper notes more frequently feature a thread and an applied feature than a decade ago and more modern polymer notes are more likely to have a security feature integrated into their window. With SAFEGUARD® ASSURE™ providing a covert feature in the very core of the polymer substrate both major banknote substrates can provide security features to meet every type of authentication need. Additionally polymer banknotes provide durable blind recognition features for central banks seeking to widen financial inclusion.

"The best format, layout and design are intuitive and appear simple, whilst incorporating significant levels of complexity."

Studies recommend taking advantage of the brain's natural methods of visual analysis, i.e. to use the features of the banknote to guide looking and information and the concept of a "navigation map" to link security features to graphic elements and encourage the public to visually travel across the banknote for ease of authentication. A balance between features is important to ensure that one 'stand-out' feature does not mean the other important elements are ignored. It is also important to ensure that the visual images used in different features are different, to avoid re-use of a single image by counterfeiters.

The responsibility of the design process is to bring all these together and engage people in their banknotes (whilst ensuring the banknotes are manufacturable and functional at every stage of their lifecycle). Aesthetics encourage people to look at a banknote for longer, with artistic elements capturing and holding attention long enough to engage with the different features. A feature that looks expensive and high impact will give users the belief that it is technically difficult to simulate, which provides reassurance. Such features require the appropriate secure effects and design to ensure the perception matches the reality. Additional processes such as overprinting and demetallisation can enhance the visual experience. It brings an overall coherence and visual journey to get interaction and provide users with an emotional reward. There is a reason that many people smile when they first see enhanced GEMINI™ magically appear under UV light.

The format and layout are key in ensuring the denomination and main security features are noticed. This needs to be balanced with the technical and production rules to ensure that the note is engaging and effective. The effectiveness of a security feature depends heavily on its visual effects, but also on size, position and how feature integrates with the rest of the banknote's design. Security features positioned too closely or to distantly from interesting design elements will not attract attention effectively. Features positioned outside of the immediate gaze areas (e.g. in the corner, that can be covered by a finger) are unlikely to be seen.

"The security features and design elements need to look as though they belong on the banknote – this is where good design plays a fundamental role."

The design needs to highlight the security feature and the easier it is to find and the more likely it is to be looked at directly. However, the increased saliency of one security feature may direct attention away from other security features, so this needs to be done with consideration for the overall visuals.

Different sizes for each denomination and different shape or image security features help protect against issues such as uprating or harvesting. While banknote equipment manufacturers prefer to make every denomination very different to speed up banknote processing and improve accuracy, this goes against other studies which recommend designing a family of notes where features are similar for ease of identification and located in same position on each banknote. It is important to ensure that while there may be design and location consistency in the security features to aid ease of visual focus no matter what the denomination, each denomination is unique with clear shapes and images related to that specific note. This will limit confusion between denomination as well as raise the counterfeit challenge.

A secure banknote frequently combines public recognition features of different technologies with machine readable, teller and even covert features. Each technology or complex print feature represents a barrier to criminals attempting to counterfeit banknotes and the feel of the note is also recognised as playing a critical role. Good design then ensures that the banknote is not too complicated to look at. A balance can be achieved, using design to ensure that the public recognition and authentication features are prominent and striking whilst including the other elements that are needed in the note.

Top to bottom: NEXUS® an 18mm embedded stripe with micro-optic effects and custom imagery.

SAFEGUARD® with a complex shaped polymer window and ARGENTUM™ metallic ink.

SAFEGUARD® with Foil on Polymer - six holographic features and effects combined into a holographic stripe in the window.

While the user may not remember all features and design elements, the absence of them will be a trigger for an authentication response through other features.
There are multiple reasons for including different public

"Visual impairments mean that no single public recognition feature will work for everyone."

features, not least that visual impairments affect a significant minority of the population. Some movement-based features only work with good stereo-vision but approximately 10-20% of adults lack the capability to perceive stereopsis (the ability to perceive the slight differences in perspective and location of the left and right hand view). For this subset of the population 3D signals can never serve as sensory triggers, and they would have to rely on other sensory info such as patterns or colour – this means that 3D features are ineffective for some of the population. Similarly approximately 4.5% of the world population is colour blind. Colour blind people may not be able to view certain colour switches within optically variable features. This means that no one feature will work for everyone and a mix of options is required to cover all visual capabilities.

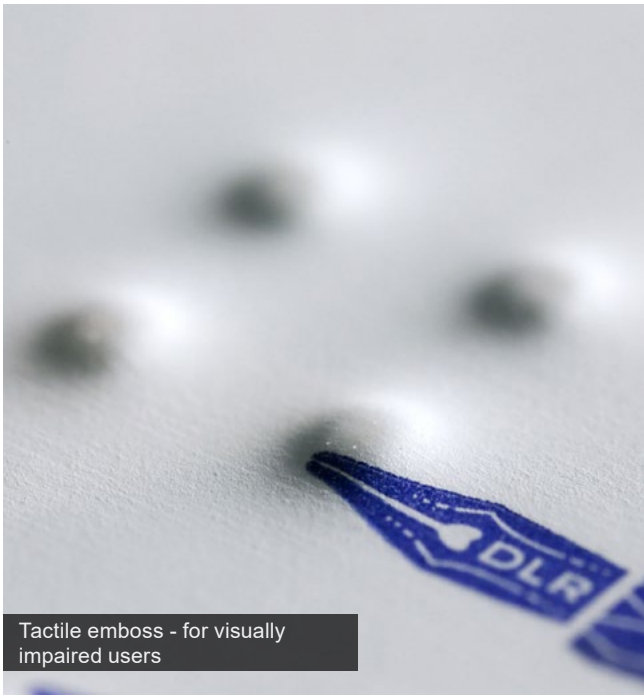
The requirement for layered security is important because banknote users consider the banknote holistically. Public education campaigns frequently suggest some type of variant of the Euro "look, feel, tilt" messaging. The extent to which people actively and fully do this is debatable. Studies suggest that people wont consciously examine individual security features to authenticate elements in isolation. The impact of a single feature is arguably much more important in the eyes of a security feature supplier than it is from those actively using the banknotes. Fortunately users look at the entire banknote holistically. During these interactions banknotes are naturally moved about whilst the 'look' and 'feel' elements act as a trigger that something isn't quite right. This trigger is frequently a combination of multiple elements of the banknote that have not been perfectly replicated.

Using technologies that have been pushed to their limit and combining with other features and processes makes convincing counterfeits much harder to produce. The risk of simulation is also important – every type of technology (micro-optics, holographics and colourshift) has been simulated and has decorative variants that are commercially available.

Decorative variants are a world apart from the highly secure variants used for banknotes though. When highly secure technology variants combine with features that have a high level of design freedom (e.g. shape, size, colours and ability incorporate unique imagery) they are particularly effective: they widen the gap further between what is on a banknote and what is available commercially and they ensure that the feature can be well integrated into that banknote – the feature and the design looks like it belongs on the note meaning that any simulation is much more likely to trigger a user to realise if something is wrong.

Overall designing a secure and engaging banknote requires expertise and the ability to consider the needs of the banknote from multiple different perspectives. Ensuring you have a secure banknote is much more nuanced than simply picking one single public recognition security feature.

IGNITE® - a combinational thread with colourshift, dynamic effects and custom imagery



Tactile emboss - for visually impaired users

What happened to the volume and value of cash in circulation?

Dr Simon Jones
Head of Data Analytics
De La Rue Currency

The way that we used cash during the early peaks of the COVID pandemic saw an abrupt change. There was an acceleration toward the digitalisation of payment methods whilst simultaneously the demand for cash grew. At first glance this increase in demand for competing payment methods may seem paradoxical, why would there be more demand for cash when we are paying for goods and services using cashless alternatives?

We looked at how cash volumes and the value of cash in circulation changed and identified some patterns using publicly available data from seventy-six central bank annual reports, statistical bulletins and data from online data warehouses.

Volumes

Between 2019 and 2020 the volume of banknotes in circulation increased by 7.7% or 40.5 billion notes from 523 billion to 563.5 billion.

During COVID demand for cash increased, everywhere. Figure 1 shows how the global increase in cash volumes between 2019 exceeded the compound annual growth rate (CAGR) of the previous years, 2014 – 2019.

In economies considered to be 'low-cash' (Europe, Oceania (predominantly Australia), North America and Latin America demand was strongest, with each of the named economies seeing double-digit increases in volume. The surge in demand was less pronounced in more 'cash prevalent' economies within Africa and Asia, seeing only a 7.9% and 5.9% increase in cash volumes respectively during the pandemic.

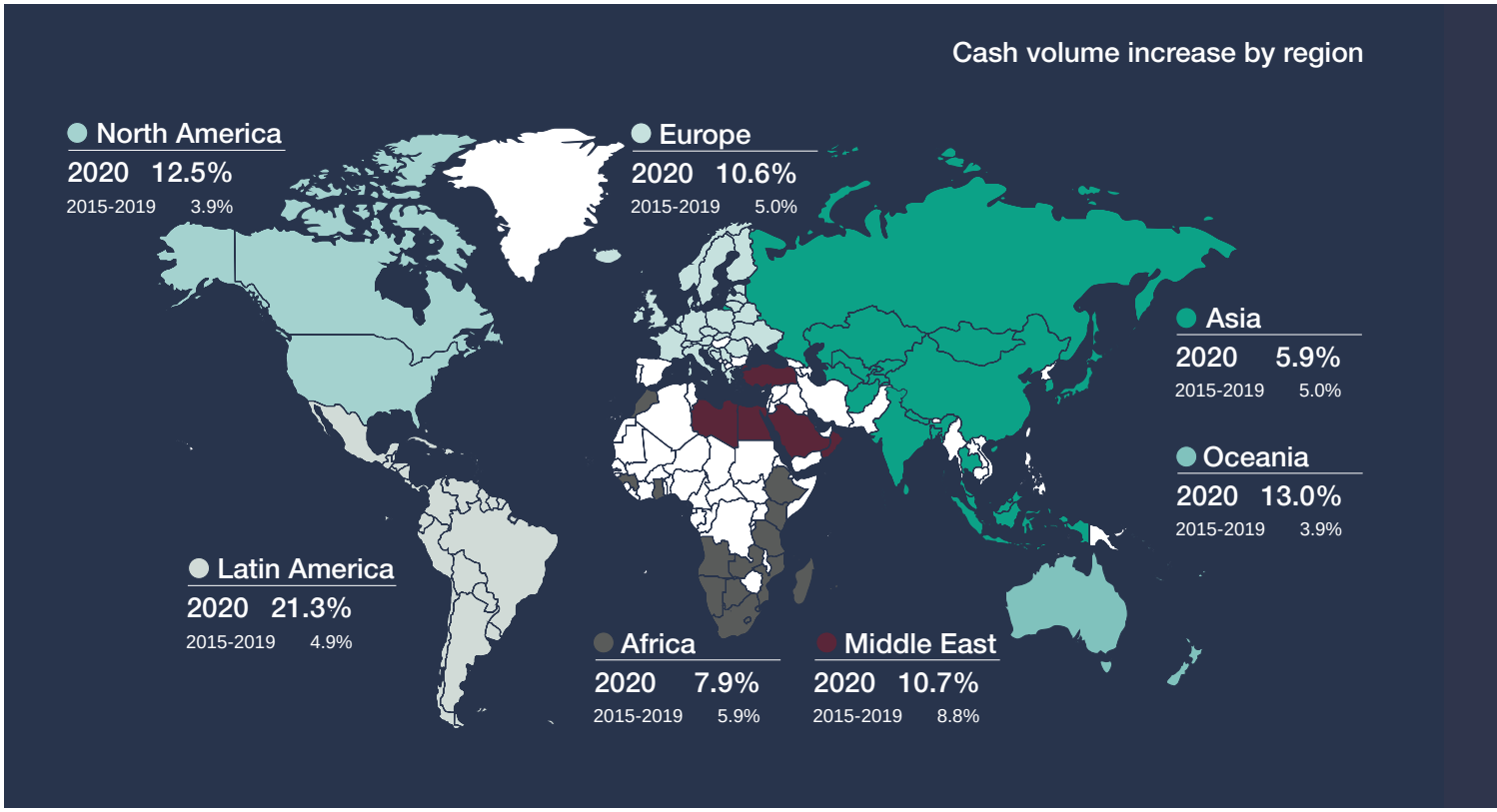


Fig 1 - cash volume increase by region

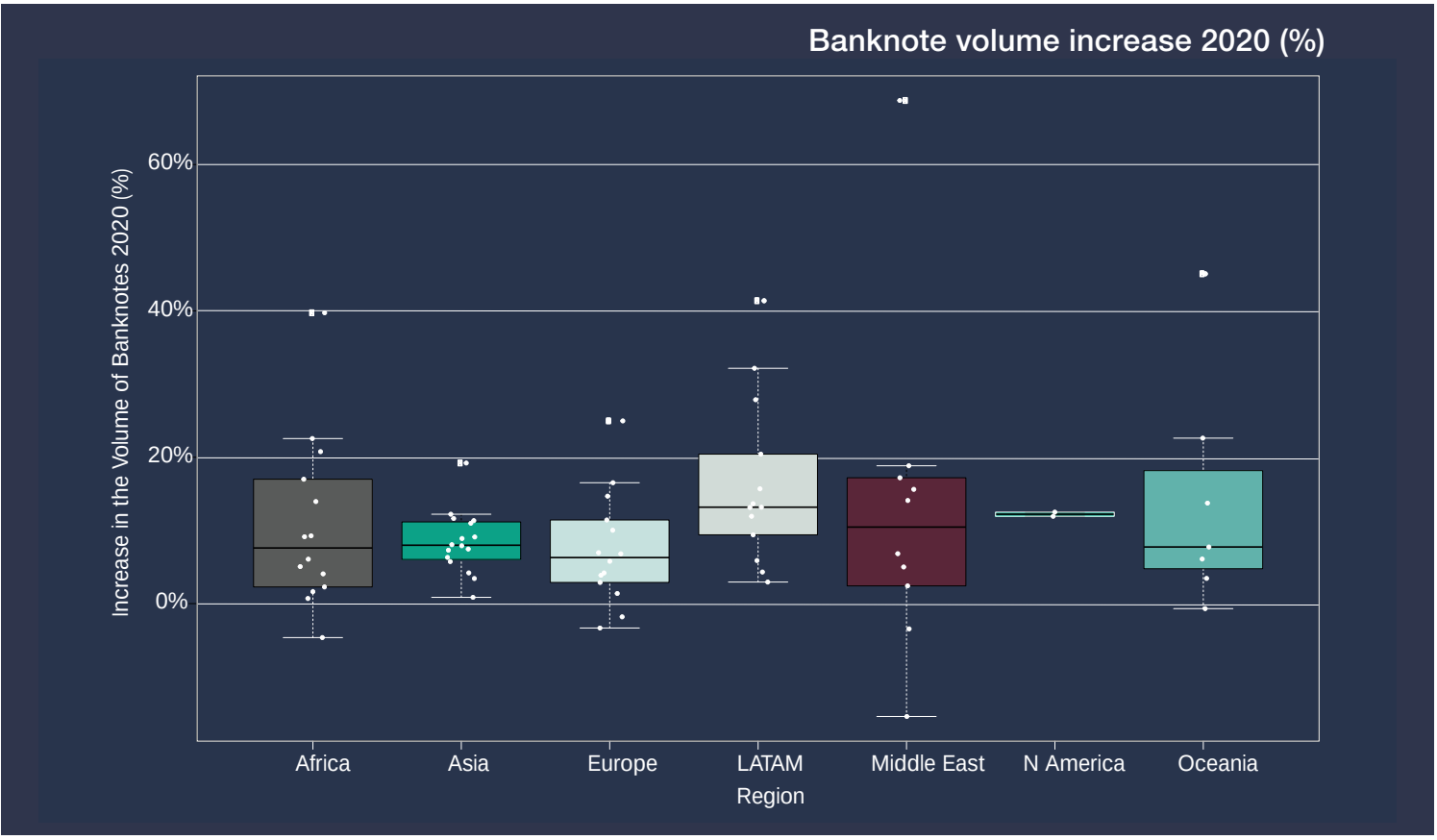


Fig 2 - cash volume change by regional spread

Each dot displayed in figure 2 represents an individual central bank. There are outliers in each region except for North America. For each region, the median provides mid-point where 50% of central banks record rates of increase above this point and 50% fall below. The range of variability demonstrates the change that happened in 2020 was predominantly caused by the increase of demand of cash during the pandemic.

The boxplot summarises the rate the volume of the banknotes increased for each central bank with the region.

Values

Most countries provide the IMF with International Financial Statistics (IFS). The value of currency in circulation is one of these many statistics. The value of currency from one country is not directly comparable to another country therefore a useful measurement is to define the value of currency at a date to be an index of 1 and then measure the growth from that time.

Trends from 2020 (Figure 3)
India's demonetisation in 2016 significantly impacted the value of cash in circulation, along with the bounce back to expected values soon after.

Sweden and Norway continued their move toward a "less-cash" society.

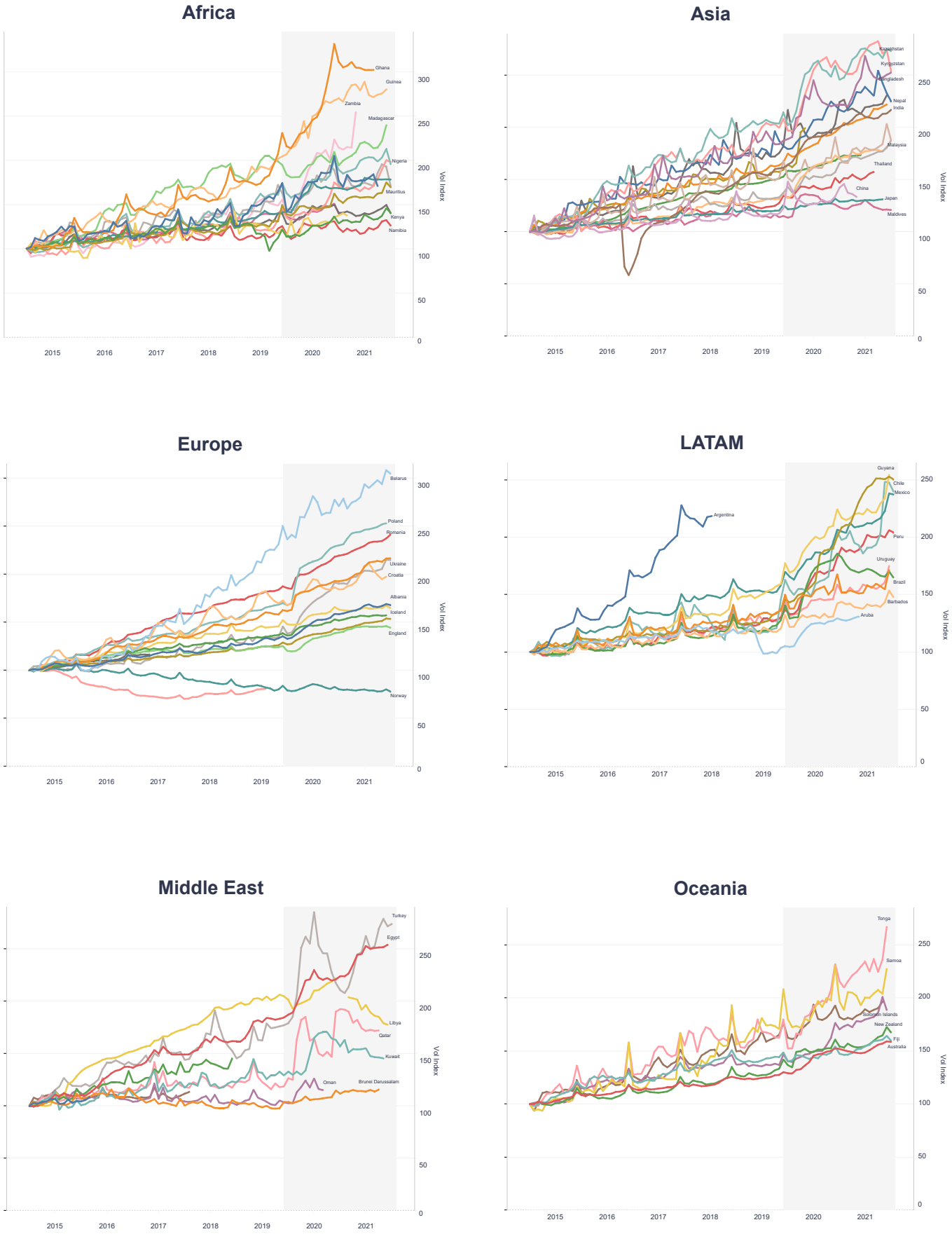
Ghana saw the most rapid increase in the demand for currency in 2020 (Figure 3). However, the more recent depreciation has likely been caused by an increased demand for foreign currencies as most businesses are now recovering from the COVID shock. This is not limited to Ghana.

China and Japan are countries which were least impacted by COVID with respect to currency in circulation. China experienced an increase at the beginning of 2020 yet returned to the original trajectory within a few months.

In Europe, Poland, Romania and the European Central Bank have experienced increased demand for value of currency in circulation and this should be expected to continue following the recent events in the Ukraine.

The Middle East shows substantial volatility in the value of currency across the region.

Value of cash in circulation, by region (2020)*



*"The graphs here show the value of cash in circulation, with the values normalised to 100 in 2015. An increase to 200 represents a doubling of cash in circulation"

Fig 3 - cash values in circulation

Impact across denominations

Australia Dollar	**5**	**10**	**20**	**50**	**100**				
2020	-2%	-2%	2%	24%	14%				
2015 - 2019	5%	4%	2%	4%	4%				
British Pound		**5**	**10**	**20**	**50**				
2020		-2%	15%	20%	2%				
2015 - 2019		6%	15%	-2%	8%				
Canada Dollar		**5**	**10**	**20**	**50**	**100**			
2020		3%	4%	11%	19%	16%			
2015 - 2019		4%	6%	0%	10%	6%			
European Euro		**5**	**10**	**20**	**50**	**100**	**200**		
2020		0%	3%	7%	13%	10%	58%		
2015 - 2019		3%	4%	5%	8%	9%	19%		
Japanese Yen		**500**	**1000**	**2000**	**5000**	**10000**			
2020		-1%	0%	-2%	1%	5%			
2015 - 2019		-1%	2%	0%	2%	4%			
South Africa Rand		**10**	**20**	**50**	**100**	**200**			
2020		0%	-2%	1%	8%	8%			
2015 - 2019		1%	6%	7%	3%	7%			
Swiss Franc		**10**	**20**	**50**	**100**	**200**		**1000**	
2020		0%	2%	1%	6%	11%		4%	
2015 - 2019		2%	3%	9%	4%	9%		2%	
US Dollar	**1**	**5**	**10**	**20**	**50**	**100**			
2020	3%	0%	10%	23%	28%	15%			
2015 - 2019	3%	4%	3%	3%	3%	7%			

D

D is calculated from GDP per capita per day as at 2019 reported in the IMF World Economic Outlook Database April 2022.

Fig 4 - demand by denomination

The impact across volume and value has been defined, nevertheless greater insight can be established on the affect within the denominational structure of banknotes in circulation. This analysis will focus on the: US Dollar, European Euro, Japanese Jen, British Pound, Swiss Franc, Canadian Dollar, Australian Dollar & South African Rand. (Figure 4)

The values represent the volume increase per denomination for 2020 and a comparison to the CAGR between 2015 and 2019.

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Trends - Figure 4
The US Dollar denominations increased significantly for the 20 & 50, followed by the 10 and 100 denominations over the previously observed rate.

The European Euro volume increased significantly, peaking with the 200. (This denomination is also impacted as a direct result of removing the 500 from circulation.)

The Japanese Yen continues to grow in the 10,000 Yen, which now represents 93% of value in circulation. The lower denominations saw a decrease in the volume in circulation. The increase of the 10,000 was only 5%.

The Swiss Franc observed an increase over 10% for the 200 Franc.

The Canadian Dollar observed a significant increase in the 50 and 100 Dollar.

Similarly, the Australian Dollar has seen significant increases in the 50 and 100. The lowest denominations have decreased in the volume in circulation.

There were no increases over 10% in South Africa, although the 100 and 200 Rand had increased above the previous observed rate.

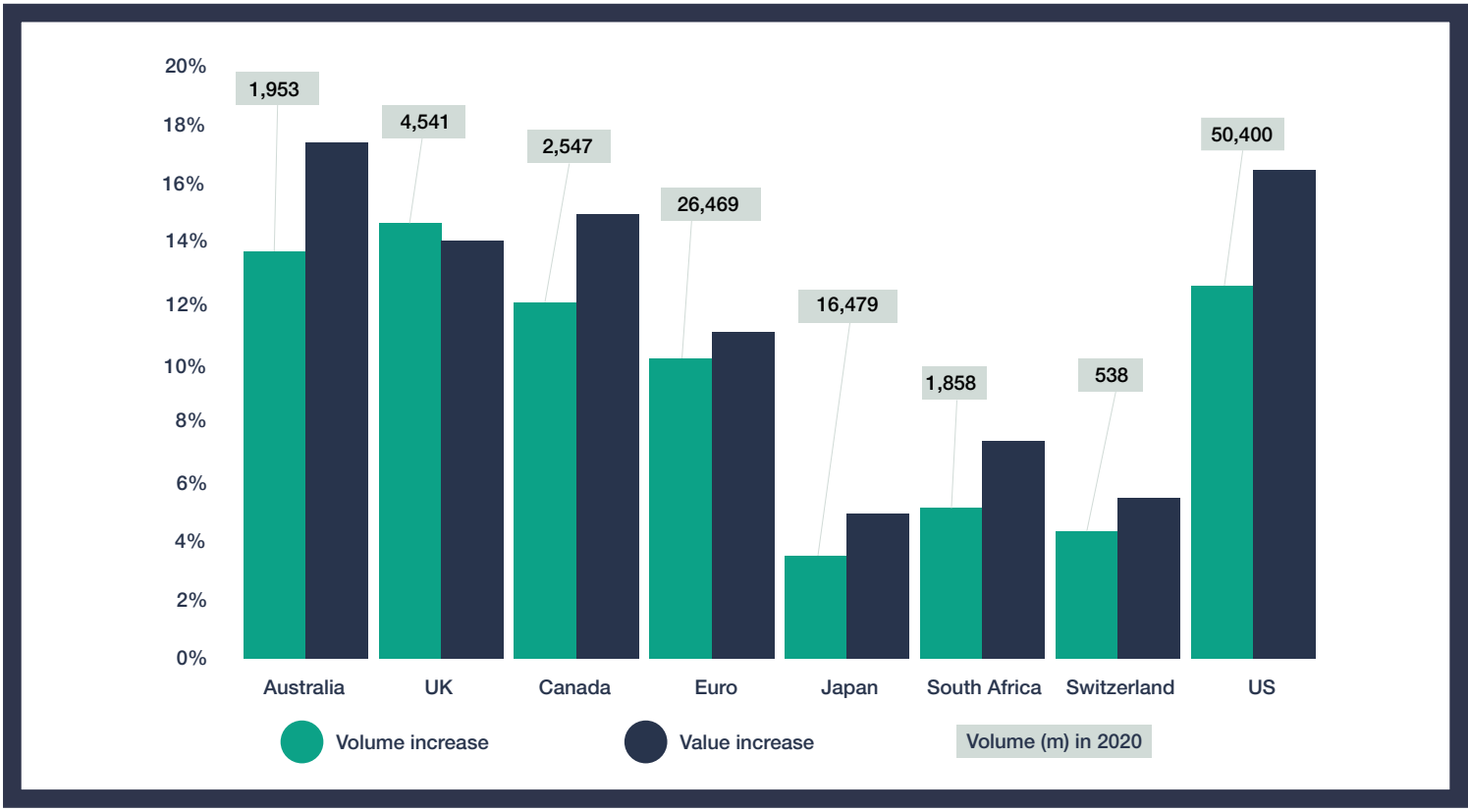

Fig 5 - volume and value increase by currency

What happened next…

In most countries, the volumes and value of currency in circulation were impacted by the pandemic and many witnessed increases significantly greater than previous recent historic growth rates. Mid to high value denominations were impacted the most during 2020.

These banknotes are likely to be used as a store of value and are often practical banknote denomination value for use within the market. The Bank for International Settlements reported that the demand for high-value denominations, increased further, and more strongly than for other notes and coins.

We are currently collating the statistics for 2021 as Annual Reports and Statistical Bulletins are being published.

For central banks interested in 2021 data, please reach out to the DLR Analytics™ team for more information.

currency@delarue.com

How to Ensure You Aren't Misled About Banknote Lifetimes

Dr Nikki Strickland
Group Director
Marketing & Strategy
De La Rue

Banknote lifetime values need to be treated with care because it is easy to form misleading conclusions. The biggest challenge is ensuring that a fair comparison is being made and that comparisons are made on representative data. The before and after scenarios should be like-for-like. This article discusses the questions to ask when considering how a new banknote series compares to a previous series.

At a simplistic level there are different starting points to the measurement, so any comparison of note life should use the same point. Does the banknote life start when the banknote was produced or when it moves vaults or when it enters circulation? Is a banknote still considered to be aging if it is issued by the central bank but sitting in storage in the vaults of a commercial bank?

There is also a consideration about whether to model the banknote lifetime or to measure it for individual banknotes. Instinctively many central banks want to track individual banknotes with their serial numbers and to capture the moment at which each individual banknote begins and ends its life. A minority of issuing authorities, most notably the Dutch National Bank, have been looking at serial number capture for years. This approach has its merits and provides the reassurance of being 'real' data, although can be costly and involved to set up and run.

Serial number tracking also has its limitations. It requires OCR sensors on sorting machines, serial numbers that can be read at speed (even on soiled/worn banknotes) and the appropriate infrastructure to securely capture and store the data. It also requires enough data points on enough notes to reach a robust conclusion. If your banknotes last for five years then you will only really have confidence that the note life is actually five years when the banknotes have been in circulation for well beyond that length of time. Some banknotes will enter circulation and get damaged quickly. Some banknotes will enter circulation and sit in a vault for a while or degrade slowly via normal wear and tear. Over time a database of note life data will build up and an appropriate distribution curve can be fitted to

"Challenge us and other suppliers about our claims – are we making comparisons that we shouldn't be making and have we extracted appropriate data points?"

There are also different banknote lifetime end points. Mathematics can model the age at which a banknote is likely to have fallen below the acceptable fitness standard, but central banks assess each note themselves before it is declared as unfit. This means that the note must physically return to the central bank before it can be declared to be at the end of its useful life. When returned to the central bank the point at which the banknote is killed could be the point of sorting or the point of physical destruction. Again, any comparison of note life should use the same ending point measurement.

the data to provide the best note life value. It can be a frustrating wait for central banks seeking to compare the performance of a new series of banknotes to that of their previous series.
The alternative approach is to model the banknote lifetime mathematically. This can be achieved from simple data that many central banks publish publicly. Monthly data such as the number of new banknotes issued that month, the number of previously used fit notes re-issued, the number of banknotes declared to be unfit and the number of notes in circulation at the end of the month is all that is required for a steady state note life calculation. Evaluation by De La Rue revealed that monthly calculation of banknote lifetimes can provide banknote lifetime values that closely resemble those from actual sorting machine serial number assessment. The closest alignment came from a frequency distribution of the outputs of the monthly note life calculations. Irrespective of methodology, when comparing the life of two different series it is important to check that the values of the series being compared have been derived from the same method.
Once the basic like-for-like comparison criteria has been established there are additional questions to ask. The first question is whether the new series of banknotes have been in circulation long enough for the note life values to be trusted. Cash cycles can take a few years to return to equilibrium after the disruption of withdrawing an old series and introducing a new one. It is likely that the cash cycle was reasonably stable with the established series of banknotes. It is also likely that the previous cash cycle had a range of banknotes of different ages all circulating together. The act of introducing a new series can increase the proportion of new notes in circulation. If the notes in circulation are mainly new there is a period before they start to wear. This means that banknote lifetime measurements need to be treated with caution – these measurements are likely to indicate banknote lifetimes that are unrepresentatively high for the new series.

Central banks can form a view of when the cash cycle has stablised by monitoring the banknote lifetimes over time. They will typically see a flat line for notelife as a function of time for the old series. When the new series is introduced, the note life measurement will jump up. Over time the note life will come down again and a new flat line will be established. If the new series is more durable the banknote lifetime will have stablished at a new higher note life average. Once a reasonably flat line of note life over time is established the cash cycle is stable enough to compare different series.

"Once you introduce a new banknote you need to let the cash cycle reach its new equilibrium. Otherwise you will overestimate the note life of your new banknote"

The final stage of obtaining a meaningful comparison between banknote lifetimes is to consider other factors that may have changed. Has the fitness standards changed? Have sorting machines been calibrated recently? Our experience of supporting DLR Analytics™ users reveals several situations where sorting machines were not appropriately calibrated and were destroying fit banknote. Any meaningful comparison of banknote series lifetimes must ensure that the sorting machines were treating the older and newer series in an equivalent way.
Then there are external factors. The pandemic has disrupted many cash cycles. 76 central bank, representing 90% of the cash cycle volume, shared public data showing the volume of banknotes increased from 523bn in circulation to 563.5bn – an increase of 7.7% in 2020. In some countries cash usage remained at pre-pandemic levels. In other countries cash use declined as people went into lock-down and/or switched to more digital payment types. Great care is needed with pandemic data (and there are many instances where it isn't appropriate to include pandemic data in your comparisons).
De La Rue's claim that polymer banknotes last 2.5 times longer than paper banknotes on average comes from over 12,000 data points, all based on central bank data. In some cash-cycles the improvement is five or six times greater. The data was scrubbed to ensure comparisons were only made between cash cycles that had finished transitioning to their new post-polymer equilibrium. The data came from every region of the world and was collated prior to the pandemic cash cycle disruption. It is significant because the cash cycles and circulating environments of the banknotes making up this data set vary (e.g. different specification of paper notes, different specification of polymer notes, different humidity/temperatures, different ways of handling cash, different sorting machines and fitness levels etc). However, despite all these variables the data revealed a statistically significant increase when transitioning to polymer banknotes. Today users of DLR Analytics™ can benchmark their banknote lifetimes to global and regional averages using a standardised methodology.

We can also model the likely impact of a polymer transition for your cash cycle (i.e. would you expect your banknotes to last 2.5 times longer or be one of the countries that sees a note-life increase of up to 5 or 6 times?)

2022 Global Currency Forum

The inaugural 2022 Global Currency Forum concluded on May 5th 2022, providing quality thought leadership on a range of topics.

In addition to the high quality of thought leadership discussions, the technology workshops were opportunities for each exhibitor to put forward their perspectives on industry trends, sustainable practices, approaches to perennial challenges (such as counterfeiting attempts) or present new products.

Mark Spencer presented on the five megatrends shaping the industry, showing that more public recognition features are becoming incorporated into modern banknote designs. Security features are become larger, more customisable and more complex, using great design to ensure that the banknote remains intuitive and easy to authenticate. With the introduction of SAEFGUARD® ASSURE™ polymer banknotes now have protection at every level of security.

Kerre Corbin revealed the most common counterfeiting methods and highlighted the importance of layering security throughout a banknote via different technologies, materials and processes.

Alan Eckford, Richard Sokl and Nikki Strickland shared the journey of De La Rue to become a Financial Times European Climate Leader, highlighting the importance of measuring, understanding and transparently reporting our baseline environmental impact in order to design a more sustainable business and products.

It was an honour to be part of the team that made this possible and we hope everyone who was able to attend found this event to be of benefit.

INTERNATIONAL CURRENCY ASSOCIATION

GLOBAL CURRENCY FORUM

Click the icons to learn more about the GCF and the International Currency Association.

Ruth Euling, Managing Director, De La Rue Currency and Wolfram Seidemann, CEO Giesecke & Devrient Currency Technology present during the plenary session.

Mark Spencer, Technical Product Manager
"Bigger, Better, Bolder - the latest security feature trends"

Kerre Corbin, Circulation, Authentication & Counterfeit Expert
"Banknote Counterfeit Resilience"

Alan Eckford, Head of Design
"Designing for a more sustainable and secure world"

We provide banknotes that central banks and issuing authorities can be proud of

De La Rue is the trusted partner of choice for governments, central banks and businesses, helping to secure global supply chains and cash cycles in over 140 countries.

Our digital and physical authentication solutions include tax stamps and supporting software, authentication labels and associated brand protection digital solutions, cheques and bank cards, and ID security components including polycarbonate.

We provide currency solutions to over half of the central banks and banknote issuing authorities, including fully finished banknotes, security features, SAFEGUARD® polymer substrate and design services. De La Rue banknotes represent the best of British design and innovation by securely capturing the richness of the cultures they represent with originality and creative flair.

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We welcome your suggestions, ideas and comments. Please send these to Nikki Strickland or Richard Sokl.

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