J.P. Morgan Perspectives

Digital transformation and the rise of fintech: Blockchain, Bitcoin and digital finance 2021



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J.P. Morgan's Approach to Blockchain

J.P. Morgan is a leader in blockchain technology and has been building innovative solutions for clients since 2015. This innovation has spanned from protocol-level development to new payment-specific networks and applications.

In 2020, J.P. Morgan launched a new business unit called 'Onyx by J.P. Morgan' that houses the firm's blockchain efforts. In doing so, J.P. Morgan became the first global bank to create a dedicated unit to develop and scale blockchain-based products. Onyx's mission is to reimagine how businesses can be built, run, and transformed with the new infrastructure, networks, and services enabled by distributed ledger technology.

Onyx has a significant portfolio of new products, including: a blockchain-based intraday repo application where J.P. Morgan executed the first live intraday repo trade on a blockchain; Liink by J.P. Morgan[SM], the world's largest blockchain-based institutional network with increasing membership and offerings; and JPM Coin, a blockchain-based payment rail and account ledger.

J.P. Morgan plans to continue increasing its investment in blockchain technology as many of these efforts mature and achieve scale at a global level. J.P. Morgan is excited to make progress on several of the highest impact blockchain initiatives in the industry:

Liink by J.P. Morgan: First piloted in 2017 as the Interbank Information Network® (IIN), Liink is the first bank-led production-grade, scalable, and peer-to-peer blockchain-based network. It addresses the longstanding challenges of sharing payments-related information across institutions. More than half of the world's largest banks have signed up to join the new paradigm, using blockchain to simplify information exchange around how money moves. Liink also enables banks to monetize their data assets by sharing information on and developing applications for the network.* Current applications on Liink include:

- Confirm, which allows participants to exchange information to validate account information prior to payment initiation across geographies and most common payment types;
- Resolve, which allows participants to exchange information to resolve compliance-related inquiries; and
- Smart check routing to streamline the processing of checks, as J.P. Morgan enables check originating financial service providers to directly transmit check transactions to lockbox providers using digital means.*

Digital Assets & Intraday Repos: Onyx Digital Assets is a new Onyx platform for digital asset transaction use cases. At the end of 2020, J.P. Morgan launched Onyx Digital Assets, along with its first live application for the execution of intraday repurchase transactions or 'repos,' which allowed for the simultaneous exchange of cash for securities on blockchain without physical movement of securities.

J.P. Morgan recognized the opportunity to build new financial technology with the initial goal of significantly enhancing active intraday liquidity management and reducing reliance on unsecured funding. By more efficiently securing a portion of liquidity provision to J.P. Morgan clients with intraday collateral, J.P. Morgan aims to reduce counterparty credit risk related to intraday liquidity financing and the resulting market risk.

Project Ubin: Onyx has been partnering with the Monetary Authority of Singapore (MAS) on a multi-year, multi-phase, collaborative project to explore the use of blockchain and Distributed Ledger Technology (DLT) for clearing and settlement of payments and securities. J.P. Morgan is now in the process of commercializing the learnings from Project Ubin. Our initial focus is on building a platform – being developed with two world-leading partners – that is expected to launch in Singapore with availability to banks in that country. The initial focus will be on domestic multi-currency payment clearing, with many other services to follow.*

The pipeline of R&D projects at Onyx is equally as exciting, including Digital Identity and quantum resistant networks. J.P. Morgan fervently believes that the financial services industry is still just barely scratching the surface of blockchain use cases and that as far as blockchain is concerned, the best is yet to come.*

– Onyx by J.P. Morgan

** Future products and services under development; features and timelines are subject to change at J.P. Morgan's sole discretion. Offering as live products subject to completion of internal review and obtaining any required consents.*

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Executive summary

COVID-19 accelerates the rise of digital finance

- The rise of digital finance and demand for fintech is the real financial transformational story of the COVID-19 era, not the rally in Bitcoin prices…
- …but the recent announcements of greater acceptance and adoption by Tesla, BNY Mellon and Mastercard confirm the increased investor demand and interest in transacting payments in cryptocurrencies.
- Competition between banks and fintech is intensifying, with Big Tech possessing the most potent digital platforms due to their access to customer data.
- 'Co-opetition' between 'Fin' and 'Tech' players lies ahead, with banks stepping up investment to narrow the technology gap, and the battle between US banks and non-bank fintech is also playing out on the regulatory front.
- Asia continues to drive third-party (noncash) global growth in payments.
- Traditional banks could emerge as endgame winners in the digital age of banking due to their advantage from deposit franchise, risk management and regulation.

The rise of Bitcoin is an economic side show but Bitcoin is here to stay as an "alternative" currency

- Bitcoin prices were boosted by Tesla's $1.5bn investment with momentum traders amplifying the up move, but current prices are well above our most recent estimates of fair value based on mining costs and risk capital equivalence with gold.
- In the long term, we estimate that theoretically Bitcoin prices would need to rise to $146k for the market cap to match the total private sector investment in gold via ETFs or bars and coins.
- Crypto assets continue to rank as the poorest hedge for major drawdowns in Equities, with questionable diversification benefits at prices so far above production costs, while correlations with cyclical assets are rising as crypto ownership is mainstreamed.
- Watch the tail risk to Bitcoin markets as a sudden loss of confidence in USDT would likely generate a severe liquidity shock, jeopardizing access to the largest pools of demand and liquidity.

Financial innovation has outpaced regulation with global financial stability concerns rising as Global Stablecoins (GSCs) are developed

- Regulation has been outpaced by innovation, creating an uneven playing field, as it is easier and cheaper for fintech to offer similar products and services.
- A return of antitrust is a risk, mostly to Big Tech, and future regulation will focus on who is permissioned to use Global Stablecoin arrangements and gain access to the Federal Reserve's payments system as well as the appropriate level of oversight, supervision and regulation.
- Central banks representing 20% of the world's population are likely to issue Central Bank Digital Currencies (CBDCs) in the next three years, but transformative impact is unclear given restrictions based on jurisdiction.

J.P. Morgan Perspectives brings together thematic and strategic views across J.P. Morgan's Global Research franchise, examining big ideas and critical global issues transforming investment markets. This is our annual update on the latest developments covering the adoption and evolution of Blockchain technology, Cryptocurrencies, Central Bank Digital Currencies, Global Stablecoins and digital finance. We also highlight regulatory issues that lie ahead as innovation has outpaced regulation, creating an uneven playing field. We hope this series will both inform and foster debate on evolving economic, investment and social trends.

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Bitcoin is an economic side show – the rise of digital finance is the real post-COVID-19 story

- **Fintech has gone mainstream, and we highlight the rise of digital finance in the COVID-19 era in our annual review of blockchain technology, Bitcoin and other digital currencies.**
- **Bitcoin prices have continued their meteoric rise with Tesla, BNY Mellon and Mastercard's announcements of greater acceptance of cryptocurrencies...**
- **…but fintech innovation and increased demand for digital services are the real COVID-19 story with the rise of online start-ups and expansion of digital platforms into credit and payments.**
- **Expect 'co-opetition' between 'Fin' and 'Tech' players with banks focused on narrowing the technology gap, while Big Tech benefits from a large customer base and access to their data.**
- **Investor and regulatory shifts will play out as Big Tech looks to issue Global Stablecoins (GSCs) and regulation has been outpaced by innovation, creating an uneven playing field.**
- **Traditional banks could emerge as endgame winners in the digital age of banking due to their advantage from deposit franchise, risk management and regulation.**
- **Bitcoin prices boosted by momentum traders, but current prices are well above our most recent estimates of fair value based on mining costs and risk capital equivalence with gold.**
- **In the long term, we estimate that theoretically Bitcoin prices would need to rise to $146k for the market cap to match the total private sector investment in gold via ETFs or bars and coins.**
- **Crypto assets rank as the poorest hedge for major drawdowns in Equities, and diversification benefits are unclear at prices so far above production costs, while increased ownership is raising correlations with cyclical assets.**
- **Watch the tail risk to Bitcoin markets as a sudden loss of confidence in USDT would likely generate a severe liquidity shock, jeopardizing access to the largest pools of demand and liquidity.**
- **Some central banks are likely to issue Central Bank Digital Currencies (CBDC) in the next 3 years but transformative impact is still questionable given restrictions based on jurisdiction.**

COVID-19 accelerates the rise of digital finance and retail investment

COVID-19 has accelerated digitalization and technological change in the finance industry, with rising concerns that disruptive technologies could emerge as a threat to global financial stability, when combined with excess liquidity and an undefined regulatory framework. In our annual round-up of the latest developments in blockchain technology, Bitcoin, and other digital currencies, we expand our analysis to include a broader discussion of the rise of digital banking (see *Blockchain, digital currency and cryptocurrency: Moving into the mainstream?*, J. Chang et al., 21 February 2020). In this publication, 35 strategists, analysts, and economists examine the latest trends in blockchain technology, the Bitcoin market, digital currencies and the rise of digital banking. Cash use was already on the decline before COVID-19, and the pandemic has fueled demand for fast and convenient digital payments. The pandemic has boosted demand for digital services and also for "alternative" currencies as multiple rounds of stimulus, accommodative monetary policy, and excess savings have boosted money supply, leading to record inflows into Bitcoin investment vehicles. The 27% rise in Bitcoin prices in the week of Tesla's February 8th announcement follows a 300%+ meteoric rise in Bitcoin prices during 2020. In addition, the higher-than-usual retail stock market participation that fueled the recent small-cap short squeeze have raised concerns that asset bubbles are forming.

We have long argued that while there is a temptation to point to the COVID-19 crisis as new and unprecedented, we see COVID-19 as an accelerant, amplifying paradigm shifts that were already in motion after the 2008 Global Financial Crisis (see *Pandemic Accelerates Paradigm Shifts*, J. Chang et al., 8 July 2020). The shift in market structure and the decline in liquidity exacerbated the sell-off in March/April 2020, resulting in the severity and speed of financial market moves that were without precedent. The US equity market moved from a record peak to a trough over 14 days compared to 14 months during the GFC. Multiple rounds of fiscal stimulus have amounted to roughly 4.2% of global GDP, while G-4 Central Bank balance sheet expansion at $8trn is more than triple the level seen during the GFC, fueling the most rapid equity market recovery ever, with the S&P 500 returning to record levels in just 6 months. The rally in Bitcoin and increase in retail participation in US equities are manifestations of record low rates. The JPMorgan Chase Institute finds

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that the COVID-19 shock to the economy, which strongly dampened consumer spending, resulted in a large spike in transfers to investment accounts, especially for men, consistent with the aggregate increase in the personal savings rate starting in March 2020.[1] Retail investors ramped up stock market participation beginning in March, when the US recorded its highest ever savings rate of 34%. In Bloomberg's latest survey of what Americans plan to do with next relief payment, 6% indicated that they intend to invest more in the stock market, compared to 5% indicating that relief would go to support child care, while 3% indicated that they would invest in cryptocurrency.[2] The savings rate has been declining gradually, but the latest reading is elevated at 13%, and our US equity strategists estimate a ~$390bn decline in consumer spending since the January 2020 peak (see *US Equity Strategy: Growing Retail Participation, Short Squeeze, Rotation into Value*, D. Lakos-Bujas et al., 29 January 2021). Policymakers are no longer stressing the temporary nature of extraordinary programs given nearly 80% of fixed-rate DM sovereign bonds trading below 0.5% and the 16% of GDP rise in sovereign debt levels. Implied volatility has also come down dramatically in a low yield world.

Some market segments are most likely in a bubble due to excessive speculation, and Bitcoin prices rallied by 27% in the week of Tesla's February 8th announcement that it had spent $1. 5bn of its cash reserve on Bitcoin. Although we are skeptical that Tesla is a typical corporate and that its example will be followed by more mainstream corporates, we recognize that Tesla's announcement broadens corporate sponsorship, after a gap of five months with no corporate treasury announcements beyond MicroStrategy and Square last August. Tesla is not alone in exploring greater acceptance of Bitcoin. In the same week of Tesla's announcement, a variety of payment providers and custodians announced their expansion into accepting crypto payments. Mastercard announced a plan allow merchants to receive payments in cryptocurrency later this year. BNY Mellon, the world's largest custodian bank with ~$41trn of in assets, announced the formation of a new unit to build a multi-asset custody and administration platform for traditional and digital assets. PayPal announced that it is considering adding cryptocurrency as a payment option through Venmo.[3] Canada's financial regulator also approved the first publicly traded Bitcoin exchange-traded fund (ETF) in North America. The receipt of approval from the Ontario Securities Commission (OSC) was filed under a Multilateral Instrument passport system in multiple Canadian jurisdictions.[4]

Despite the current spotlight on the growing acceptance of cryptocurrencies, we find the real financial transformation story of the COVID-19 era is the increase in demand for digital services as the shift away from in-person interactions is a lasting legacy from the pandemic. The ongoing progress in digital technology has made new forms of digital money cheaper and faster than traditional electronic instruments, especially for cross-border payments.[5] The past year was marked by the rise of online start-ups without a banking background and the expansion of social media and digital platforms into credit and payments. A number of breakthroughs played out during the course of 2020, including scaling up digital solutions in third-party payments, advances by digital finance into retail lending and insurance, and the emergence of partnerships between Big Tech and banks.

Although the market has fixated on the rally in Bitcoin, the real economic and exciting action is in the new battle for digital supremacy between the banks and fintech, which is likely to lead to renewed competition and innovation with major IT capex forthcoming on both sides. The playing field is uneven as financial regulations have not kept pace with fintech innovation, and it is easier and cheaper for fintech to offer similar products and services. Big Tech firms have an informational advantage over banks to privileged customer data. At the same time, their platforms' activity can be viewed as "match-making," which does not require risk-taking, since they do not need to provide financial services themselves, as discussed in a recent

[1] See "Finding Four" here: https://www.jpmorganchase.com/institute/research/financial-markets/the-stock-market-and-household-financial-behavior
[2] https://www.bloomberg.com/news/articles/2021-02-11/stimulus-checks-americans-plan-to-save-not-spend-covid-relief-money
[3] https://www.forbes.com/sites/haileylennon/2021/02/12/bitcoin-welcomes-tesla-mastercard-bny-mellon-venmo-to-the-cryptocurrency-party/
[4] https://www.coindesk.com/first-north-american-bitcoin-etf-approved-by-canadian-securities-regulator
[5] https://www.imf.org/en/Publications/Policy-Papers/Issues/2020/10/17/Digital-Money-Across-Borders-Macro-Financial-Implications-49823, p. 9

report published by the IMF. Big Tech companies could also bundle their social media services with payment services through the issuance of stablecoins.[6] J.P. Morgan estimates that there are about 58 fintech companies with a market cap greater than $1bn, and fintech companies have not yet experienced a systemic liquidity test. As the Center for Financial Stability points out, the migration of financial activities to non-bank financial institutions was in many ways created by regulators themselves as full-service brokerage firms were rendered less competitive with non-traditional, tech-based securities firms like Robinhood, with investors incentivized to move their accounts to firms offering lower cost trading, coinciding with more information derived from social media rather than traditional regulated entities.[7] Asia continues to drive digital solutions in scaling up third-party payments, and our Asia equity analysts estimate over $1.5trn total addressable market for the ASEAN 6 countries (Indonesia, Thailand, Singapore, Malaysia, Philippines, and Vietnam), with tremendous scope for growth as penetration remains low (2%) (Modi, Sharma, Kim, Yao).

Like many other themes, COVID-19 intensified and accelerated the underlying retail investment trend, as evidenced by record retail brokerage volume (retail at ~30% of US stock/ETF equity volume in June/July 2020), non-institutional ownership, and use of leverage via margin and derivatives (highest recorded single-contract option volume) (see *US Equity Strategy: Growing Retail Participation, Short Squeeze, Rotation into Value*, D. Lakos-Bujas et al., 29 January 2021). Active retail participation growth is a secular trend that will introduce opportunities and risks and is not close to exhausted. Beyond excess liquidity from fiscal and monetary stimulus, the low consumer debt service ratio and rising home equity, along with the scarcity of substitutes to spend cash, will translate into the riskiest and most shorted areas of the equity market seeing renewed interest by retail, supported by liquidity and social media's influence. Retail investors have historically been attracted to consumer products / service companies with broad brand awareness, new-tech IPOs, and high social media chatter / rising volumes. The recent episode of "gamefication" demonstrated how quickly this retail impulse can propagate via social media platforms, which in turn shows the importance of using social media platforms in gauging retail.

Although legal and regulatory frameworks are still being developed, central banks are also beginning to consider digital currencies as a way to modernize payments in the digital age. There is no "one size fits all" CBDC, but the universal driver for exploring a general purpose CBDC is its use as a means of payment, with some governments now exploring CBDCs as a fast and direct mechanism to provide fiscal assistance in the event of a shock such as a pandemic. In a report published by the Bank for International Settlements (BIS), seven major central banks assess the feasibility of publicly available CBDCs in helping central banks achieve their public policy objectives.[8] The transformational impact of CBDC remains to be seen, as its usage for cross-border transactions remains questionable, particularly for China's CBDC, as capital controls and slow progress in RMB internationalization remain key constraints (Lei et al.). The global financial stability risks that could be introduced in any scenario in which stablecoins have a global and systemic footprint are now being considered by policymakers and regulators. In June 2019 the G20 mandated the Financial Stability Board (FSB) to examine regulatory issues raised by GSCs and to advise on multilateral responses.[9]

Whether cryptocurrencies are judged eventually as a financial innovation or a speculative bubble, Bitcoin has already achieved the fastest-ever price appreciation of any must-have asset to which it is often compared, such as Gold (1970s), Japanese Equities (1980s), Tech stocks (1990s), Chinese Equities (2000s), Commodities (2000s) and FANG stocks (2010s) (Normand). We estimate about $11bn of cumulative institutional flows into Bitcoin since the end of September (see *Flows & Liquidity: The retail impulse remains strong*, N. Panigirtzoglou et al., 16 February 2021), but we believe that a significant component of institutional flows into Bitcoin reflects speculative investors seeking to front run other more real-money institutional investors. We believe Bitcoin, at current market prices, has already surpassed gold in risk capital terms (Panigirtzoglou et al.). Tesla's recent

[6] https://www.imf.org/en/Publications/WP/Issues/2020/08/07/Financial-Intermediation-and-Technology-Whats-Old-Whats-New-49624
[7] http://www.centerforfinancialstability.org/research/GME_Robinhood_020421.pdf
[8] https://www.bis.org/publ/othp33.htm
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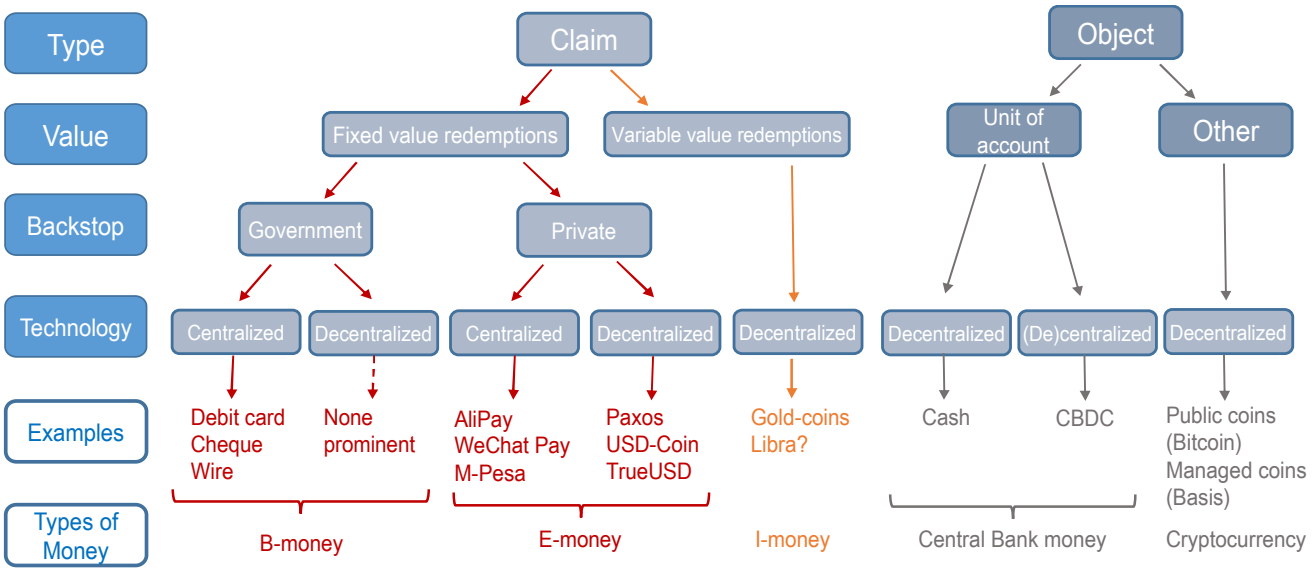
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announcement that it has invested $1.5bn in Bitcoin or 8% of its corporate cash reserves surprised markets by the magnitude of the purchases and re-invigorated expectations that other corporates will follow with their cash reserves.

Irrespective of how many corporates eventually follow Tesla's example, their announcement abruptly changed the near-term trajectory for Bitcoin by bolstering inflows, although the longer-term implications for Bitcoin prices remain unclear. Our strategists note that their position proxy based on CME Bitcoin futures, the preferred vehicle of momentum traders and other speculative investors, saw a sharp almost $1bn increase after Tesla's announcement, but their second proxy for the institutional flow into Bitcoin, i.e. the flow into the Grayscale Bitcoin Trust (GBTC), has not exhibited a similarly strong impulse. According to Panigirtzoglou et al., one can argue that, in terms of risk capital, Bitcoin has more than equalized with gold already. Thus, they believe that Bitcoin's current price of ~$51k looks unsustainable, unless Bitcoin volatility subsides quickly from here. We also highlight that while on-screen liquidity in Bitcoin markets has continued to improve and outpace more traditional asset classes on a relative basis, more than 90% of visible depth has been provided by HFT-style activity over the past few months, which often ends up disappearing when volatility picks up (Younger et al.).

The IMF has laid out a tree featuring the different forms of digital money and different means of payment, mapping the type, value, backstop and technology for digital currencies. We find this mapping useful for understanding the framework for digital money before analyzing the practical hurdles and potential market implications (Figure 1).

Figure 1. Money Trees: Mapping the New Payment Technologies



Note: CBDC = central bank digital currency. Since this chart was originally published, Libra has been renamed as Diem.
Source: https://www.imf.org/en/Publications/fintech-notes/Issues/2019/07/12/The-Rise-of-Digital-Money-47097

The rise of digital banking: The real financial transformational story of COVID-19

Digital banking licenses are allowing competition from players without a banking background, which is a powerful driver of innovation. The move to everything online triggered by COVID-19 has led to an avalanche of fintech start-ups. Many fintechs, such as Chime and Robinhood, are seeing valuation levels soar, and the common denominator is that these new entrants are seeing a surge in customer acquisition. Fintechs have offered a cutting edge experience for customers, and a key point of differentiation is that many fintechs don't charge customers fees for products and services that the legacy bank industry has become reliant on. For example, pure-play fintech banks such as Chime and Varo do not charge industry standard nuisance fees such as for overdrafts (Alexopoulos et al.).

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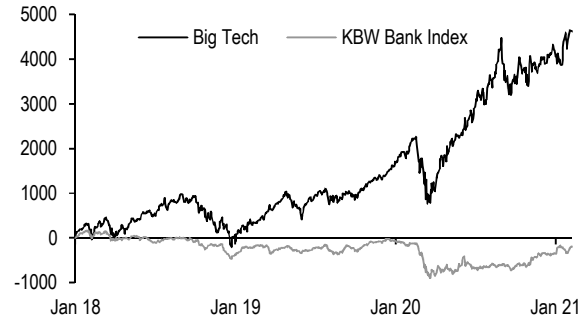
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Banks have been sleepy, but we do not subscribe to the most extreme arguments that technological progress may lead to the vertical and horizontal disintegration of the traditional bank business model. The overall structure of the financial industry with banks at its core has remained remarkably robust through many waves of technological innovation, including the rise of passive investing, securitization revolution, and innovations in communications, as well as through the Global Financial Crisis. As the IMF notes in a recent report, standalone providers of specialized services rarely possess deep balance sheets, while large digital platforms have deep pockets but their reach in financial services is constrained by their focus on serving retail consumers.[10] We would not underestimate banks forming tech partnerships to combat share loss, even if relegated to a wholesale model, which could be a boon to the winning bank tech partners of choice (Huang et al.). Banks have stepped up investment to narrow the technology gap or create strategic partnerships, such as the alliances between Apple and Goldman Sachs as well as Google and Citigroup. J.P. Morgan launched Onyx Digital Assets, a platform for digital asset transaction use cases. At the end of 2020, J.P. Morgan executed its first intraday repurchase transactions or 'repos' on Onyx Digital Assets, which allowed for the simultaneous exchange of cash for securities on blockchain without physical movement of securities. As part of Onyx by J.P. Morgan, JPM Coin is aimed at driving innovation within the financial services industry. In 2019, J.P. Morgan became the first global bank to design a network to facilitate instantaneous payments using blockchain technology, with the unveiling of JPM Coin. JPM Coin is essentially a deposit account ledger built on a permissioned blockchain system, enabling participating J.P. Morgan clients to transfer US Dollars held on deposit with J.P. Morgan.

J.P. Morgan bank equity analysts believe that regional banks are in a strong position to emerge as the winners in the digital age as they have the support of the regulators, still have the real client franchise, and are superior in risk management. In the US, Alexopoulos et al. highlight the advantage that regional banks bring to customers in the digital age as a model of high tech meets high touch, where empowered employees serve as a competitive advantage. Looking ahead, many banks will likely use M&A of fintech to defend their market share. We expect banks to leverage their balance sheets and offer more competitive lending products as a way to compete versus fintechs that might fear taking on too much credit revenue to the detriment of valuation (Huang et al.).

Figure 2: US Big Tech market cap increased by $4.2trn over 2018-20, while big banks' market cap shrunk by $340bn
Cumulative change in market capitalization for US Big Tech companies* and KBW Bank Index from 1/1/2018; $bn



* Sum of the market capitalization for AAPL, AMZN, Alphabet Inc., FB, and MSFT
Source: Bloomberg Finance L.P., J.P. Morgan

Among US regional banks, Alexopoulos et al. highlight that Signature Bank is now a top bank of choice for digital asset clients and is positioned to ride the digital asset wave. The digital asset market has seen an influx of interest from corporate treasurers and institutional investors over the past several months given the rally in Bitcoin prices in 2020. As more corporate treasurers and institutional investors look to increase exposure to digital assets such as Bitcoin, this represents a potentially very large runway ahead for Signature to acquire new customers as the ecosystem expands. Moreover, as new customers join the network, this could translate into much more significant deposit growth at Signature beyond the $10bn of deposits held today from digital asset clients, as well as the opportunity to expand fee revenue from this vertical over time. However, they note this story is not without its risks as SBNY deposit balances (as well as stock price) may fluctuate with the interest in digital assets such as Bitcoin, which is directly linked to the value of the asset. Even considering this risk factor, however, given the possible reward of Signature potentially becoming one of the key banks (if not *the* bank) of the digital asset ecosystem, they maintain their Overweight rating and added SBNY shares to the J.P. Morgan US Equity Analyst Focus List (see *Signature Bank: Banking Bitcoin:*

[10] https://www.imf.org/en/Publications/WP/Issues/2020/08/07/Financial-Intermediation-and-Technology-Whats-Old-Whats-New-49624

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Positioned to Ride the Crypto Wave; Digital Asset Deep Dive; Add to Focus List, S. Alexopoulos et al., 9 February 2021).

Transformation is occurring most rapidly in Asia, where we estimate the total addressable market for third-party payments in the ASEAN 6 countries at $1.5trn, with tremendous scope for growth as penetration remains low (2%). Lending and insurance are emerging opportunities in fintech, while non-life insurance players may scale up more easily due to simpler product structure (Modi, Sharma, Kim, Yao). In China, the COVID-19-led lockdown induced wider acceptance and usage of mobile banking, leading to a strong rebound in mobile banking MAU (monthly active users) and transaction volume in 2Q and 3Q20 when activity levels recovered. The potential upside from digitalization is on offering cash management services in order to lower deposit costs, driving sales of high-margin products to improve fee income, and lowering credit costs by leveraging fraud detection technology and big data analytics (Lei et al.). In Japan, private sector-led digital currencies are expected to be issued as early as 2022, while the BoJ plans to begin Proof of Concept for CBDC early this year, although it currently has no specific plans for issuance (Nishihara).

As internet infrastructure has expanded within emerging markets and digital literacy has improved, the penetration of internet banking in CEEMEA markets has increased significantly, up threefold on average in the last ten years compared to 1.75x in the EU. Turkey and Greece have seen penetration gains of 7x over ten years, and further gains there look most promising (Goodacre et al.). In the MENA region, neobanks, which are fully mobile/web-only banks with no physical presence, are growing fast in the UAE compared to the rest of the region which is seeing a rapid shift to digital (Bilandani).

The rally in Bitcoin: A side story of COVID-19

Bitcoin's appeal and competition with gold as an "alternative" currency will likely continue as millennials become a more important component of investors' universe and have shown their preference for "digital gold" over traditional gold (Panigirtzoglou et al.). The demand for an unconventional and high-volatility hedge has been driven by record-rich Equity and Credit valuations, while conventional hedges like DM Bonds barely serve as insurance when US 10Y rates are near 1%; and shocks such as materially higher inflation, economically-debilitating cyberattacks or climate catastrophes could favor an asset that operates outside conventional financial channels. As a stand-alone asset, cryptocurrencies remain several times more volatile than core asset markets, with 3M realized volatility of 90% compared to about 20% on US Equities and Gold. This high level of volatility is likely to prevent corporates from following Tesla's example as the typical portfolio of a corporate treasury consists of bank deposits, money market funds and short-dated bonds. As a result, the annualized vol of a typical corporate treasury portfolio is around 1% (see *Flows & Liquidity: Did Q4 rebalancing flows materialise?*, N. Panigirtzoglou et al., 10 February 2021).

But coupled with extraordinary returns in some years, crypto has often generated a much higher Sharpe ratio on average than core markets like Equities or hedge assets like Commodities in general and Gold specifically (Normand). However, our strategists believe that Bitcoin's current price of ~$51k looks unsustainable, unless Bitcoin volatility subsides quickly from here. Moreover, they note an argument can be made that the $25k price that equalizes Bitcoin with gold in risk capital terms could be considered as an upper bound of its fair value range as this price already frontloads (at current levels of volatility) any long-term upside for Bitcoin stemming from real money institutional adoption (Panigirtzoglou et al.).

In the long term, our theoretical price target of $146k is conditional on Bitcoin vol converging to that of gold, which is not only likely to be a multi-year process but would also depend on Bitcoin ownership becoming more institutional and less retail over the coming years. For the Bitcoin market cap to match the total private sector investment in gold via ETFs or bars and coins, we estimate that mechanically Bitcoin prices would need to rise to $146k (Panigirtzoglou et al.).

The diversification benefits of Bitcoin remain questionable at prices so far above production costs, while the mainstreaming of crypto ownership is raising correlations with cyclical assets. Normand finds that small (up to 2%) allocations to cryptocurrencies can improve portfolio efficiency due to high returns and moderate correlations, but mean-reversion lower in returns is a recurring concern at current prices, while correlations with cyclical assets are increasing, potentially converting crypto assets from insurance to leverage. Over shorter intra-month and

intra-quarter horizons, crypto assets continue to rank as the poorest hedge for major drawdowns in Global Equities, particularly relative to the fiat currencies like the dollar which they seek to displace. To the extent that Bitcoin remains an investment vehicle rather than a funding currency, it will always lack the short base that sponsors USD (and JPY and CHF) strength during periods of acute market stress. A more unique macro shock related to much higher US inflation or a breakdown of the payments system could alter this pattern.

Younger et al. **consider what potential catalyst, aside from idiosyncratic flows, could generate a shock to Bitcoin and discuss why a sudden loss of confidence in USDT would likely generate a severe liquidity shock to Bitcoin markets, as they would lose access to by far the largest pools of demand and liquidity.** A critical lesson of last March is no asset class, including even US Treasuries, is 'safer' than the ability to exchange it for fiat cash at a reasonable cost. Most Bitcoin trading occurs, not against fiat USD, but USDT, which is a stablecoin issued by Tether Ltd and pegged 1:1 to the US dollar. Data collected by NYDIG suggests that since 2019 around 50-60% of BTC trades for USDT. USDT is engaged in a classic liquidity transformation along the lines of traditional commercial banks, but is not subject to the same strict supervisory and disclosure regime, and certainly does not have anything like deposit insurance. Tether Ltd. claims reserve assets of cash and equivalents equal to their outstanding liabilities, but has famously not produced an independent audit and has claimed in court filings that they need not maintain full backing. Thus, **were any issues to arise that could affect the willingness or ability of both domestic and foreign investors to use USDT, the most likely result would be a severe liquidity shock to the broader cryptocurrency market which could be amplified by its disproportionate impact on HFT-style market makers which dominate the flow.**

The rise of Central Bank Digital Currencies (CBDCs): Not yet transformational

CBDCs are entering the "advanced stages" of engagement around the world, and a recent survey by the Bank for International Settlements (BIS) indicates that 86% of global central banks are actively exploring CBDCs. While the majority remain unlikely to issue a digital currency in the foreseeable future, a sizable minority are moving ahead. Roughly 60% of central banks are experimenting with digital currencies, while 14% are moving forward with development and pilot programs. The BIS highlights that central banks representing roughly a fifth of the world's population are set to introduce a "general purpose CBDC in the next three years."[11] However, the IMF notes that there will be challenges to using digital money across borders as policymakers will call for harmonization of legal and regulatory frameworks governing data use, consumer protection, digital identity and other policy issues. Safety, liquidity, trade links, financial connection and geopolitical factors explain why some currencies are disproportionately used in cross-border transactions.[12]

The transformation across borders will occur more slowly, but the advancement of CBDCs can be viewed as an exercise in geopolitical risk management, brought on in part by the US-China conflict (Younger, Feroli, St John). The massive advantage the US has on maxi-QE and the weaponization of the dollar have prompted both China and Russia to develop CBDC for cross-border payments, with the ultimate objective to dampen dollar hegemony. The Fed is slowly monitoring these developments, but sees no first mover advantage as the US dollar remains the reserve currency. China is also likely unwilling to truly open its financial markets and eliminate capital controls, which is required to significantly raise the internationalization of the RMB (Lei et al.).

The adoption of Global Stablecoins (GSCs): FSB calls for greater regulatory oversight

Our economists and strategists see a case to be made for CBDCs, and a way to introduce them at a minimum of disruption while preserving their benefits, but there are greater questions around the regulation, supervision and oversight of so-called Global Stablecoin (GSCs) arrangements (Younger, Feroli, St John). While CBDCs are a digital form of fiat money issued by a central bank subject to issuance and design regulations that are determined by each sovereign jurisdictions, the monetary and private law status of GSCs is unclear. The IMF notes that GSCs could range from money, electronic money, a commodity, a security,

[11] https://www.bis.org/publ/bppdf/bispap114.pdf

[12] https://www.imf.org/en/Publications/Policy-Papers/Issues/2020/10/17/Digital-Money-Across-Borders-Macro-Financial-Implications-49823

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or a combination of those. GSCs are stablecoins, a type of digital money that could be issued by Big Tech with the potential to be widely adopted. To the extent that GSCs aren't considered deposits, they may not be required to be insured by deposit guarantee schemes, such as Federal Deposit Insurance Corporation (FDIC) insurance. Future regulation will focus on who is permissioned to issue GSC arrangements and gain access to the Federal Reserve's payment system as well as the appropriate level of oversight, supervision and regulation. In FY20, 10 companies filed for bank charters with the Office of the Comptroller of the Currency, the most since FY10, with the applications coming from "new" tech companies that are challenging "legacy" firms.[13] Given the wide variance in the design of private digital money and stability of value, **our strategists believe that all digital currency should include liquidity savings mechanisms as part of their liquidity designs** (Younger, Feroli, St John).

As the IMF notes, the most potent digital platforms are the ecosystems of Big Tech firms, which can draw on data from large customer bases with non-financial core activities to exert market power, with a clear edge over banks in both communication and information. While the involvement of non-financial firms in financial services is not new, it has historically been confined to project finance, leasing, loans for consumer durables and facilitated trade credit.[14] The Facebook-backed stablecoin project, Diem, is being closely watched and has faced numerous legal and regulatory challenges since it was proposed in June 2019. Press reports indicate that Diem, which was previously named Libra, may simply launch as a single coin backed 1:1 by the US dollar, pending approval from the Swiss regulator, FINMA, abandoning original plans to be pegged to a basket composed of multiple fiat currencies.[15] Big Tech might propose initially pegging their GSCs to fiat currencies to ensure confidence in the stability of their value, but concerns have been raised that GSCs might be de-linked from fiat currencies over time if their adoption becomes widespread.

Central banks have made it clear that they are not set up to be technological innovators and the private sector will be the greater driver, but they realize that a global framework for digital currencies needs to be established given the potential impact on domestic and cross-border payments. The Financial Stability Board (FSB) is leading a global initiative to create architecture around digital currencies that will take advantage of new technologies, while increasing financial inclusion and lowering the cost of finance. The FSB issued 10 high level recommendations for the regulation, supervision and oversight of "global stablecoin" arrangements in October 2020, including ensuring that GSC arrangements have appropriate recovery and resolution plans.[16] Policy makers have raised concerns about the potential challenges in using digital money across borders given the distinct regulatory requirements of particular jurisdictions. The FSB report calls for completion of international standard-setting work by December 2021 and the establishment of national-level regulatory, supervisory and oversight frameworks by July 2022, with international standards set by July 2023.

Biden's priorities: Greater focus on regulation of digital finance, non-bank financial intermediation and financial inclusion

The battle between US banks and non-bank fintech will be fought not just in the field of technology, fees, and convenience, but also on the regulatory field. The latter is quite uneven with fintech companies subject to a lot fewer regulations, based more on their tech than financial activities. Banks, in contrast, benefit from their access to the Fed and the deposit insurance that their customers receive. As long as there is no crisis or major scandals in fintech, their much lower regulatory burden probably creates an uneven playing field versus banks. But this is unlikely to last. Changes could come in two areas: consumer protection and antitrust.

The Consumer Financial Protection Bureau, created as part of Dodd-Frank and the brainchild of Senator Elizabeth Warren, is tasked with promoting fairness and transparency in consumer financial products. It has been relatively inactive over the past four years, but under the Biden administration it should become a lot more

[13] https://seekingalpha.com/article/4391520-wave-of-new-bank-charters

[14] https://www.imf.org/en/Publications/WP/Issues/2020/08/07/Financial-Intermediation-and-Technology-Whats-Old-Whats-New-49624, p. 18.

[15] https://www.coindesk.com/facebook-libra-stablecoin-january-2021

[16] https://www.fsb.org/wp-content/uploads/P131020-3.pdf

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proactive and in our view will likely focus on the relatively unregulated world of non-bank finance.

A return of antitrust is a second risk to look out for but is mostly a threat to Big Tech (more details in "Business concentration: Consequences of winner-takes-all for tech," J. Loeys, in *The Credit Crisis that Wasn't: The Returns Crisis that Looms*, J. Chang et al., 21 September 2020). Just weeks before the November 2020 elections, President Trump's Justice Department filed an antitrust suit against Google. The origin of antitrust in America from 1890 on tells us that it was not based on concerns about monopoly profits, but on the perception that holding companies—then called trusts—had become too powerful relative to government and other social groups. The Chicago School revolution that brought free markets and globalization to the world also changed the focus of US antitrust from company size to consumer benefits. The massive rise in business concentration, the growth of Big Tech over the past two decades, and the perceived political, economic and social power of Big Tech are now recreating interest, on both sides of the aisle, to critically review perceived non-competitive behavior as well their attempts to make inroads into consumer banking.

Beyond greater oversight of stablecoins and Bitcoin, Biden's platform could potentially impact Big Tech in many regulatory dimensions, including stricter rules surrounding digital identity issues and data privacy, taxation on the revenue from digital ads, and removing the immunity that tech companies now receive from lawsuits over what people post on their websites. The January 6 riots on Capitol Hill could also expedite greater regulation on Big Tech, specifically repealing or overhauling Section 230 of the Communications Decency Act, as they have not done enough to stop misinformation and hate speech. Section 230 has been called the "legal liability shield" for Big Tech as it provides tech companies with protection from lawsuits over what people post to their sites.[17] The state of Maryland voted on February 12 to place a tax on the revenue from digital advertisements sold by companies like Facebook, Google and Amazon, becoming the first state to approve such a measure, which could generate up to $250mn for schools in the first year. The tax mirrors policies put into place by European countries, and similar proposals are under consideration by Connecticut and Indiana.[18]

Finally, while we have focused on the challenges that lie ahead, we highlight the potential benefits that digital financial services ultimately bring to low-income households and small firms.[19] Financial inclusion as a result of these services can also boost economic growth, as noted in a recent IMF study.[20] This study builds on the blueprint laid out in the Bali Fintech Agenda, which was launched in October 2018 and laid out 12 policy elements to harness the benefits and opportunities of rapid advances in financial technology for the estimated 1.7bn adults in the world without access to financial services.[21] In their recent report, IMF researchers introduced an index of digital financial inclusion that measures the progress in 52 emerging market and developing economies and found that digitalization increased financial inclusion between 2014 and 2017, even where financial inclusion through traditional banking services was declining. Previous studies found that extending traditional financial services to low-income households and small firms is associated with increasing economic growth and reducing income inequality due to lower transaction costs, ease of access and the ability to provide access to complementary services or bundling.[22] This analysis found that digital financial inclusion is also associated with higher GDP growth. During the COVID-19 lockdowns, digital financial services enabled governments to provide quick and secure financial support to "hard-to-reach" people and businesses, and broadening the financial access of low-income households and small businesses could also support a more inclusive recovery.

However, the paper also warns that the pandemic could accelerate pre-existing risks of financial exclusion and lead to new risks to the fintech sector itself. The researchers note that fintech appears to be closing gender

17 https://www.washingtonpost.com/politics/2021/01/18/silicon-valley-tech-biden-democrats/

18 https://www.nytimes.com/2021/02/12/technology/maryland-digital-ads-tax.html

19 https://www.jpmorganchase.com/institute/research

20 https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2020/06/29/The-Promise-of-Fintech-Financial-Inclusion-in-the-Post-COVID-19-Era-48623 and https://blogs.imf.org/2020/07/01/digital-financial-inclusion-in-the-times-of-covid-19/

21 https://www.imf.org/-/media/Files/Publications/PP/2018/pp101118-bali-fintech-agenda.ashx

22 https://www.imf.org/en/Publications/Policy-Papers/Issues/2020/10/17/Digital-Money-Across-Borders-Macro-Financial-Implications-49823, p. 14

gaps, but they also note that special attention needs to be paid to ensure that women are not left behind during the COVID-19 crisis. Stakeholders interviewed for the paper highlighted several barriers to digital financial inclusion such as access to resources (mobile phone, internet), cultural or social norms, and digital and financial literacy, may be higher for women.

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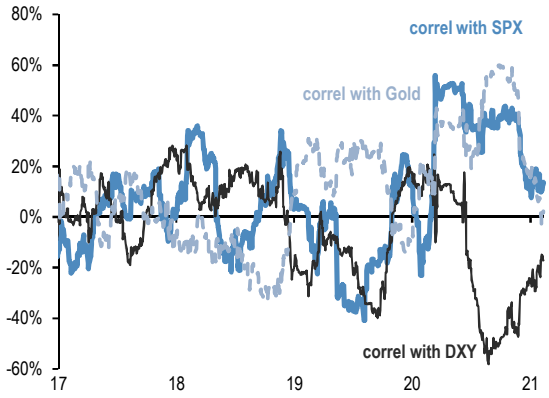
J.P.Morgan

A review of the past year for Bitcoin: Competition with gold as "alternative" currency is here to stay

- **Bitcoin's competition with gold as an "alternative" currency will likely continue as millennials become a more important component of investors' universe and given their preference for "digital gold" over traditional gold.**
- **We believe Bitcoin, at current market prices, has already surpassed gold in risk capital terms. In fact an argument can be made that the $25k price that equalizes Bitcoin with gold in risk capital terms could be considered as an upper bound of its fair value range as this price already frontloads (at current levels of volatility) any long-term upside for Bitcoin stemming from real money institutional adoption.**
- **We view the current mining cost of $11k as a lower bound of Bitcoin's fair value range.**
- **While Bitcoin got another boost with Tesla's announcement, the 8% allocation of its cash reserves to Bitcoin is unlikely to be followed by more mainstream corporates.**
- **Irrespective of how many corporates eventually follow Tesla's example, there is no doubt its announcement changed abruptly the near-term trajectory for Bitcoin by bolstering speculative institutional flows via Bitcoin futures as well as retail flows.**
- **How sustained the price surge post Tesla's announcement becomes would depend, in our opinion, on whether less speculative institutional flows like those behind the Grayscale Bitcoin Trust follow suit.**
- **In the long term, our theoretical price target of $146k is conditional on Bitcoin vol converging to that of gold, which is not only likely to be a multi-year process but would also depend on Bitcoin ownership becoming more institutional and less retail over the coming years.**

The virus crisis, by boosting money supply as well as demand for an "alternative" currency, has supported both gold and Bitcoin over the past year. The older cohorts preferred gold, while the younger cohorts preferred Bitcoin as an "alternative" currency. Both gold and Bitcoin investment vehicles have experienced strong inflows over the past year, as both cohorts saw the case for an "alternative" currency. This simultaneous flow support has caused a change in the correlation pattern between Bitcoin and other asset classes, with a more positive correlation between Bitcoin and gold but also between Bitcoin and the dollar (Figure 1). In addition, the simultaneous buying of US equities and Bitcoin by millennials has increased the correlation between Bitcoin and S&P500 since last March, so it is more appropriate to characterize Bitcoin as a "risk" asset rather than a "safe" asset, also given its still very high 70% realized volatility. To some extent, this is also true with gold. Gold's correlation with the S&P500 has been predominantly positive over the past year and its volatility at close to 20% is more similar to that of equities than to currencies or bonds (Figure 2). In other words, both Bitcoin and gold could be more characterized as "risk" rather than "safe" assets based on their behavior over the past year and investors' preference for them is likely more of a reflection of a need for an "alternative" currency rather than a need for a "safe" asset or "hedge."

Figure 1: Correlation between Bitcoin and other asset classes
3-month rolling correlation of daily returns



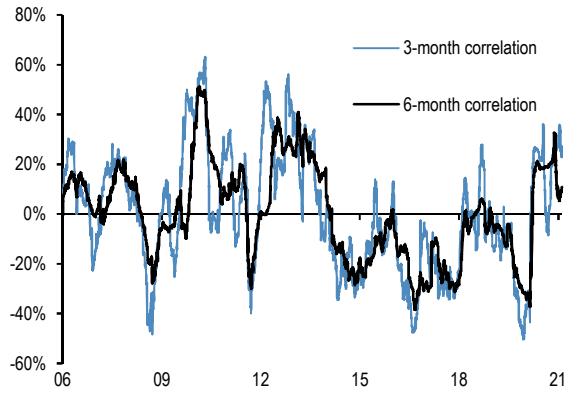
Source: Bloomberg Finance L.P., J.P. Morgan

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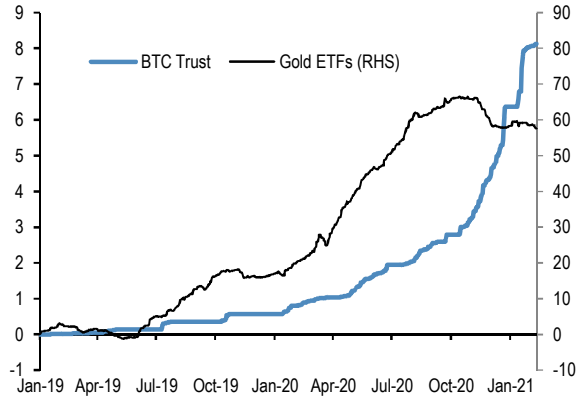
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Figure 2: Gold vs equity correlation
3m and 6m rolling correlation between daily returns of Gold futures (GC1 Comdty) with S&P 500 Index



Source: Bloomberg Finance L.P., J.P. Morgan

Figure 3: Cumulative Flows in Bitcoin Trust & Gold ETF holdings
Both the y-axes in $bn



Source: Bloomberg Finance L.P., J.P. Morgan

In the second half of 2020, Bitcoin started receiving more support via corporate adoption, initially with Square and MicroStrategy and last October with Paypal. Paypal's adoption of Bitcoin was a big step toward corporate support for Bitcoin, which in turn appears to have triggered demand for Bitcoin by institutional investors such as family offices, hedge funds and even insurance companies such as MassMutual. Some of that institutional impulse into Bitcoin likely came at the expense of gold based on the more than $4bn of inflows into the Grayscale Bitcoin Trust and the more than $7bn of outflows from Gold ETFs since mid-October (Figure 3). There is little doubt that this competition with gold as an "alternative" currency will continue over the coming years given that millennials will become over time a more important component of investors' universe and given their preference for "digital gold" over traditional gold. Considering how big the financial investment into gold is, any such crowding out of gold as an "alternative" currency implies big upside for Bitcoin over the long term. As we had mentioned previously in the Oct 23rd Flows & Liquidity, "Bitcoin's competition with gold," private gold wealth is mostly stored via gold bars and coins, the stock of which, excluding those held by central banks, amounts to 42,600 tonnes or $2.7trn including gold ETFs. Mechanically, the market cap of Bitcoin at $900bn currently would have to rise by 3x from here, implying a theoretical Bitcoin price of $146k, to match the total private sector investment in gold via ETFs or bars and coins.

We mentioned previously this long-term potential upside based on an equalization of the market cap of Bitcoin to that of gold for investment purposes is conditional on the volatility of Bitcoin converging to that of gold over the long term. The reason is that, for most institutional investors, the volatility of each asset class matters in terms of portfolio risk management, and the higher the volatility of an asset class, the higher the risk capital consumed by this asset class. Thus, it is unrealistic to expect that the allocations to Bitcoin by institutional investors will match those of gold without a convergence in volatilities. A convergence in volatilities between Bitcoin and gold is unlikely to happen quickly and is in our mind a multi-year process. This implies that the above $146k theoretical Bitcoin price target should be considered as a long-term target, and thus an unsustainable price target for this year.

In fact, an argument can be made that, in terms of risk capital, Bitcoin has more than equalized with gold already (see Jan 4th Flows & Liquidity, "Has Bitcoin equalised with gold already?"). To see this, one could compare the volatilities of Bitcoin and gold, or the volatilities of the biggest Bitcoin and gold funds given many institutional investors are only allowed or prefer to invest in fund format. The 3m realized vol for Bitcoin currently stands at 87% vs. 16% for gold. In other words, the ratio of the two vols suggests that Bitcoin currently consumes 5.4x more risk capital than gold. This ratio rises further if one looks at the biggest Bitcoin and gold funds. The 3m realized vol for the Grayscale Bitcoin Trust stands at 113% vs. 16% for GLD, the largest gold ETF by AUM, i.e., the ratio of the two vols suggests that the Grayscale Bitcoin Trust currently consumes 7.1x

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more risk capital than GLD. Taking the average of the 5.4x and 7.1x ratios, suggests that Bitcoin and its biggest fund on average consume 6.2x more risk capital than gold and its biggest fund, double the 3x ratio needed to equalize the market cap of Bitcoin ($900bn) to that of gold for investment purposes ($2.7trn). In other words, Bitcoin, at current market prices, has already more than doubled relative to gold in risk capital terms. In our opinion, unless Bitcoin volatility subsides quickly from here, its current price of $51k looks unsustainable. In fact an argument can be made that the $25k price that equalizes Bitcoin with gold in risk capital terms could be considered as an upper bound of its fair value range as this price already frontloads (at current levels of volatility) any long-term upside for Bitcoin stemming from real money institutional adoption.

What about the lower bound of its fair value range? In our opinion one way of thinking about the lower bound of its fair value is based on the mining cost or intrinsic value of Bitcoin. The ratio of the Bitcoin market price to its intrinsic value is shown in Figure 4. The current ratio is higher than its previous mid-2019 peak and matches its end-2017 peak, again raising concerns about valuations. This is not to say that the mining cost is driving the market value. The opposite is likely true. In the early years, Bitcoin's production cost had naturally stronger influence on the price because new coin generation was a higher percentage of existing stock or supply. Now that more than 18.6mn Bitcoins have been mined already (vs. max supply of 21mn) and new coin generation is a smaller percentage of the existing supply, the influence of the production cost on the price has likely diminished. Thus, in the current conjuncture, the market price is likely driving the production cost rather than the other way round. However, this causality does not mean that the Bitcoin price would be diverging from its mining cost on a sustained basis. Similar to gold, when the Bitcoin market price is well above the production cost, mining activity and mining difficulty should increase, pushing the cost of production up towards the market price, thus inducing some convergence. But similar to previous episodes, some of that convergence could happen with an adjustment in the market price also. We thus view the acute divergence of Figure 4 as another valuation challenge for Bitcoin and the current mining cost of $11k as a lower bound of its fair value range.

Figure 4: Ratio of Bitcoin market price to intrinsic value
Intrinsic value estimated using the cost of production approach following Hayes (2018)



Source: Bitinfocharts.com, J.P. Morgan

What about positioning? There is little doubt that the institutional flow impulse into Bitcoin is what distinguishes 2020 from 2017. And there is no better metric to capture this institutional impulse than the flow trajectory of the Grayscale Bitcoin Trust in Figure 3. This is because many institutional investors are only allowed or prefer to invest in Bitcoin in fund format for regulatory or other reasons. In fact, many of them are not even allowed to hold restricted shares of the Grayscale Bitcoin Trust via private placements given the 6-month lock up period, and are thus forced to pay a premium by buying these shares in the secondary market.

It is, however, wrong to view all these institutional flows of last year as entirely driven by long-term investors. We believe that a significant component of last year's institutional flows into Bitcoin reflect speculative investors seeking to front run other more real-money institutional investors. The frothy positioning in CME Bitcoin futures is one manifestation of this speculative institutional flow which encompasses momentum traders such as CTAs and quantitative crypto funds. Indeed, Bitcoin futures, the preferred vehicle of speculative investors, saw a sharp increase in open interest in recent months (Figure 5) pointing to intense buildup of futures positions. This is also true with our more carefully calculated Bitcoin futures position proxy shown in Figure 6, which experienced a similarly steep ascent in recent months to unprecedented territory. As a reminder to our readers, to infer positioning in Bitcoin futures, we use our open interest position proxy methodology that we also apply to other futures contracts, where we look at the cumulative weekly absolute changes in the open interest multiplied by the sign of the futures price change

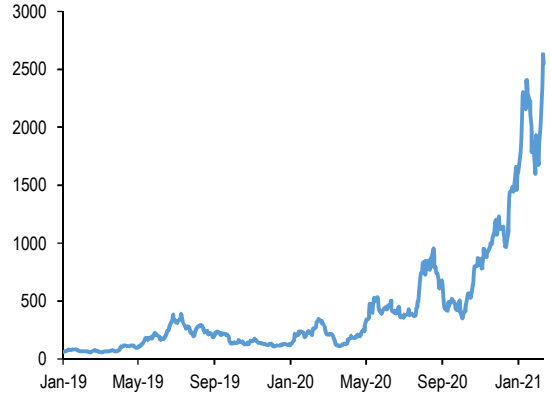
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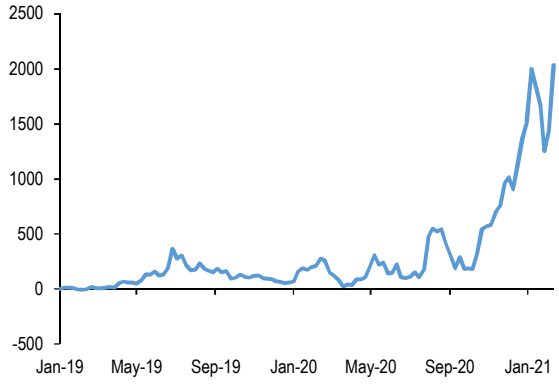
every week. The rationale behind this position proxy is that when there is a price increase, the net long position of spec investors increases also with the magnitude of the increase determined by the absolute change in the open interest. It does not matter whether the open interest rises or falls, as the net long position can increase either via fresh longs (increase in open interest) or a reduction of previous shorts (reduction in open interest), and vice versa. When there is a price decrease, the net long position of spec investors decreases also, with the magnitude of the decrease determined by the absolute change in the open interest. It does not matter whether the open interest rises or falls, as the net long position can decrease either via fresh shorts (increase in open interest) or reduction of previous longs (reduction in open interest). Looking at Figure 5 and Figure 6 it is difficult to not have been concerned about a buildup of institutional speculative long futures positions in Bitcoin.

Figure 5: Open interest in CME Bitcoin futures contracts
$mn. Last obs. for 10th Feb 2021.



Source: CME, J.P. Morgan

Figure 6: Our Bitcoin position proxy based on open interest in CME Bitcoin futures contracts
$mn. Last obs. for 10th Feb 2021.



Source: J.P. Morgan

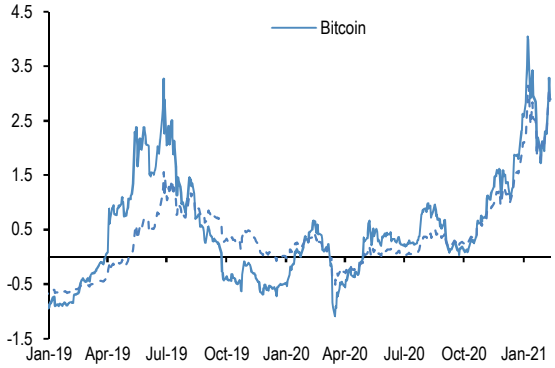
How much vulnerability do these momentum traders pose for Bitcoin at the moment? Clearly, the price surge to above $40k had shifted our Bitcoin momentum signals to even higher territory. This is shown in Figure 7, which depicts our short and long lookback period momentum signals for Bitcoin. Figure 7 shows that the short lookback period momentum signal rose above 3.5 stdevs in early January, and the long lookback period to above 2.5 stdevs, i.e., to even higher levels than the previous peaks of mid-2019. Both are well above our 1.5 stdev threshold typically associated with overbought conditions and a high risk of mean reversion. As we mentioned in the Jan 15th Flows & Liquidity publication, the challenge for Bitcoin at the time was that if its price failed to break out above $40k, the momentum signals would keep decaying till the end of March, given a lookback period of around 2-3 months for our short lookback period momentum signal. Bitcoin faced a similar challenge at the end of November when its price was hovering just below $20k. At the time we had argued that if the Bitcoin price had failed to break out above $20k, the momentum signals would have naturally decayed until the end of January creating negative dynamics for Bitcoin. Luckily, at the time the institutional flow impulse behind the Grayscale Bitcoin Trust was so strong that Bitcoin managed to break out above $20k inducing further position build up rather than position unwinding by momentum traders in December. At the moment the institutional flow impulse behind the Grayscale Bitcoin Trust by itself is not strong enough for Bitcoin to break out above $40k as the 4-week pace of the flow into GBTC (Figure 8) appears to have peaked in December. Luckily, Tesla's announcement that it has invested $1.5bn in Bitcoin, or 8% of its corporate cash reserves, abruptly changed the near-term trajectory for Bitcoin by bolstering speculative flows and by helping Bitcoin to break out above $40k. This reduces one downside risk that we saw previously with Bitcoin, i.e. the idea that if its price fails to break out above $40k, the momentum signals would keep decaying till the end of March, inducing further unwinding by momentum traders. The opposite is now happening. With Bitcoin breaking out above $40k, momentum traders are forced to amplify the current up move by rebuilding their long Bitcoin futures positions. Indeed, our position proxy based on CME Bitcoin futures, the preferred vehicle of momentum traders and other speculative investors, saw a sharp almost $1bn increase after Tesla's announcement (Figure 6) pointing to intense buildup of futures positions.

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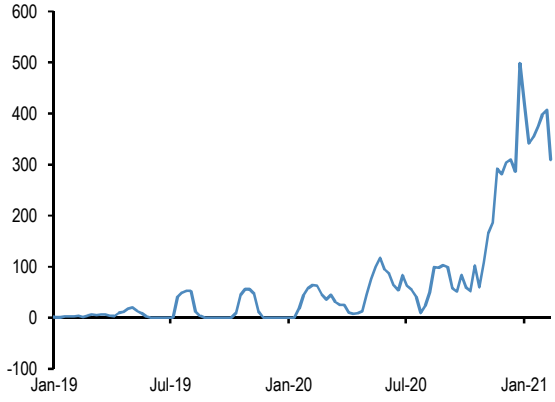
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Figure 7: Momentum signals for Bitcoin
z-score of the momentum signal in our Trend Following Strategy framework shown in Tables A5 and A6 in the Appendix of the Flows & Liquidity publication. Solid lines are for the shorter-term and dotted lines for longer-term momentum.



Source: Bloomberg Finance L.P., J.P. Morgan

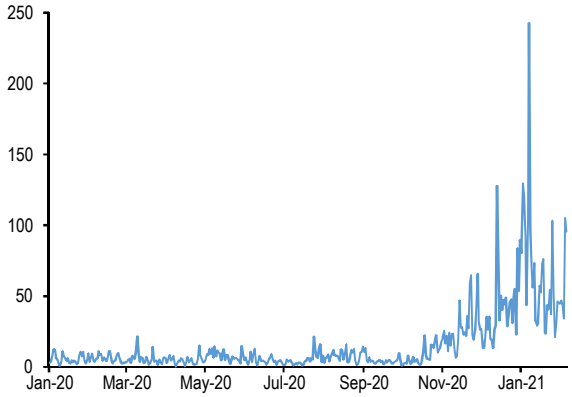
Figure 8: Grayscale Bitcoin Trust flow
$mn, 4-week rolling average flows



Source: Bloomberg Finance L.P., J.P. Morgan

What about retail investors? The speculative mania by retail investors characterized the Bitcoin surge during 2017. Unfortunately, there are some signs that retail interest has also increased sharply in recent months. For example, as we had argued previously the broadening of corporate support for Bitcoin, e.g., via Paypal and Square, has been facilitating and enhancing over time the usage of Bitcoin by millennials. While we do not yet have data for 4Q volumes, one way to gauge the impact from retail purchases via Paypal is to look at volumes on itBit. These volumes (Figure 9) had increased markedly since Oct 21st when Paypal announced the launch of services to enable trading and holding of cryptocurrencies. In addition, there appears to have been an increase in the flow impulse by retail investors post Tesla's announcement, as suggested by the most recent spike in volumes at itBit in Figure 9.

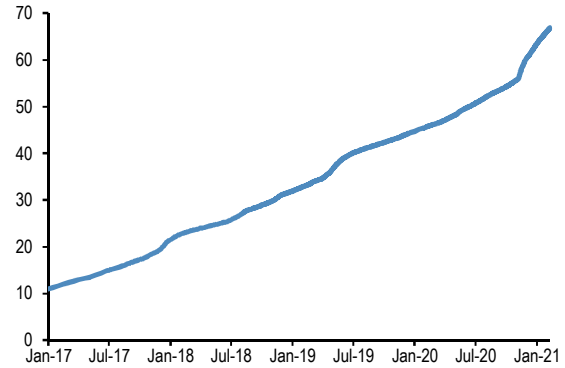
Figure 9: Daily volume on itBit
In $mn per day



Source: cryptocompare.com, J.P. Morgan

Another proxy suggesting increased retail participation is new account openings on 'traditional' cryptocurrency exchanges. Figure 10 below shows unique cryptocurrency wallet accounts on blockchain.com. While the number of accounts clearly has an increasing trend over time, there are sharp pickups in new wallet accounts during the retail-driven price spikes in end-2017, as well as mid-2019. Since the start of November 2020, there has been a proportionally similar rise in new wallet accounts to those two previous episodes.

Figure 10: Unique wallet accounts on blockchain.com
# of accounts in mn.



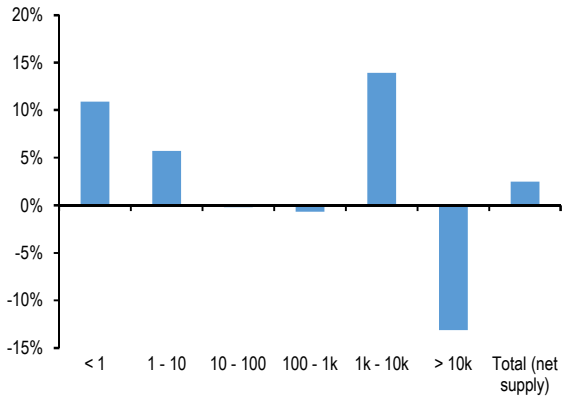
Source: Blockchain.com

Moreover, data on the distribution of Bitcoin balances held in wallet accounts is also suggestive of retail participation. Figure 11 shows the percentage change in total Bitcoin held in wallet accounts by bucket of Bitcoin balance, e.g. < 1 shows the % change in Bitcoin held in wallet accounts with a balance of less than one Bitcoin. It shows that between the start of 2020 and 2021 accounts with less than one Bitcoin or between one and ten Bitcoin have seen a marked increase in holdings that is more likely

to be retail driven. Similarly, there has been a significant increase in balances held in accounts between 1,000 and 10,000 Bitcoin, which is more likely to be institutionally driven. By contrast, balances held in accounts with more than 10,000 Bitcoin have declined significantly, suggesting early investors and miners have been selling Bitcoin to facilitate the increase of new entrants.

Figure 11: % increase in Bitcoin held in wallet accounts by bucket of wallet balance

In %



Source: Bitinfocharts.com, J.P. Morgan

In all, while Bitcoin got another boost with Tesla's announcement, the 8% allocation of its cash reserves to Bitcoin is unlikely to be followed by more mainstream corporates. Irrespective of how many corporates eventually follow Tesla's example, there is no doubt that Tesla's announcement abruptly changed the near-term trajectory for Bitcoin by bolstering speculative institutional flows via Bitcoin futures, as well as retail flows. How sustained the recent price surge becomes would depend, in our opinion, on whether less speculative institutional flows like those behind the Grayscale Bitcoin Trust follow suit.

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What cryptocurrencies have and haven't done for multi-asset portfolios: Mainstreaming is reducing diversification benefits and leading to failure during a crisis

- **Whether cryptocurrencies are judged eventually as a financial innovation or a speculative bubble, Bitcoin has already achieved the fastest-ever price appreciation of any must-have asset to which it is often compared, such as Gold (1970s), Japanese Equities (1980s), Tech stocks (1990s), Chinese Equities (2000s), Commodities (2000s) and FANG stocks (2010s).**
- **Those only interested in potential long-run return targets can review a few research notes published earlier by J.P. Morgan's Research (see Kaneva from 2018 and Panigirtzoglou from 2021). This note instead revisits cryptocurrencies' role in delivering portfolio diversification for global investors, which is an issue we have been analyzing for a few years as this market matures.**
- **The criteria are improvements in long-term portfolio efficiency (do small allocations raise a multi-asset portfolio's risk-adjusted returns) and mitigation of short-term drawdowns (does Bitcoin rally during major Equity market declines).**
- **Why bother considering an unconventional and high-volatility hedge? Three reasons: Equity and Credit valuations look record-rich for a very young business cycle; conventional hedges like DM Bonds barely serve as insurance when US 10Y rates are near 1%; and some as-yet unseen shocks (materially higher inflation, economically-debilitating cyberattacks or climate catastrophes) could favor an asset that operates outside conventional financial channels.**
- **On these two criteria, small (up to 2%) allocations to cryptocurrencies still improve portfolio efficiency due to high returns and moderate correlations, but the persistence of this diversification effect is questionable from both ends. Current prices are so far above production costs that mean-reversion lower in returns is a recurring concern. Also, the mainstreaming of crypto ownership is raising correlations with cyclical assets, potentially converting them from insurance to leverage.**
- **Over shorter intra-month and intra-quarter horizons, crypto assets continue to rank as the poorest hedge for major drawdowns in Global Equities, particularly relative to the fiat currencies like the dollar which they seek to displace. To the extent that Bitcoin remains an investment vehicle rather than a funding currency, it will always lack the short base that sponsors USD (and JPY and CHF) strength during periods of acute market stress. A more unique macro shock related to much higher US inflation or a breakdown of the payments system will alter this pattern.**

One decade's bubble can become the next decade's innovation

Whether cryptocurrencies are judged eventually as a financial innovation or a speculative bubble, Bitcoin has already achieved the fastest-ever price appreciation of any must-have asset to which it is often compared (Figure 1), such as Gold (1970s), Japanese Equities (1980s), Tech stocks (1990s), Chinese Equities (2000s), Commodities (2000s) and FANG stocks (2010s). Each of these predecessors began with a compelling narrative and a tagline ("honest money" for Gold, "Japanese economic miracle" for Nikkei, "dot-com revolution" for Nasdaq, "a billion Chinese consumers" for China Equities, "supercycle" for Commodities and "secular growth" for FANGs), and each delivered extraordinary price momentum that challenged standard valuation models at that time. Each also delivered at least one, high-volatility price crash during the price discovery process that reversed more than half the market's previous gain, even though several of these markets (Gold, Nasdaq, Chinese Equities, FANGs) were later vindicated via further all-time highs.

Those only interested in potential long-run return targets for cryptocurrencies can review a few research notes published earlier by JPM Research (see *Examining Bitcoin's cost structure* by Kaneva from Feb 9, 2018 and *Has Bitcoin equalized with gold already?* by Panigirtzoglou from Jan 4, 2021). **This note instead revisits cryptocurrencies' role in delivering portfolio diversification for global investors,** which is an evolving issue we have been analyzing over the past few years through the research notes hyperlinked in the blue box below. The criteria are **improvements in long-term portfolio efficiency** (do small allocations raise a

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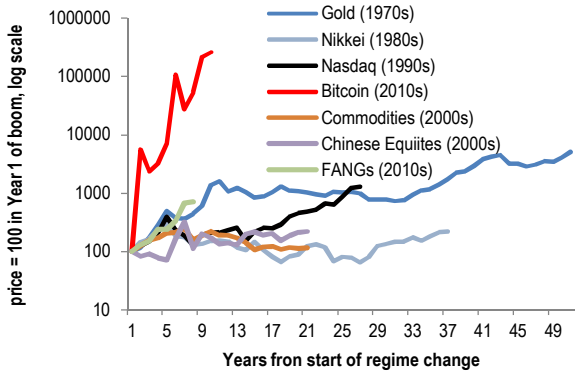
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multi-asset portfolio's risk-adjusted returns) and **mitigation of short-term drawdowns** (does Bitcoin rally during major Equity market declines).

Why bother considering hedging with an asset as unconventional and high-volatility as cryptocurrencies? **A few reasons**. One is that extraordinary monetary and fiscal stimulus over the past year has created one of the **broadest and earliest valuation problems** of the past 25 years (Figure 2), which creates general concerns about portfolio vulnerability to a macro or policy shock. These spoilers range from somewhat familiar ones such as an inability to tame COVID-19, a destabilizing rise in inflation, a debt-related aftershock, significant regulatory tightening, renewed US-China or US-North Korea conflicts; to the as-yet unseen ones such as an economically-debilitating cyberattack or an economically-significant climate catastrophe in a large economy. Another is that the collapse in DM Bond yields to negative levels in Japan and Europe and to only 1% in the US has limited their role as **defensive hedges** in global portfolios and forced investors to focus on a range of second-best substitutes across Equities and FICC (Quality stocks, EM Bonds FX hedged, USD vs EM FX, JPY vs any currency, Gold), with cryptocurrencies considered by some to be the private and digital alternative to Gold (see *Safe havens of the past, present and future* by Normand from Jul 3, 2020). **Our conclusions haven't changed much in the three years we have been tracking this diversification issue.** Bitcoin improves long-term portfolio efficiency, but its contribution will probably diminish as its mainstreaming increases its correlation with cyclical assets. And crypto continues to rank as the least reliable hedge during periods of acute market stress.

Figure 1: The hype cycle – Bitcoin ascent has been steeper than any other financial innovation or asset bubble of the past 50 years

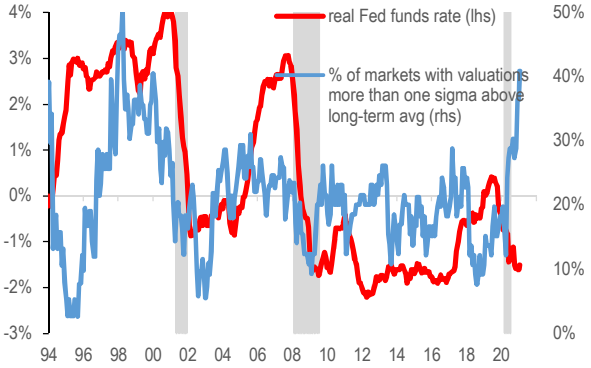
Asset values indexed to 100 in Year 1 of regime change, chosen approximately as 1970 for gold, 1985 for Nikkei, 1995 for Nasdaq, 2001 for Chinese Equities & Commodities, 2012 for Bitcoin and 2014 for FANGs.



Source: J.P. Morgan

Figure 2: Proportion of Equity & FICC markets trading rich to long-term valuation metrics is unusually high for a young expansion

Real Fed funds rate vs percentage of 70 Equity and FICC markets trading more than one sigma above long-term average based on 1Y forward P/Es, credit spreads, real 10Y rates, real FX rates and real commodity prices. Bars indicate US recessions.



Source: J.P. Morgan

Previous research notes from JPM Cross-Asset Strategy on Cryptocurrencies

Cryptocurrencies as portfolio diversification: Still failing in high-stress environments from January 2019 by Normand

Cryptocurrencies as portfolio diversification: Questionable, despite low correlations from February 2018 by Normand

The audacity of bitcoin: Risks and opportunities for corporates and investors from February 2014 by Normand

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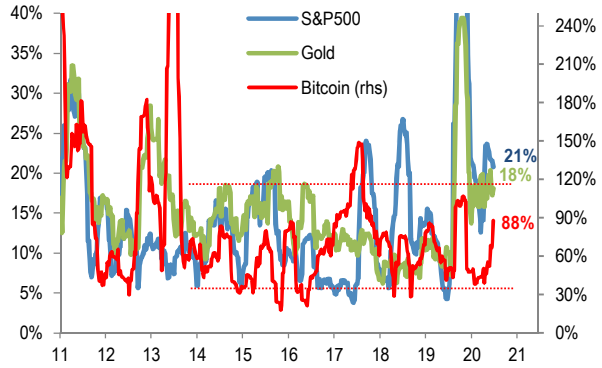
Revisiting cryptocurrencies' advantages and limitations in global portfolios

J.P. Morgan research reports over the past few years have explored cryptocurrencies' diversification benefits and concluded the following:

- Despite their extraordinary standalone volatility (Figure 3), crypto assets still raise the **long-term efficiency** (the Sharpe ratio, or return per unit of risk) of a multi-asset Equity and FICC portfolios due to extraordinarily-high historical returns and lower cross-asset correlations (table 1) than traditional markets whose returns are driven more by business cycle fluctuations and monetary/fiscal policy shifts;
- Those **efficiency gains likely overstated,** however, since crypto assets' returns in their first decade are often so far above intrinsic value (mining costs) that bubble critiques are legitimate (Figure 4). Future returns are thus inclined to be much lower than historicals, just as average annual gains for other regime change beneficiaries (Gold, Tech stocks) moderated as the price discovery process evolved and the market matured.
- Even miniscule exposure of 1% to cryptocurrencies could prove impractical for institutional investors and corporates since crypto assets' lack of **legal tender status** will probably always limit their use as a medium of exchange and therefore their **liquidity** (Figure 5). A medium of exchange that agents are not obligated to accept in settling debts or in purchasing goods and services has less utility than those that must be accepted.
- Constrained liquidity due to lack of legal tender status contributes to the **structurally-higher volatility** of crypto assets, similar to the behavior of supply-constrained Commodities. Such is the tradeoff in owning an asset with fixed supply (only 21mn Bitcoin can be produced, around 18.5m of which have already been mined), even if that scarcity amplifies purchasing power. For those thinking of the macroeconomic consequences of a fixed money supply, yes crypto as monetary anchor would be more deflationary than anything witnessed by Argentina under its defunct currency board, Hong Kong SAR under its longstanding currency board, or Greece working through a debt crisis under the euro.
- Unlike traditional defensive assets like DM Bonds, the US dollar vs EM currencies or the Yen versus any currency, cryptocurrencies' contribution to long-term portfolio efficiency has proven **ineffective in mitigating short-term drawdowns** during periods of acute market stress. So if one's risk horizon is intra-month, intra-quarter and potentially during a recession, cryptocurrencies appear inferior to other defensives.
- Relative to any other asset class or portfolio hedge, cryptocurrencies would **uniquely** protect portfolios against a **simultaneous loss of faith in a country's currency and its payments system**, because they are produced and they circulate outside conventional and regulated channels (Figure 6). So as insurance (or a lottery ticket) against dystopia, some exposure to these assets could be always justified irrespective of liquidity and volatility concerns.

Figure 3: Cryptocurrency volatility has not trended lower over the past several years – it remains about four times more volatile than Equities or Gold

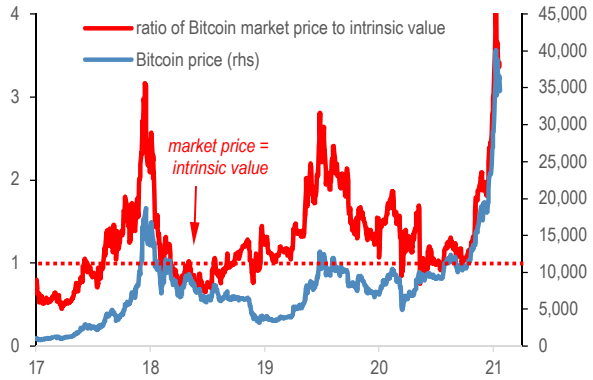
3M realized volatility on BTC, S&P500 and Gold



Source: J.P. Morgan, Bloomberg Finance L.P.

Figure 4: Recurring Bitcoin price surges beyond intrinsic value (estimated mining costs) are one reason to expect long-term mean reversion

Ratio of BTC price to intrinsic value. Intrinsic value estimated using the cost of production approach following Hayes (2018)

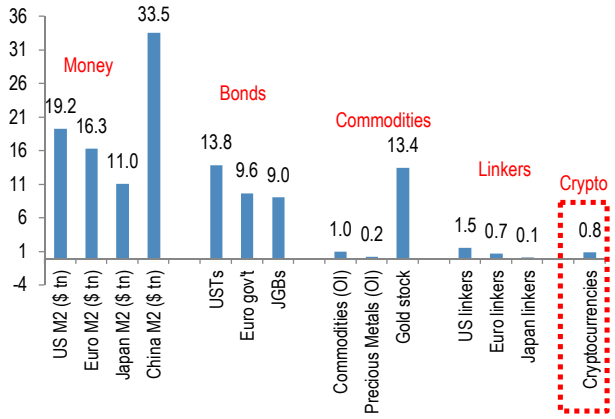


Source: J.P. Morgan *Flows & Liquidity* by Panigirtzoglou

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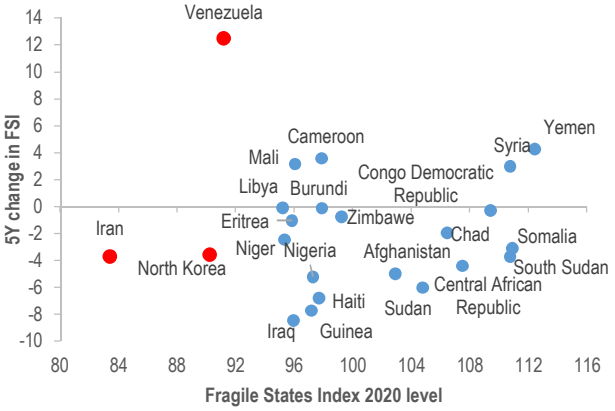
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Figure 5: Lack of legal tender status may always constrain cryptocurrency liquidity compared to traditional portfolio hedges
Value of outstandings in traditional and digitial assets in $ trillions. Measures used are: for Money, M2 monetary aggregates; for DM Bonds, outstanding nominal and inflation-linked bonds; for Commodities, open interest across futures and value of above-ground Gold stock; and for cryptocurrencies, market capitalization of main digital currencies.



Source: J.P. Morgan, Bloomberg Finance L.P.

Figure 6: Thunderdome money – Private, digital currencies are a unique hedge for fragile states vulnerable to simultaneous loss of faith in the currency and payments system
Fragile States Index (FSI) level for worst 20 countries in 2020 vs 5Y change in FSI. Higher levels indicate a more fragile country based on component indicators covering security, factionalism, income inequality, human rights, refugees and external intervention. Venezuela (28th), North Korea (30th) and Iran (44th) added for their geopolitical significance.

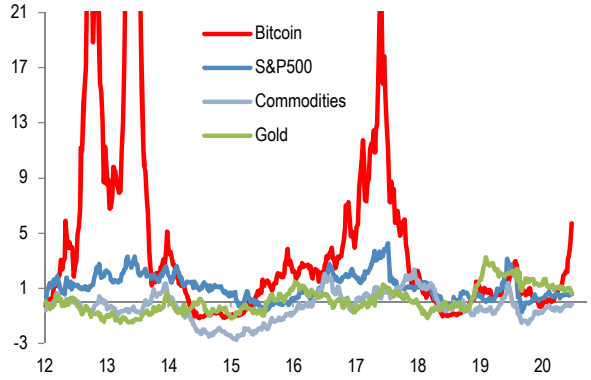


Source: J.P. Morgan, The Fund for Peace (www.fundforpeace.org)

Contribution to long-run portfolio efficiency

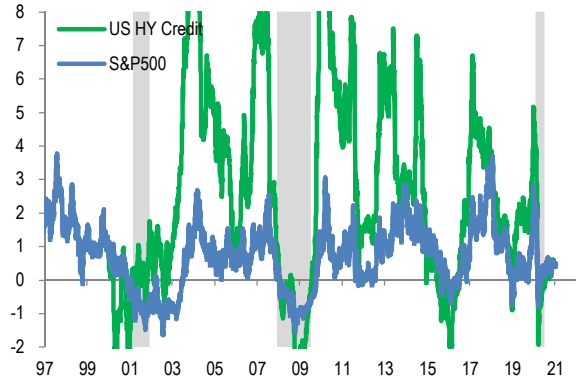
Developments over the past year and particularly during the COVID-19 recession have confirmed this view on the distinction between long-term efficiency and short-term risk management. As a stand-alone asset, cryptocurrencies remain several times more volatile than core asset markets, with 3M realized volatility of 90% compared to about 20% on US Equities and Gold (Figure 3). But coupled with extraordinary returns in some years, crypto has often generated a much higher Sharpe ratio on average than core markets like Equities or hedge assets like Commodities in general and Gold specifically (Figure 7). These averages obscure stretches like 2019-20, when crypto proves less efficient than its nearest competitor Gold. Thus the debate over whether Bitcoin or Gold can deliver superior volatility-adjusted returns remains unresolved, unlike some other quite reliable relationships informed by decades of performance trends. US High Yield Credit, for example, is almost always more efficient than Equities for taking exposure to the US corporate earnings cycle (Figure 8), while EM Corporates (CEMBI) and Sovereigns (EMBIG) almost always dominate Local Currency Bonds (GBI-EM in USD terms) for trading EM cycles (Figure 9).

Figure 7: Cryptocurrencies' risk-adjusted returns have usually beaten Gold, except for 2019-20
Rolling 12-mo returns divided by rolling 1Y realized volatility



Source: J.P. Morgan

Figure 8: By comparison, there are more reliable risk-adjusted return patterns, such as the higher efficiency of US HY Credit vs Equities…
Rolling 12-mo returns divided by rolling 1Y realized volatility



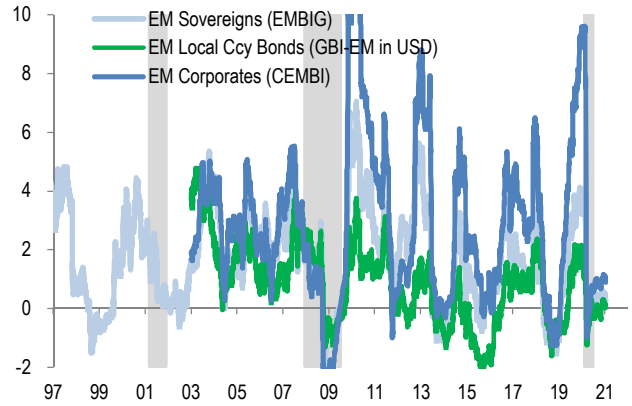
Source: J.P. Morgan

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Figure 9: …or of EM Corporates and Sovereigns relative to Local Currency Bonds

Rolling 12-mo returns divided by rolling 1Y realized volatility for JPM's EMBIG, CEMBI and GBI-EM (in USD) indices



Source: J.P. Morgan

But in a portfolio context, the mainstreaming of cryptocurrencies – particularly with retail investors – appears to be raising its correlation with all cyclical assets (Equities, Credit, Commodities, the EM complex). **If sustained, this development could erode diversification value over time**. Table 1 refreshes correlations amongst cryptocurrencies (proxied by Bitcoin), major asset classes and conventional portfolio hedges (Treasuries, TIPS, Gold and Yen). Measured over a five year sample (top half of table), cryptocurrencies' co-movement with all markets remains low and seems to highlight their potential diversification value. Indeed, Bitcoin's correlation coefficients range from 0 to 0.2 and would seem to position it better than the Yen or Gold for hedging purposes. Over the past year these correlations have doubled or tripled, coinciding with surging interest in access products such as the Grayscale BTC Fund (Figure 10). While many pairwise correlations remain moderate (around 0.4) even after their rise, this trend bears watch.

Table 1: The correlation appeal of crypto seems to have slightly moderated giving some credit to the initial concerns that a gradual mainstreaming of these instruments could synchronize their moves with core markets

Correlation of weekly returns over past five years and past year

Past five years										
	S&P500	USTs	US HG Credit	EM Local	TIPS	USD trade-wtd	Commodities	Gold	Yen cash	BTC
S&P500	1	-0.25	0.45	0.51	0.15	-0.44	0.56	0.20	-0.12	0.14
USTs		1	0.54	0.08	0.76	-0.09	-0.20	0.46	0.54	0.03
US HG Credit			1	0.52	0.70	-0.48	0.31	0.49	0.41	0.12
EM Local				1	0.37	-0.85	0.51	0.49	0.28	0.17
TIPS					1	-0.35	0.20	0.61	0.45	0.16
USD trade-wtd						1	-0.51	-0.52	-0.43	-0.17
Commodities							1	0.27	-0.01	0.17
Gold								1	0.54	0.19
Yen cash									1	0.11
Bitcoin										1
Past year										
	S&P500	USTs	US HG Credit	EM Local	TIPS	USD trade-wtd	Commodities	Gold	Yen cash	BTC
S&P500	1	-0.22	0.66	0.83	0.30	-0.75	0.76	0.47	0.17	0.34
USTs		1	0.41	-0.07	0.69	0.09	-0.23	0.41	0.58	0.06
US HG Credit			1	0.71	0.69	-0.64	0.52	0.55	0.62	0.25
EM Local				1	0.41	-0.93	0.77	0.52	0.34	0.47
TIPS					1	-0.37	0.32	0.69	0.53	0.43
USD trade-wtd						1	-0.72	-0.49	-0.45	-0.43
Commodities							1	0.36	0.13	0.41
Gold								1	0.43	0.43
Yen cash									1	0.16
Bitcoin										1

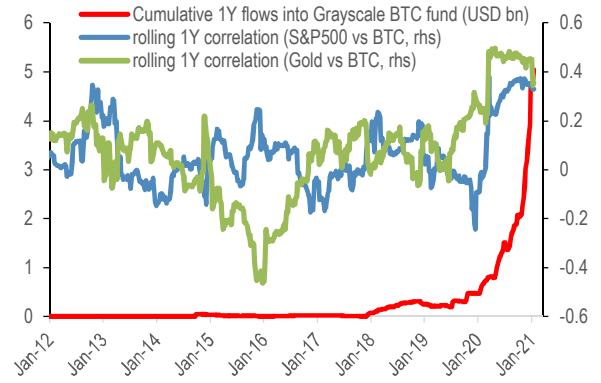
Source: J.P. Morgan, Bloomberg Finance L.P.

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Figure 10: The rise in cryptos' correlation with other asset classes over the past year coincides with its mainstreaming via products such as the Grayscale BTC Fund

Rolling 1Y correlation of BTC daily returns with S&P500 and Gold versus cumulative 1Y inflows into Grayscale BTC Fund



Source: J.P. Morgan

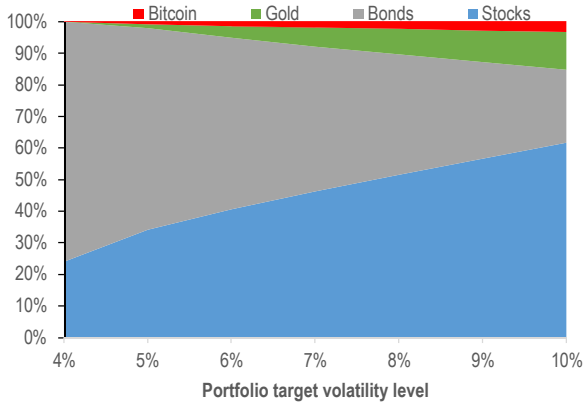
More formally, cryptocurrencies' potential role in a portfolio seems to emerge also from a standard optimization framework. Figure 11 illustrates the results of applying standard unconstrained Markovitz optimization to a **model USD-denominated multi-asset portfolio**, including Equities, Bonds and conventional hedges (Gold in this example). In this exercise, capital markets conditions are assumed to be average rather than representative of the current market environment. Hence, expected returns are not based on JPM's expectations for 2021 but on historical averages adjusted for valuations (10% for US Equities, 2% for US Treasuries, 5% for Gold and +20% for BTC). Similarly, a five-year sample is used to estimate volatility and correlations.

Under these assumptions, **the optimization framework still supports the inclusion of BTC in a multi-asset portfolio.** As Figure 11 highlights, the implied weight for cryptocurrencies increases with target portfolio risk and ranges from 0% to 2.5% for portfolios with volatility targets between 4% and 10%. The model's positive allocation is primarily motivated by cryptos' correlation with conventional asset classes being close to zero, thereby generating a significant diversification advantage. However, for realistic levels of target portfolio risk, the optimal BTC weight remains notably small relative to what is assigned to Equities, Bonds and Gold given that BTC historical volatility, much higher than those of traditional asset classes, penalizes ex-ante risk-adjusted returns.

However, cryptocurrencies' role in a diversified portfolio is dependent on their cross-asset correlations, which appear to be rising. The asset allocation implications of crypto behaving more like a cyclical asset than a reserve asset are illustrated in Figure 12, which shows model-implied allocations for different levels of target portfolio risk using three different samples (past three, five and ten years) for calculating correlations. Notably, the weight assigned by the optimization drops as the length of the sample period shortens and BTC gets excluded from more conservative portfolios (4% volatility) when using three-year and five-year correlations. While the allocation to BTC remains positive for more aggressive portfolios (10% volatility), using a ten-year sample to estimate correlations results in a 3% allocation to cryptocurrencies while the weight falls to 1% using a three-year sample. Unless convergence in volatility compensates for what seems to be a gradual drop in correlation savings, BTC might remain excluded by more risk-averse investors and become at best marginal for more aggressive risk takers.

Figure 11: Based on cross-asset correlations over the past five years, the optimal portfolio's allocation to crypto is 0% to 2.5% for portfolio volatility targets of 4% to 10%

Optimal allocation to US Equities, US Treasuries, Gold and BTC for an unconstrained portfolio for different levels of target volatility. The optimization is a standard Markovitz framework applied to expected return assumptions and 5Y historical volatilities and correlations.



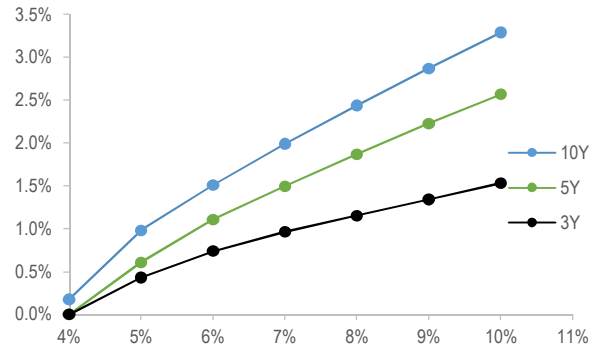
Source: J.P. Morgan

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Figure 12: But if the past three years of rising cross-asset correlations are indicative of mainstreaming's impact, the optimal allocation drops by half

Optimal allocation to BTC for an unconstrained portfolio for different levels of target volatility under correlation matrices based on different sample period (3Y, 5Y and 10Y).



Source: J.P. Morgan

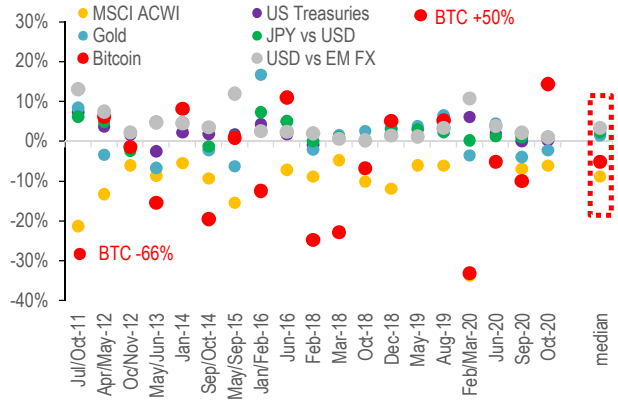
Mitigation of short-term market drawdowns

For tactical investors focused on risks that could crystallize over the next year, the better test of hedge effectiveness is whether a defensive or quasi-defensive asset rallies when Equities experience a material drawdown of perhaps 10% on Global Equities. On this measure, Bitcoin ranks seventh out of 10 alternatives, including: US Treasuries, USD vs EM Currencies, JPY vs USD, CHF vs EUR, Gold, S&P Quality stocks vs Value, EM Local Currency Bonds and UG High Grade. The first five in this list (Treasuries through Gold) are the most conventional and could be backtested further over at least two decades. The last two (EM Bonds with an FX hedge, US High Grade Credit) are potential, emerging hedges on a view that the COVID-19 recession has sponsored two regime changes that alter these asset classes' correlation with Equities during a crisis. One is that many EM central banks (though of moderate-debt economies) will cut interest rates, and the other is the Fed will buy High Grade Credit. The risk-return properties of these two markets will not approximate what Treasuries delivered when yields were higher and therefore offered greater offsets to declining stock markets during a crisis. But the behavior of EM Bonds and HG Credit could still change enough post-COVID-19 to qualify them as potential diversifiers in a world with few good options (see *Safe havens of the past, present and future* by Normand from Jul 3, 2020).

For each of these assets, Figure 13, Figure 14 and table 2 show returns and success rates (the percentage of Equity drawdowns in which the hedge rallied) **during the 20 largest Global Equity corrections of the past decade**. Bitcoin ranks as the worst in terms of median returns (-5%) and the third worst in terms of success rate (42%). Gold is slightly better on both metrics (52% success rate, 2.5% returns), but inferior to fiat currencies like USD vs EM FX (100% success rate, 3% returns) and JPY vs USD (86% success, 2% returns). What distinguishes USD and JPY from Gold and Bitcoin is that the first two are often funding legs of investments in higher-yield assets, so are bought back during periods of acute market stress. Neither Gold nor crypto benefit from that short base that lends technical support to some major fiat currencies in a crisis, regardless of longer-term concerns about debt monetization in the US and Japan. Perhaps market dynamics will be different during an Equity market correction driven by much higher US inflation and a more durable loss of confidence in the dollar (none of the episodes in table 2 were driven primarily by upside surprises on inflation). But until and unless those macro concerns materialize, crypto's ownership structure inclines it to underperform in a macro crisis those very currencies it aspires to replace.

Figure 13: Despite their medium-term diversification benefit, cryptocurrencies have not hedged the largest Equity drawdowns

Returns on defensive and quasi-defensive assets during largest global equity drawdowns since GFC. X axis shows dates of MSCI ACWI drawdowns > 5%.



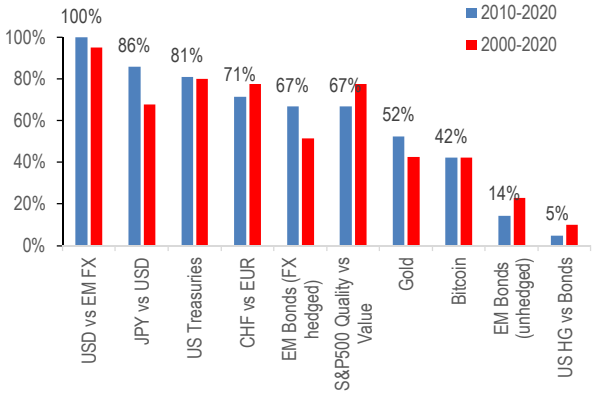
Source: J.P. Morgan

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Figure 14: USD vs EM FX, JPY vs USD and US Treasuries have hedged Equities more reliably than other asset classes

Success rate for various defensive assets during MSCI ACWI peak-to-trough drawdowns of at least 5%. 2000-20 and 2010-2020 sample periods.



Source: J.P. Morgan

Table 2: Drawdowns of at least 10% on Global Equities have occurred almost annually over the past decade, during which cryptocurrencies have proven the least profitable hedges

Returns on traditional and non-traditional defensive assets during largest global equity drawdowns since 2009. Drawdown calculated as maximum peak-to-trough move during episode. Returns on other asset classes calculated as total return over same window. Green indicates positive return on hedge during Equity decline.

		Traditional hedges						Non-traditional hedges				
	MSCI ACWI	S&P500 Quality vs Value	US Treasuries	Gold	JPY vs USD	CHF vs EUR	USD vs EM FX	US HG Credit	US HG vs Bonds	EM Bonds (hedged)	EM Bonds (unhedged)	Bitcoin
Sep/Nov-08	-43.7%	5.2%	5.2%	-10.5%	16.8%	5.9%	17.1%	-6.3%	-12.1%	-3.0%	-25.0%	NA
Jan/Feb-09	-26.8%	14.8%	-1.6%	6.8%	-5.2%	3.2%	10.0%	-3.5%	-2.6%	-4.2%	-14.0%	NA
Jun/Jul-09	-7.8%	1.6%	1.9%	-7.0%	3.4%	0.3%	1.4%	4.7%	2.2%	0.2%	-0.8%	NA
Jan/Feb-10	-10.0%	1.8%	1.5%	-7.7%	3.2%	0.7%	3.8%	0.7%	-1.4%	0.2%	-4.1%	NA
May/Jun-10	-16.3%	3.0%	4.6%	4.3%	6.0%	7.4%	5.4%	3.1%	-3.6%	1.3%	-3.1%	NA
Jul/Oct-11	-21.4%	7.6%	7.1%	8.2%	6.0%	-0.1%	12.9%	2.6%	-6.4%	2.0%	-11.8%	-66.0%
May-12	-13.4%	1.1%	3.6%	-3.5%	4.7%	0.2%	7.3%	1.8%	-2.7%	0.7%	-6.8%	6.0%
Oc/Nov-12	-6.2%	2.2%	1.5%	-1.6%	-2.5%	0.3%	2.1%	0.3%	-1.8%	0.5%	-1.5%	-1.6%
May/Jun-13	-8.8%	-0.7%	-2.7%	-6.8%	4.9%	2.2%	4.6%	-4.9%	-0.7%	-5.6%	-11.1%	-15.6%
Jan-14	-5.6%	-0.2%	2.1%	4.7%	4.3%	0.7%	4.4%	2.1%	-0.9%	-1.3%	-4.4%	8.0%
Sep/Oct-14	-9.4%	0.4%	1.7%	-2.4%	-1.4%	0.0%	3.4%	0.9%	-1.3%	-0.4%	-5.1%	-19.6%
Jul/Aug-15	-15.5%	1.1%	1.6%	-6.4%	1.1%	-4.8%	11.8%	-0.4%	-1.9%	-3.5%	-15.9%	0.7%
Jan/Feb-16	-12.7%	0.4%	4.1%	16.6%	7.2%	-1.5%	2.4%	1.1%	-3.4%	1.3%	-0.7%	-12.5%
Jun-16	-7.3%	0.2%	1.6%	4.9%	4.9%	1.3%	2.2%	1.1%	-0.8%	0.1%	-2.4%	10.9%
Feb-18	-9.0%	0.9%	-1.0%	-2.3%	-0.1%	1.2%	1.9%	-1.2%	0.0%	-0.2%	-2.4%	-24.9%
Mar-18	-4.9%	-0.4%	1.1%	1.3%	0.9%	-0.4%	0.4%	0.6%	-0.7%	0.8%	0.5%	-23.0%
Oct-18	-10.3%	-0.4%	0.0%	2.4%	0.2%	-1.1%	0.1%	-0.6%	-0.9%	0.6%	1.1%	-6.9%
Dec-18	-12.0%	-0.2%	1.8%	3.1%	2.9%	0.7%	1.3%	1.2%	-0.7%	0.7%	-0.3%	5.0%
May-19	-6.2%	0.8%	3.0%	3.6%	2.8%	2.0%	1.0%	1.8%	-1.6%	1.1%	0.8%	50.4%
Aug-19	-6.2%	0.5%	3.3%	6.3%	2.2%	1.2%	3.2%	2.4%	-1.1%	0.5%	-3.0%	5.2%
Feb/Mar-20	-33.8%	8.6%	6.0%	-3.6%	0.1%	0.6%	10.7%	-11.6%	-17.6%	-5.8%	-19.3%	-33.3%
Jun-20	-5.1%	6.2%	1.8%	4.3%	1.1%	1.7%	3.7%	1.2%	-0.8%	0.7%	-2.3%	-5.3%
Sep-20	-7.1%	-1.7%	-0.2%	-4.1%	0.8%	0.2%	2.0%	-0.5%	-0.3%	-0.2%	-1.6%	-10.1%
Oct-20	-6.2%	-1.2%	0.1%	-2.4%	1.0%	0.4%	0.9%	0.3%	0.4%	0.1%	-0.5%	14.2%
Success rate	NA	71%	79%	50%	83%	75%	100%	67%	8%	63%	13%	42%
Median return	-9.2%	0.9%	1.8%	2.4%	2.2%	0.6%	3.2%	1.1%	-1.1%	0.5%	-2.4%	-5.3%
Avg return	-12.7%	2.1%	2.0%	0.3%	2.7%	0.9%	4.7%	-0.1%	-2.5%	-0.6%	-5.6%	-6.2%

Source: J.P. Morgan, Bloomberg Finance L.P.

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Only as strong as the foundation: Risks inherent in the microstructure of Bitcoin markets

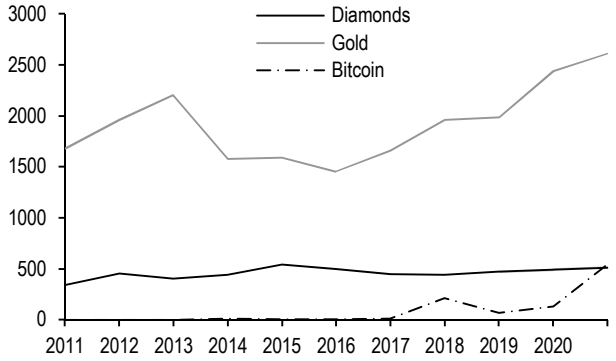
- **On-screen liquidity in Bitcoin markets has continued to improve and outpace more traditional asset classes on a relative basis…**
- **…but, as with many global markets, the vast majority of this liquidity provision comes from high frequency-style traders who often end up fleeing when volatility picks up.**
- **A critical lesson of last March is no asset class, including even US Treasuries, is 'safer' than the ability to exchange it for fiat cash at a reasonable cost.**
- **Given this vulnerability, we consider what potential catalyst, aside from idiosyncratic flows, could generate such a shock.**
- **Most Bitcoin trading occurs, not against fiat USD, but USDT, a stablecoin issued by Tether Ltd. and pegged 1:1 to the US dollar.**
- **USDT is engaged in a classic liquidity transformation along the lines of traditional commercial banks, but is not subject to the same strict supervisory and disclosure regime, and certainly does not have anything like deposit insurance.**
- **Tether Ltd. claims reserve assets of cash and equivalents equal to their outstanding liabilities, but has famously not produced an independent audit and has claimed in court filings that they need not maintain full backing.**
- **A sudden loss of confidence in USDT would likely generate a severe liquidity shock to Bitcoin markets, which could lose access to by far the largest pools of demand and liquidity.**

Only as strong as the foundation

A few months back, we highlighted the resilience of Bitcoin markets relative to more traditional asset classes during periods of stress last March and April (see *Cryptocurrency takes its first stress test*, J. Younger et al., 11 June 2020). Liquidity was clearly robust through the more disorderly phases of that crisis, dropping comparably to equities, gold, FX and fixed income, but staging a more rapid and resilient recovery. As we have found in Treasury markets, this relied on the return of high frequency traders, who contribute most of the on-screen depth on major exchanges like Coinbase (see *Wallet Chain*, H. St John et al., 30 Oct 2020). That said, we found price action was more in line with the performance of risky assets than stores of value or a medium of exchange. In that sense, **Bitcoin appeared to be performing like a hybrid product, displaying elements of both**.

Figure 1: The market capitalization of Bitcoin now exceeds the value of above-ground diamonds, and is ~20% that of all gold held purely for private investment purposes

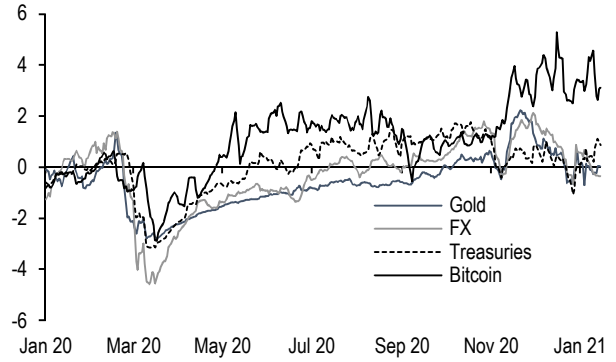
Market capitalization of Bitcoin versus above-ground diamonds* and gold held for private investment purposes†; $bn



* Estimated from annual production figures from the British Geological Service Mineral Statistics Datasets (1970-2010) and Kimberley Process (2011-19), scaled to rough diamond prices using Kimberley Process value estimates through 2019 and extrapolated using the Zimnisky Rough Diamond Index.
† Above-ground gold statistics from the World Gold Council.
Source: Metals Focus, Refinitiv GFMS, World Gold Council, Kimberley Process, UKGS, Zimnisky Rough Diamond Index, Coinmarketcap.com

Figure 2: Bitcoin market depth dropped less and recovered faster than several more traditional asset classes, and has since improved further as prices rose

1-year z-score of weekly average market depth by asset class; unitless



Note: Bitcoin market depth from Coinbase USD pairs.
Source: J.P. Morgan, CME, BrokerTec, bitcoinity.com

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The continued resilience of the liquidity of this market is arguably increasingly important to broader financial stability. Judged based on market value, Bitcoin is far from a niche asset class. At the peak earlier this year, its market capitalization was in excess of $750bn—and even with the recent sell-off it remains well above $600bn. That would make Bitcoin, by some estimates, worth more that the full stock of above-ground diamonds, and ~20% of gold held for investment and trading purposes (Figure 1).

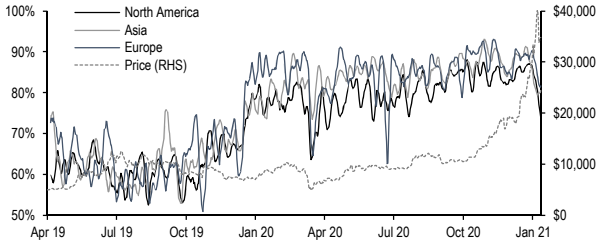
As this has occurred, there is evidence to suggest that liquidity in the Bitcoin market has continued to improve. Market depth, for example, clearly jumped in October—though we see a similar effect in other asset classes, it was both earlier and larger in relative magnitude (Figure 2). **This has furthermore been largely sustained in more recent weeks as the deepening of Gold, FX, and Treasury markets proved more transient**.

That said, the experience of last March made clear that visible depth often cannot be relied upon when times turn rough. Not only was this true even of the market for US Treasuries, but risk-free assets more generally were arguably the epicenter of the liquidity shock that destabilized global markets, leading to the most significant financial stability event since 2008 (see e.g., *Scary stories to tell in the dark*, J. Younger et al., 29 June 2020). **A critical lesson of that period is that no asset class is safer in practice than the ability to exchange those holdings for fiat cash[1] under stress and at a reasonable cost**. Thus the resilience of market microstructure is a key input into evaluating risk, and arguably more important at times than other factors like credit or limited supply.

We believe this risk originates in the role of high-frequency (HFT) market making activity from both principal trading firms (PTFs) and automated systems run by bank-affiliated and other dealers. In Treasuries, for example, we estimate roughly 70-80% of on-screen liquidity is provided by these participants (see e.g., *The Life Aquatic*, H. St John et al., 5 June 2020 and references therein). **Bitcoin markets, if anything, show a stronger effect, with more than 90% of visible depth provided by HFT-style activity over the past few months (Figure 3)**. This remains strikingly true throughout the 24-hour trading day, and unlike Treasury markets, for example, if anything is more pronounced in European and Asian trading hours.

Figure 3: As with other asset classes, high-frequency traders have grown to dominate the provision of liquidity on Bitcoin exchanges, including the most recent few months of exponential price appreciation…

Rolling weekly average of the fraction of market depth attributable to high-frequency style market makers during North American, European, and Asian trading hours (LHS; %) versus BTC/USD price (RHS; $)

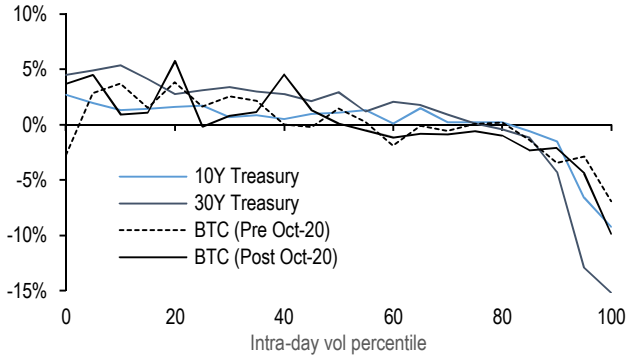


Note: For details see *Wallet Chain*, H. St John et al., 30 Oct. 2020.

Source: J.P. Morgan, NYDIG

Figure 4: … but, also like other markets, this liquidity tends to disappear quickly during times of stress, and that has grown even more true in recent months

Expected drop in the fraction of market depth attributable to HFT activity for 10- and 30-year Treasuries, as well as BTC prior and post 10/1/2020; %



Source: J.P. Morgan, NYDIG, BrokerTec

As expected, we see a sharp drop in more recent days as volatility has increased. As of the middle of January, HFT-style activity contributed roughly 74% in North American trading and 80% in European and Asian hours, compared to peaks of 88% and 93% over the past few

[1] Focusing on interchangeability for fiat cash clearly implicates broader debates regarding the future of money. That is well beyond the scope of this discussion. But it can be argued that as long as only deposits at the Federal Reserve, intermediated by commercial banks, are accepted to cure liabilities to the US government, they will remain the ultimate source of value in the broader monetary ecosystem.

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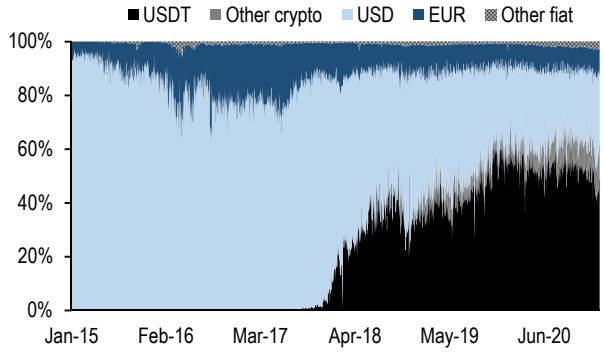
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months. **A somewhat more systematic look reveals a clear tendency for HFT market makers to back off when volatility is elevated (Figure 4)**. In fact, their propensity to do so appears to have increased over the past few months. That said, the extent to which this relationship resembled much larger and more systemically important assets like Treasuries is striking—if anything liquidity in 30-year Bonds looks more prone to flight by this measure. The lesson appears to be that Bitcoin is subject to the same pro-cyclical liquidity dynamics as many other markets.

That said, **volatility shocks generally require a catalyst**. Aside from random imbalances of flows or idiosyncratic trading activity, what might cause such an event in Bitcoin? This is where the composition and geography of trading activity comes in. Though the value of a Bitcoin is most commonly quoted in US dollar, the vast majority of the trading is not against fiat currency at all. Rather, **data collected by NYDIG suggests that since 2019 around 50-60% of BTC trades for USDT,[2] which is a stablecoin issued by Tether Ltd.** (Figure 5; for a broader overview of stablecoins, see *Can stablecoins achieve global scale?*, J. Younger et al., 3 Dec. 2019). Reliance on USDT specifically has declined in recent weeks, but only due to increased use of other stablecoins; trading versus fiat USD is down marginally on average since October relative to the rest of 2020.

Figure 5: Most Bitcoin trading occurs relative to stablecoins, particularly USDT which is issued by Tether Ltd. and pegged to the US dollar …

Fraction of trading volume in BTC by pair; %

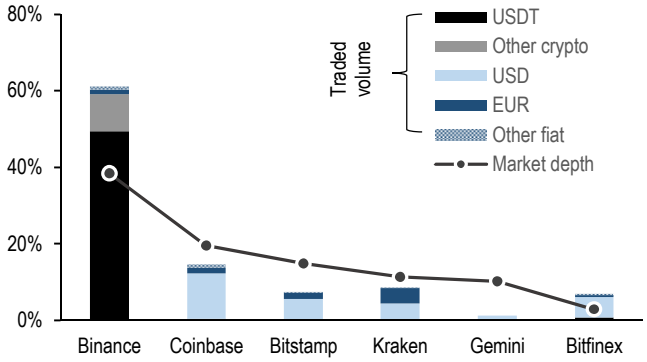


Note: Includes activity on Binance, Coinbase, Bitstamp, Kraken, Gemini and Bitfinex.
Source: J.P. Morgan, NYDIG

This owes primarily to the balkanized nature of cryptocurrency exchanges, including many without direct access to the US banking system. Binance in particular has a commanding lead in both traded volume and liquidity provision but only accepts USDT and other stablecoins (Figure 6). Relying on Tether and other stablecoins pegged 1:1 to fiat currency is more efficient for cross-border transfers and inter-exchange arbitrage trading. **It does, however, expose the broader Bitcoin ecosystem to the stability of this peg—without USDT, the market would lose access to its largest pools of liquidity in both spot and derivatives**.

Figure 6: … which reflects the dominance of offshore venues like Binance which do not have formal US banking relationships

Fraction of traded volume by trading pair and market depth (bids and asks within 2% of mid) by exchange, all from 9/1/2020 to 1/21/2021; %



Source: J.P. Morgan, NYDIG

This is nothing new—concerns about the long-term stability of USDT have circulated for several years.[3] This has clearly not stood in the way of further rapid growth in open interest and overall usage. That said, **increased institutional sponsorship[4] largely brings enhanced and renewed scrutiny as larger, more liquidity-sensitive investors enter the space**. It also invites more regulatory attention as potential financial stability risks increase—for example, the recently proposed STABLE Act. These developments motivate revisiting the topic.

We begin by asking how good the USDT peg performs in practice. Over the past couple of years, daily volatility in the USD/USDT cross is more in line with freely floating G4 NEERs than other pegged

[2] Tracking 'true' trading volumes in cryptocurrency markets is a matter of some debate, particularly offshore where USDT trading dominates. Another analysis showed USDT volume as more than 70% of global turnover, while others are consistent with the figures quoted here.

[3] For example, in early-2018 as the first run-up in Bitcoin rapidly reversed and April 2019 when the NYAG case was first announced.

[4] Now including the largest asset manager in the world.

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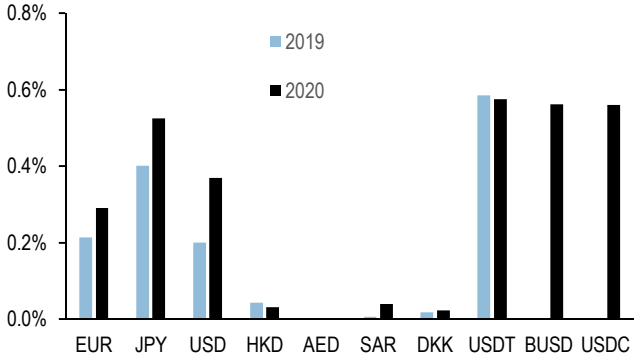
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exchange rates but better than some other relatively common stablecoins like USDC (USD Coin; notable for reasons which, again, will come up shortly; Figure 7). That said, it has been rather consistent over that period, which suggests this level of inefficiency in redemptions is tolerable to the market, and it remains quite small compared to Bitcoin, which realized roughly 4-5% daily volatility over the same period.

Figure 7: USDT shows considerably greater volatility than pegged fiat currencies, though noticeably less than USDC and others that offer greater disclosure and are subject to US law

Standard deviation of daily changes by year; %



Note: HKD, AED and SAR are pegged to USD, and DKK is pegged to EUR.

Source: J.P. Morgan, coinmarketcap.com

How does USDT work? For details, we direct the reader to a whitepaper posted to their website. But at a high level, the **Tether market is tiered into liquidity providers (sometimes termed "verified customers") and users (buyers and sellers in the secondary market)**. The former are a small subset[5] which participate in the creation and redemption process. New tokens are minted following a wire of fiat currency funds in the same amount (net of fees) to a preselected bank account owned by Tether Ltd., which are then delivered to the liquidity provider to exchange for BTC, other cryptocurrencies, or other stablecoins. Those funds can be reclaimed through a prescribed redemption process,[6] making USDT in principle a claim on this pool of reserve assets.

There is not a great deal of transparency around the ratio of reserve fund assets to USDT tokens, or what they constitute. A report commissioned in 2018 lists bank deposits totaling slightly more than 100% of outstanding liabilities as of June 1st of that year. This suggests that, at last as of mid-2018, reserve assets consisted primarily of unsecured bank deposits. A letter released by Tether Ltd. suggests at least one of these accounts (likely the larger of the two) is held at Deltec Bank in The Bahamas. It seems unlikely, however, that this account remains the primarily source of bank assets.[7] This suggests the reserve fund is primarily held elsewhere[8] and could consist of assets besides bank deposits. And, of course USDT may not be fully reserved[9]—we know from filings related to an ongoing court proceeding that, at least for a period of time, the value of the cash and equivalent reserve fund assets was only 74% of total liabilities and that it should not be required to fully back the tokens.[10]

In this sense, **Tether Ltd. is engaged in a variant of the classic liquidity transformation**.[11] Parallels are often

[5] According to documents released by Tether Ltd., the parent and issuing company for USDT tokens, US persons must be incorporated offshore (i.e., "outside the United States or its territories or insular possessions").

[6] Because USDT is a tiered market with only a small subset permissioned to redeem fiat currency funds for tokens, in practice redemptions are more easily accomplished through an intermediating buy/sell of free floating cryptocurrencies like BTC. This, however, leaves the reserve fund intact and relies on deep and liquid markets in BTC/USDT pairs.

[7] The latest Quarterly Statistical Digest from the Central Bank of the Bahamas shows increases of roughly $1.8bn and $580mn in non-resident deposit liabilities of international banks and foreign currency deposit liabilities of domestic banks from Q4-end 2019 to Q3-end 2020, respectively, while compared to a more than $11bn increase in USDT outstanding over the same period. For context, as of December 2020 the Central Bank of the Bahamas listed Deltec Bank & Trust as an Authorized Agent, which suggests their balance sheet would be included among international banks for reporting purposes. Along the same lines, BIS locational banking statistics show external claims of banks in the Bahamas increased $1bn over the same period. More generally, TIC data show total liabilities payable in US dollars (including T-bills, negotiable CDs, and others) declined roughly $4bn from December 2019 to November 2020, despite a roughly $15bn increase in USDT outstanding over the same period.

[8] A White Paper released in 2016 notes accounts at two banks in Taiwan, for example.

[9] This was addressed in a recent blog post, though we also point the reader to a rebuttal on a recent podcast.

[10] It is interesting to note that BTC usually trades at a discount to offshore stablecoins like USDT and BUSD. This suggests demand in cash is incrementally greater on average.

[11] For an overview, see *Banks and Liquidity Creation*, D. Diamond, Economic Quarterly, Federal Reserve Bank of Richmond, Spring 2007. An interesting nuance here is the liquidity benefits offered by USDT owe to segmentation and

drawn to more traditional commercial banks, which operate under a presumably much more aggressively fractional reserve regime—in the US, for example, as of this writing large institutions hold only 14% of their assets in cash and equivalents, up from less than 8% in early-2020 and levels as low as ~2.5% in 2008.[12] **Unlike Tether Ltd., however, commercial banks are subject to a strict regulatory regime[13] of risk-based and leverage capital requirements, liquidity requirements, and regular extensive disclosures[14]**—not to mention being covered by Federal deposit insurance. In other words, the ability to mint 'money' typically comes at the cost of invasive supervision and public disclosure. Tether Ltd. has famously refused a third party audit, and does not apparently have any clear regulatory constraints on leverage or the composition of their reserve assets. Thus, **if we apply the Diamond-Dybvig framework, their only true protection against runs is suspension of convertibility, either through the coordinated action of verified customers[15] or by Tether Ltd. themselves**.

This stands in contrast to other stablecoins like Binance USD (BUSD; ~8% of volume since September 2020) and USD Coin (USDC; ~1.8%). These tokens are fully reserved and subject to a clear and independent audit trail with monthly disclosure (e.g., here and here) which make it clear that these tokens are fully backed by commercial bank deposits. This means that, in principle, they should inherit the supervisory regime to which those deposits are subject, reducing run risk. That said, they are not purely fungible, and still bear regulatory risk associated transferability, especially in the context of cross-border transactions.

Given this level of transparency, it is only natural that many in the cryptocurrency market have speculated about the long-term stability of the USDT peg. To date, there is little evidence of significant cracks emerging, and we certainly do not take a view on the facts of this case. Further, as alluded to above the tiered structure of USDT markets could in principle offer gatekeeping mechanisms which could constitute a credible threat to suspend convertibility, thus reducing run risk. That said, particularly in light of the recent run-up and resulting increase in value at risk since the lows last year, the heavy reliance of Bitcoin on Tether tokens is important to bear in mind. **Were any issues to arise that could affect the willingness or ability of both domestic and foreign investors to use USDT, the most likely result would be a severe liquidity shock to the broader cryptocurrency market which could be amplified by its disproportionate impact on HFT-style market makers which dominate the flow**. One potential such catalyst is any less than flattering revelations from discovery related to ongoing court proceedings.[16]

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frictions in cross-border flows, rather than the more fundamental illiquidity of the reserve assets.

[12] Cash and equivalents versus total assets for large commercial banks (>$250bn total assets) from Federal Reserve H.8 data as of Jan. 15, 2021. The recent increase reflects the rapid expansion of the Fed's balance sheet. The pre-crisis era primarily reflects risk-based capital requirements while more recent years include total leverage and GSIB score related constraints.

[13] For an overview of international standards under Basel III see this overview provided by the BIS BCBS.

[14] For example, FDIC Call Reports and Financial Stability Monitoring Reports.

[15] To first order, verified customers are subject to similar economic incentives and behavior constraints typically applied to the holders of unsecured commercial bank deposit liabilities. However, their much smaller number and therefore greater ability to coordinate could in principle shift or remove some Nash equilibria and allow them to participate to some extent in suspension of convertibility of USDT for fiat USD cash.

[16] Including a case brought by the Attorney General of New York State (New York County Supreme Court 450545/2019; public documents available here).

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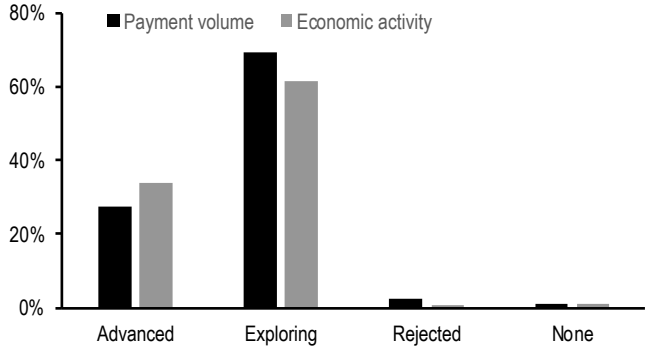
You say you want a revolution: Who is permissioned to utilize digital currencies?

- **Though free-floating cryptocurrencies and private stablecoins have struggled to gain traction, central bank digital currencies (CBDCs) are, in many ways, a compelling alternative.**
- **Any potential CBDC would form a third component of the monetary base, and be issued by the central bank.**
- **The first and most important choice is who will be permissioned to utilize these tokens; a retail CBDC runs the risk of absorbing large quantities of bank deposits and disintermediating the private sector financial system.**
- **The specific use cases for CBDCs are not as compelling as the ubiquity of these projects would suggest …**
- **… but in addition to higher levels of financial inclusion, more efficient cross-border payments, and improved financial stability monitoring, CBDCs can be viewed as an exercise in geopolitical risk management—particularly for the United States.**
- **Several design choices will be key to success: (1) maintaining a separation between central bank and private money, even if both are tokenized on distributed ledgers; (2) a sufficiently efficient protocol that is compliant with applicable laws governing privacy and reporting; (3) preserving liquidity savings mechanisms and intraday liquidity.**

You say you want a revolution: considering central bank digital currency

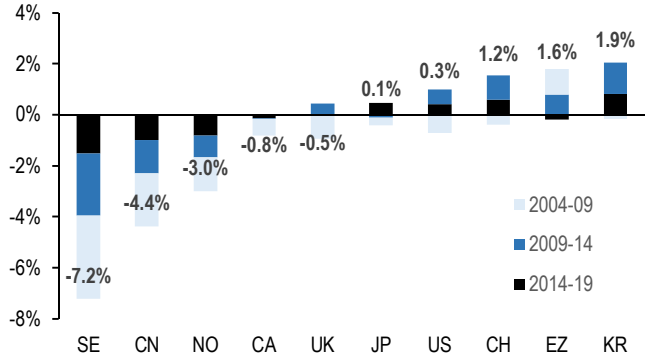
The popularity of cryptocurrencies like Bitcoin and Ethereum has waxed and waned over the past couple of years. Perhaps more importantly, these tokens remain primarily vehicles for speculation; by some estimates only 1% of BTC transactions came from merchants in early-2019. That is not to say the technology itself has not increasingly found its footing. Alternative payment systems are fast becoming a key component of Chinese financial infrastructure (see *A case study in alternative payments*, J. Younger et al., 5 Dec 2019), banks have introduced their own digital tokens, and blockchains have been deployed in a variety of venues including financial services and transportation (see *J.P. Morgan Perspectives: Blockchain, digital currency, and cryptocurrency*, J. Chang et al., 21 Feb 2020 and *The road ahead for digital currency and fast payments*, J. Younger, 9 Jan 2020). However, **the cryptocurrency revolution has clearly not had the scope and reach some thought possible a few years ago**.

Figure 1: The vast majority of central banks, covering most global economic and payments activity, are in the advanced or exploratory stage of pursuing central bank digital currencies
Share of global payment volume and economic activity as of 2018 grouped by stage of development for CBDCs (as of 1Q 2020); %



Source: J.P. Morgan, BIS, JPM Blockchain Center of Excellence (JPM BCOE)

Figure 2: Though paper currency remains a key means of payment, particularly for consumers, in several larger countries it is shrinking as a share of the overall money supply
Change in currency in circulation as a share of M2 (central bank and quasi-money) over the past fifteen years, overall change indicated; %



Source: J.P. Morgan, Haver Analytics

That said, free floating private tokens are but one possible version of digital money. Over recent years many have looked to apply some of the principles underlying the design and implementation of BTH and ETH to public money—**central bank digital currencies, or CBDCs**. Unlike Bitcoin and other cryptocurrencies, a

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potential CBDC would be issued and backed by the central bank and trade 1:1 with the existing currency, thus having a much more stable value. Also in being central bank money, these tokens would avoid many (but not all) of the pitfalls of private stablecoins (see *Can stablecoins achieve global scale?*, J. Younger et al., 3 Dec 2019 and *The market implications of Libra and other stablecoins*, J. Younger et al., 5 Sep 2019). It should come as no surprise that a recent BIS survey found that 86% of their respondents were exploring some version of a CBDC last year, up from about 65% in 2017. Based a survey of public information, advanced and exploratory projects cover roughly 90% of payment and economic activity, respectively (Figure 1). The Fed has not been at the vanguard of central banks studying CBDCs, though it is carefully monitoring these developments.

Why issue a CBDC in the first place? As a general matter, however, use of paper money is already on the decline relative to quasi-money in some major economies. Sweden and China are clearly the most important such examples, but it is notable that many other G10 countries are experiencing flat to negative growth in paper currency as a fraction of broad money[1] (Figure 2). Along these lines, some estimates suggest this trend is likely to continue (e.g., *Cash Use Across Countries*, T. Khiaonarong and D. Humphrey, IMF WP/19/46, March 2019). **Providing a digital replacement potentially offers numerous societal benefits**, including better financial inclusion, more efficient and faster payments, and geopolitical advantages for the issuing country (more on this later).

The COVID-19 crisis has brought the potential financial inclusion benefits of digital money into sharper relief, especially for advanced economies. Perhaps most immediately, paper currency is a potential vector for transmission. Along these lines, numerous central banks have taken steps to either limit its use (e.g., by encouraging contactless payments), or gone so far as the quarantine of some repatriated notes (for a fuller accounting, see *Covid-19, cash, and the future of payments*, Auer et al., BIS Bulletin No. 3, 3 April 2020). This risk is felt disproportionately by lower-income households: a recent San Francisco Fed study found that households making less than $50k per year were increasing their cash holdings, while the opposite was true of higher income brackets. Digital money would be contactless by definition and could therefore potentially limit the spread of contagions.

Though the acute risk of contagious disease may fade over time, one endearing lesson of the current crisis is the difficulty in getting direct government payments to individuals in a timely manner. Take, for example, the first round of Economic Stimulus Payments in the United States. After three weeks of processing the IRS reported roughly 90mn had been distributed, or roughly 60% of the total expected total. This likely owes in no small part to a lack of direct deposit access to taxpayer bank accounts, and there are a number of cases (mostly non-filers) where beneficiaries are much less likely to have access to traditional financial services at all. Given nearly 40% of American households still without $400 on hand in the event of a financial emergency, and 12% unable to borrow to cover such an expense, speed is critical to the effectiveness of direct assistance programs for millions of recipients, particularly the most economically vulnerable.[2] A retail CBDC or other widely adopted digital token to which the government had access, for example, could help speed the distribution of these types of payments.

Our analysis looks at the creation of retail CBDCs as conceptually equivalent to two steps. **First**, allowing non-banks (businesses and households) to have the ability to directly hold reserve account balances at the Fed, giving them a claim on the Fed's balance sheet (Fedcoins). **Second**, allowing transactions on these claims to clear and settle on a peer-to-peer basis, utilizing the distributed ledger technology that serves as the backbone of Bitcoin. Both steps would be controversial and require the assent of Congress. **The first step could serve as a backdoor route to a narrow banking system, with large and controversial implications for financial intermediation**. The second step raises questions about whether a Fed CBDC should be structured to preserve the anonymity of cash (or Bitcoin). Moreover, it remains to be seen whether the second step is even necessary, as the Fed can (and does) efficiently serve as a trusted third-party clearing and settling agent.

[1] Unfortunately this measure comingles effects related to central bank balance sheet expansion (QE, liquidity programs, etc.), as well as FX reserve and exchange rate management. But it does capture shifts in the stock of public and private money.

[2] For more detail, see *Report on the Economic Wellbeing of U.S. Households in 2018*, FRB, May 2019.

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Why bother with CBDCs?

The white paper that introduced Bitcoin in 2008 described it as "a peer-to-peer electronic cash system." The supply of Bitcoins follows a predetermined path and does not adjust in response to fluctuations in the money demand curve. This has resulted in huge fluctuations in value, relative to traditional currencies or to a basket of goods and services. Because of these value fluctuations, most economists are quite skeptical that Bitcoin will ever be useful as a medium of exchange or unit of account (for example, see the survey here). This skepticism seems validated by practice. Bitcoin has been around for over a decade and still has not taken off as a legitimate payment medium. **If instead cryptocurrency supply were controlled by a central bank to trade 1:1 with the existing, conventional, currency then the supply could be adjusted to have a more stable value relative to a basket of goods and services, thereby making it more usable for everyday transactions**.

Any potential CBDC would be a third form of monetary base, alongside currency and reserves. Just as a dollar of currency trades 1:1 with a dollar of reserves, so too would a dollar of Fed CBDC trade 1:1 with either of the other two dollar forms. From the perspective of the central bank balance sheet the introduction of another form of liability for the central bank would be the only change. This would not necessarily have any implications for monetary policy, and all three forms of monetary base would continue to be backed by assets on the Fed's balance sheet.

Bank reserves arguably are a form of electronic cash, like Bitcoin. Unlike Bitcoin, their issuance is controlled by the Fed's monetary policy, which, as mentioned earlier, most economists see as a desirable property. Reserves still differ from a CBDC in three respects. **First**, only a limited number of entities, primarily depository institutions, are allowed to hold reserves. **Second**, reserve payments are settled by a trusted third party, the Fed, rather than on a peer-to-peer basis. **Third**, transactions are tracked and recorded in an account, rather than a token-based system.

A banker's bank or a people's bank?

The Fed's interaction with businesses and households is generally mediated through the banking sector, as is common for central banks. A retail CBDC would give businesses and individuals direct access to a claim on the balance sheet. Depending on how it is structured, **this could create a strong incentive to shift transaction deposits from the commercial banking system to the CBDC.** Claims on the Fed balance sheet are even safer than FDIC-insured claims. If Fedcoin paid interest, as is currently the case with reserves, this incentive would be even stronger. **Were this migration from deposits to a Fed CBDC to occur, the Fed would be effectively using its balance sheet to create a public "narrow bank."** (In brief, narrow banks take deposits and invest them solely in safe, liquid securities—often only government securities. The idea is to separate deposit creation and payment services from the financial intermediation involved in screening and lending to risky borrowers). Narrow banking proposals have a long history, with advocates both for and against the idea. The move toward such a system involving either public or private institutions could be quite disruptive to the financial sector, including major revisions to banking regulations, and Congress would almost certainly want to weigh in on a vast restructuring of a large sector of the economy.

In Fed we trust?

A digital claim on the Fed balance sheet held by non-banks is still one step removed from being considered a CBDC. **For cryptocurrencies like Bitcoin, and like a hypothetical CBDC, payments between two parties are cleared and settled in a decentralized, peer-to-peer setting, facilitated by distributed ledger technology**. This is in contrast to, for example, Fedwire, which is used for large-value, time-critical payments executed between banks. In that scheme, the Fed sits at the center of the network, acting as a centralized, trusted third party in clearing and settlement.

For Bitcoin and other cryptocurrencies, there is no such trusted third party, which was the motivating rationale for a distributed ledger. Transactions occur on a peer-to-peer basis and are validated by the network of users. This rationale clearly doesn't exist in the case of a Fed CBDC; if you don't trust the Fed, then you probably shouldn't be using the dollar in the first place.

That said, numerous proposals have called for broad, digital access to balances at the Fed while still using centralized clearing and settlement. For example, researchers at the NY Fed recently floated a proposal called Segregated Balance Accounts (SBAs), which effectively would allow non-bank access to the Fed's balance sheet. And as we noted here, James Tobin

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proposed a similar "Deposited Currency Accounts" scheme at the 1987 Jackson Hole Conference.

Table 1: Central bank-issued digital money

		Peer-to-peer?	
		No	Yes
Available to non-banks?	No	Reserves	CADcoin
	Yes	SBAs/DCAs	Fed CBDC?

Source: J.P. Morgan

If, for whatever reason, it is decided to construct Fedcoin as a distributed ledger payment system, then another design choice is whether it should share one important attribute of both Bitcoin and cash: anonymity. This contrasts with the other principal means of payment available to individuals—bank deposits—where the government encourages banks to know their clients. It seems that Fedcoin could be structured to preserve anonymity, but the question is: should it? Privacy has come to be seen as an implicit constitutional right, and that may extend to monetary transactions. On the other hand, there are several laws on the books intended to prevent the financial system from being used to launder money or finance terrorism and other activities. **As with other Fedcoin design issues, it is almost certain that Congress would want to have the last word**.

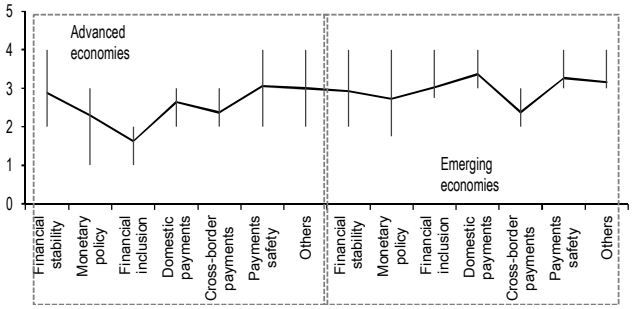
Use cases for CBDCs

Despite extensive discussion in media and policy circles, we would argue that the specific use case for CBDCs has been left a bit murky. It comes as no surprise, then, that the BIS recently convened a working group including representatives of several major central banks to address precisely that question. As a general matter, there are few problems for which digitizing central bank money is the unique solution. Of course, the goals of different central banks can vary quite a bit. **The 2019 BIS survey on CBDCs found that monetary policy implementation and financial inclusion were noticeably more important motivations for emerging markets when considering the issuance of a CBDC than advanced economies (Figure 3)**. That said, the payment system, both domestic and cross border, was a consistently important factor in their thinking.

To be clear, along with others we believe there are relatively few truly compelling use cases for CBDCs. They do exist, however, and we review the most important, in our view, below.

Figure 3: The BIS survey of central banks suggests the use case for CBDCs varies a bit between advanced and developing economies, particularly on the relative importance of financial inclusion and monetary policy implementation

Average and interquartile range of the importance assigned to each consideration in motivating the issuance of CBDCs, split into advanced and emerging economies



Note: From the 2019 BIS Survey on CBDCs. Motivations for issuing: (1) "Not so important", (2) "Somewhat important", (3) "Important", and (4) "Very important".

Source: J.P. Morgan, BIS

Financial inclusion

CBDCs can be transformative in countries with large un- and under-banked populations by reducing the barriers to entry relative to more traditional financial services.[3] This is unsurprisingly much more relevant to lower income countries, where roughly half of the population does not have easy access to bank and bank-like accounts, than developed markets like the United States, Europe, and other G10 countries. **This is a problem worth solving; higher levels of financial inclusion are associated with stronger growth as households have access to financial products including credit, as well as other social benefits** (see e.g., *Financial Inclusion: Can It Meet Multiple Macroeconomic Goals?*, Sahay et al., IMF Staff Discussion Note, September 2015 and references therein).

Thanks to the rapid penetration of mobile internet access, digitizing central bank money has a real chance at reaching a significant fraction of this population. For example, the World Bank estimates that a majority of the nearly 1.7 billion people without a traditional bank account in 2017 did have access to a

[3] This is one of many ways to increase inclusion. Mobile payment networks that operate alongside the traditional banking system, for example, have also proven effective at expanding access to credit and other financial services. That said, there are also significant practical and social barriers that are not directly addressed by either approach.

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mobile phone (Figure 4). A sizeable subset of the unbanked also receives cash-only payments related to government distributions, private sector wages, and agricultural payments. Finally, it is worth noting that the shadow economy, which presumably is heavily cash-based, makes up a sizable fraction of overall activity in lower-middle and lower income countries, as do remittances of foreign currency from former residents living abroad.

Figure 4: Of the 1.7 billion adults without access to traditional financial services globally, most have a mobile phone, and many receive significant income in cash or from cross-border remittances
Population statistics in income tiers using World Bank Definitions, as well as allocation of economic activity, the role of remittances, and shadow economic activity; units as indicated

	Income Category				
Population Segment	High	Upper middle	Lower middle	Low	World
Total	730	2,618	2,896	584	6,828
Adults (15+ years old)	601	2,071	2,023	331	5,027
Unbanked	57	565	823	218	1,663
own a mobile phone	49	439	499	92	1,079
receive cash only govt pmts	5	41	38	6	90
receive cash only wages	6	73	123	16	217
receive cash only ag pmts	0	34	117	65	216
cash or OTC remittances	3	62	140	43	248
% of adult population	12%	41%	40%	7%	100%
% of economic activity	51%	38%	11%	1%	100%
Remittances as % of GDP*	0.3%	0.9%	4.2%	5.5%	1.0%
Shadow activity as % of total†	12%	20%	23%	29%	17%

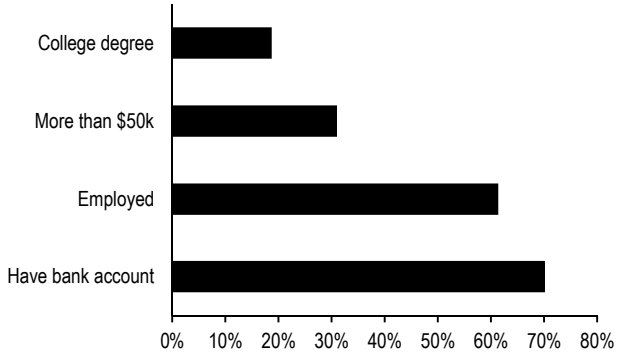
Note Statistics for the unbanked population from the Global Findex Database provided by the World Bank Group. Data as of 2017.

* Migration and Remittances Data as of October 2019.

† Shadow activity based on estimates as a % of GDP as of 2015 by L. Median & F. Schneider, *Shadow Economies Around the World*, IMF Working Paper 18/17, 2018, which covers 92% of the World Bank sample by count and more than 99% by GDP
Source: J.P. Morgan, World Bank, Median & Schneider

Financial inclusion is not only about less developed economies, of course. **Here in the United States, having easy electronic access to either quasi- or central bank money would have clear benefits for consumers, particularly at the lower end of the income spectrum**. Of particular note, though many assume that individuals use check cashing and other non-bank financial services for liquidity do so because they are unbanked, FDIC survey data suggest most had bank deposits and/or earned close to the national median income, and quite a few were college educated (Figure 5). Why would these people pay higher fees to cash their checks? Some have speculated[4] that they are seeking to avoid payment delays which can trigger overdraft charges. This is consistent with CFPB findings that frequent overdrafters do not have lower average balances, just higher turnover in available funds (Figure 6). Delays in processing paper check transactions are typically associated with fraud prevention and verifying availability of funds, both of which can be done more quickly and reliably with digital money. In the current crisis, a lack of access to traditional banking services can severely limit access to emergency support measures like Economic Stimulus Payments.

Figure 5: In the US, most users of non-traditional financial services actually have a bank account and are employed, well above the poverty line, and have a college degree
Fraction of respondents who used a check casher in the past year



Note: From the 2017 FDIC National Survey of Unbanked and Underbanked Households.
Source: J.P. Morgan, FDIC

Streamlining cross-border payments

Despite recent advances in cross-border transactions, delays and high fees are common with many individual transactions often required to facilitate a single attempted transfer. The situation is arguably getting worse: **BIS data suggest that the number of active correspondent banks has declined substantially over the past ten years even as message volume has increased, suggesting a material lengthening of message chains (Figure 7)**. The more numerous and removed the intermediaries are from the end users of a given transaction, the greater the risk of error and delays if concerns arise at any point in the chain (e.g., AML, sanctions, etc…more on this in a moment) owing to difficulties tracing the provenance of a given payment back through its many hops through the correspondent banking network. Along these lines, a recent survey of

[4] See e.g., *The fastest way to address income inequality? Implement a real time payment system*, A. Klein, Brookings Institution Report, January 2019

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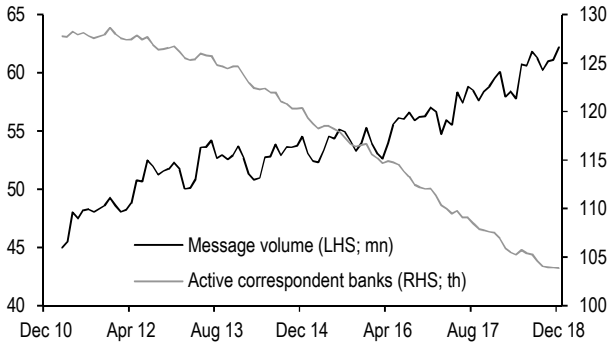
corporates[5] found that a third of participants in cross-border wire transfers experienced error rates of 2% or higher. **The risk of delays is compounded by still-common use of paper checks, which roughly 30% of participants in the same survey reported using for cross-border payments in the past year**.

Figure 6: Very frequent overdrafters in the US tend to have much higher turnover in their balance with limited access to credit
Summary statistics of overdrafts among US consumers; units as indicated

	Annual overdraft frequency				
Attribute	Never	1-3	4-10	10-20	>21
Share of Accounts	67%	15%	10%	4%	5%
Share of overdraft fees	0%	7%	15%	15%	63%
EOD balance	$1,585	$518	$398	$345	$276
Monthly deposits	$2,093	$1,726	$1,816	$2,050	$2,554
Tenure	63.5	42.5	36	33	31.5
Credit score	747	654	610	585	563
Available credit	$14,100	$3,000	$960	$521	$225

Note: Summary data from *Frequent Overdrafters*, D. Low et al., CFPB Data Point, August 2017.
Source: J.P. Morgan, CFPB

Figure 7: The shrinking population of active correspondent banks at the same time as volume has steadily grown suggests lengthening message chains that increase the risk of delays or other errors
Number of active correspondent banks (LHS; thousands) and SWIFT message volume (RHS; millions)



Note: Data from the BIS Correspondent Banking Survey.
Source: J.P. Morgan, BIS

This suggests a system primed for disruption. A digital currency with the backing of a major central bank could circumvent many of these obstacles. Tokenized payments on a semi-public ledger, for example, would be much easier to trace and could be tagged with metadata to identify their origin, destination, and path through the network. The protocol could also be designed in such a way as to obviate the need for clearing banks in the first place. For example, so-called atomic cross-chain swaps are programmed such that either both tokens change hands at the same time, or neither do,[6] which eliminates the role of a trusted third party and reduces the number of parties involved in a given transaction. Both features of digital money have the potential to clearly improve efficiency and reduce cost in cross-border payments. It is important to note that this applies mostly to B2B payments and does not solve first or last mile issues for C2C and C2B cross-border payments, particularly in frontier economies.

Improved financial stability and monitoring

For regulators, transitioning to tokenized payments offers AML and sanctions enforcement. As a corollary to the above discussion of cross-border payments, presumably regulators and law enforcement agencies would also have access to the ledger. Because transactions are public and can be easily traced back to individual owners, "following the money" becomes a much easier exercise. This allows for much more effective monitoring and enforcement actions, particularly financial crimes that would otherwise be obscured through layering or other complex chains of transactions designed to obscure their origins.

There are also financial stability benefits. On the one hand, payments could be made "smart" to improve the efficiency of liquidity savings mechanisms (discussed in more detail below). This could reduce gridlock risk and allow the system to operate smoothly under stress. On the other, tokenized securities settlement would enable real-time monitoring chains of re-hypothecation in secured lending, including more than $2trn of overnight lending collateralized by US Treasury securities. This would help avoid concentrations of risk and the potential for the default of a single participant in those markets to trigger a cascade of subsequent failures that can lead to market seizure. Particularly with benchmark reform pushing consumer and business lending to a repo benchmark, this is an increasingly important consideration.

Geopolitical risk management

Finally, there is the more nebulous, but potentially crucial element of geopolitical risk management. Here, the incentive to offer CBDCs is strongest for the richest nations, given their preeminent position in global

[5] *The Case for the Global Payments Platform*, Level Research, 2018.

[6] For details, see *Redesigning digital money*, R. Ali & N. Narula, MIT Media Lab: Digital Currency Initiative, 2019 and references therein.

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financial markets. Among them, **there is no country with more to lose from the disruptive potential of digital currency than the United States**. This revolves primarily around US dollar hegemony. Issuing the global reserve currency and the medium of exchange for international trade in commodities, goods, and services conveys immense advantages.

First and foremost, the US dollar dominates FX reserves. Data collected by the IMF, for example, suggest that central banks held more than $6.75trn of USD claims, or roughly 58% of the total, followed by EUR at 19%. Perhaps even more striking, USD allocations have grown over the past 20 years (by 3% over the past 20 years) even as the US economy has made up a smaller fraction of global GDP (from 29% to 24%). China, on the other hand, has grown from 3% to nearly 16% of output over the same period, but FX reserve holdings of RMB are less than 2% of the total. As our colleagues point out, the process of establishing a new major global currency, let alone a true competitor to the US dollar, is a long road with many pitfalls for any would-be challenger. The RMB is very early in this process, and the past 20 years suggest that continued rapid growth of the Chinese economy in no way guarantees its adoption as a global reserve currency.

There are other more fragile ways in which US interests are tied to the use of dollars for cross-border transactions. The preeminence of USD for global trade settlement (including commodities, goods and services) will be a difficult paradigm to shift; even in China, only 15-20% of trade is settled in RMB (for more discussion, see *The RMB challenge to USD hegemony*, D. Hui and P. Locke, 5 Feb 2019). That said, data collected by McKinsey suggest that the $127trn of cross-border transactions that occurred in 2017 were dominated by inter- and intra-corporate treasury flows (82%), with trade taking only a 15% share and B2X/C2X at only 3%. Nearly half of this value transfer occurs through the SWIFT messaging system. Any move by another nation or group of nations to provide alternative payment rails using non-USD digital currencies could threaten the current paradigm, and in particular US influence over the architecture of cross-border payments.

This desire to reduce US influence is arguably shared by a broader group of nations than one might expect. A particularly instructive example occurred in late-2018, when Brussels-based SWIFT suspended access for some Iranian banks. **This was consistent with recently imposed US sanctions, but was arguably in violation of EU law**.[7] In this sense, extracting US influence from the cross-border payments system is not just a goal of geopolitical competitors like China and Russia, but also otherwise aligned interests like the EU.

Were alternative rails to allow other nations to circumvent USD-based cross-border payments, it could inhibit the ability of the US to protect its national interests. Sanctions and terrorism financing enforcement has been a key element of US foreign policy for decades—recent examples include Iran, North Korea, and Russia. Effective implementation relies in large part on continued control of and influence over cross-border payments. Circumventing the SWIFT- and USD-dominated system could make this exercise much more difficult, if not impossible to do so. Considering this enormous downside, offering a cross-border payments solution built on top of a digital dollar would, particularly if designed to be minimally disruptive to the structure of the domestic financial system, be a very modest investment to protect a key means to project power in the global economy. In this sense, **we would argue that, for high income countries and the US in particular, digital currency is an exercise in geopolitical risk management**.

Design requirements

Maintaining separation between commercial and central bank tokens

The first and arguably most important design decision for CBDCs is who would be authorized to use them: should it be for wholesale (i.e. large value/interbank) payments only, or for general purposes as a substitute for currency in circulation and new component of the monetary base. **It is possible in principle to maintain the current separation, and by extension a fractional reserve regime, via two different tokens—one for central bank money, one for quasi-money/deposits—designed and regulated by the central authority but permissioned separately**, which would be conceptually similar to the Digital

[7] *The "New" Iran E.O. and the "New" EU Blocking Statute*, Gibson Dunn, August 2018

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Currency Electronic Payment (DCEP) project in China. **Reserve tokens** could be issued to member banks to replace Federal Reserve accounts, a relatively straightforward technology improvement, but not a significant change to the interbank payment system. At the same time, **deposit tokens** could be issued by each member bank but conform to standards set by the Federal Reserve, with consumers and businesses storing them in "custody" wallets subject to KYC. In this sense, banks would compete for custody by offering services and customer experience and compete for funding via the remuneration rate they offer for their tokens, with a common standard enforcing convertibility among tokens issued by different depository institutions. Depositors would also gain diversification benefits over time, as their holdings would naturally be spread among numerous issuers via interbank retail payments—only a fraction of which are internalized (see discussion below).

One could also imagine allowing non-bank (e.g., third party payment providers) and even non-financial institutions to issue their own tokens. This would work if they were either backed fully by very high-quality assets (e.g., short-dated government securities) or by deposit tokens issued by commercial banks. In that these secondary tokens would inherit the regulations governing banks or be held to a higher standard (e.g., being fully backed by high-quality short-term assets). Doing so could help foster use of these tokens among various digital wallet infrastructures, particularly those with global footprints such as Facebook, Apple, or Google. Doing so would help realize the inclusion benefits of digital money by reducing barriers to introducing funds for domestic usage (the first mile) as well as cross-border payments (the last mile). It would also expand effective access to the financial system without sacrificing regulatory oversight of money creation or subjecting non-traditional providers of financial services to undue compliance burdens.

Choosing the right protocol

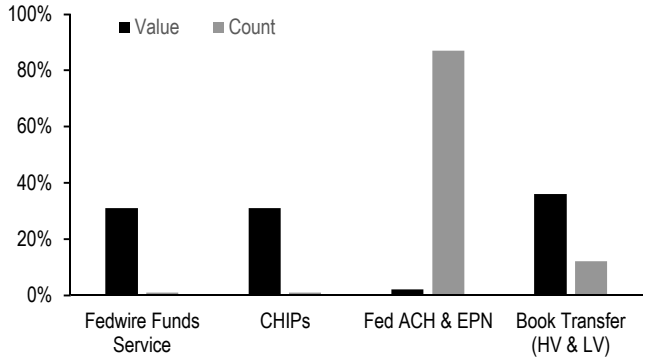
The first and most important design requirement of a CBDC is the right protocol. This relates to how the network reaches agreement (consensus) on which transactions have occurred and are valid, at which point they are added to the ledger. In traditional payment systems, this function is performed by central nodes which maintain their own ledger. Network participants submit instructions to this single trusted validator, and it alone maintains the ledger. This centralized record can then be used to back into account balances at any given time.

For distributed ledgers, by contrast, validating transactions requires achieving consensus among a number of participants on the network. The most limited such example is a permissioned network, in which a preselected group of nodes are granted voting rights. This is very computationally efficient and scalable but can be cumbersome if the trusted nodes are not known in advance or can change over time. New protocols that have since become associated with cryptocurrency allow voting on the basis of credit for solving complex mathematical puzzles (proof of work, or Nakamoto consensus) or via their current ownership of the network (proof of stake).

Ultimately the choice between a centralized and distributed ledger comes down to three considerations. How important is computational efficiency and speed? How important is transactional visibility? How important is a dynamic set of trusted participants in the network?

Figure 8: Though a noticeable fraction of global activity is internalized as book transfers, the bulk of payments occur between major financial institutions …

Fraction of payment activity in 2018 by type weighted by value and count; %



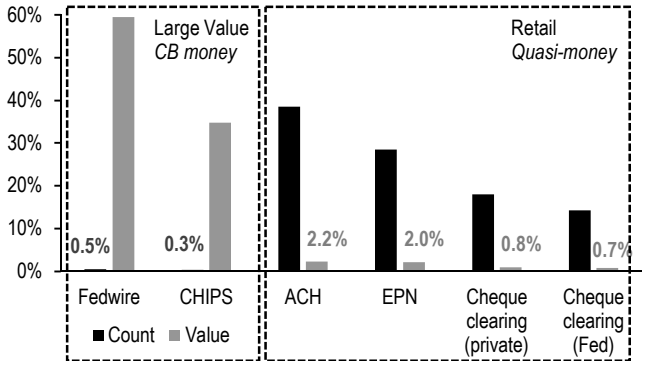
Source: J.P. Morgan

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Figure 9: … and looking across the system in aggregate, large value payments utilizing central bank money make up the vast majority of value transfer but a *de minimis* fraction by count
Fraction of 2018 interbank payment activity by count and value across venues, split into those relying on central bank versus quasi-money as the medium of exchange; %



Source: J.P. Morgan, BIS

For the case of CBDCs, the answers complicate matters a bit. Though a decent fraction of these transactions is internalized (both by count and value), **the bulk of payments occur between financial institutions** and require system-wide solutions (Figure 8). This arises from the fact that **wholesale payments make up more than 90% of the value transferred in the US, but less than 1% of the transactions (Figure 9)**. This suggests that load considerations are much more important for a retail-only CBDC. Unfortunately, this is also the area where the benefits of a distributed ledger are more apparent. The ability, even if only by permissioned participants, to view all transactions occurring in the retail payments system easily could vastly improve the quality and efficiency, and speed monitoring and law enforcement. The ease of joining such a network also reduces the barriers to competition for startup financial institutions, for example internet-based banks, which should improve the competitive landscape. **Such a system could be designed to handle many millions of transactions per day, e.g., proof-of-work, particularly in a federated consensus or sharding architecture, but doing so requires very careful design and testing**.

Another key consideration for any protocol is the level of anonymity afforded to participants in the payment system. A common misconception regarding distributed ledgers is that they are anonymous. That is true for some protocols, i.e., so-called privacy coins like Monero, where information regarding transactions and participants is purposefully obscured or encrypted. Most, however, are better described pseudonymous in that all the transactions associated with a particular blockchain address (i.e., wallet) are stored on a public ledger, but without any identifying information. **Though end-users can in principle be obscured through chains of beneficial ownership, at the end of the day the activity of any individual wallet is often quite easy to view**. A tiered system that largely preserves fractional reserve banking, in which digital interbank payments exist alongside retail tokens, could in principle address these issues.

As a general matter, compliance requirements make true privacy unfeasible for either reserve or deposit coins. The Bank Secrecy Act of 1970 introduced an array of monitoring, reporting, and KYC requirements for financial institutions (very broadly defined) to assist with law enforcement activity, particularly as regards money laundering. Though they have been revised over the years (for example, certain provisions of the Patriot Act of 2001 and increased prosecutions of individuals under the FCPA), the trend has been rather consistently towards more, not less, collaboration between banks and federal authorities. **Thus, any move to a CBDC, including both wholesale and retail tokens, would need to be designed to meet these requirements**. However, as alluded to above, distributed ledgers are potentially more effective for monitoring and enforcement actions by making it more difficult to layer transactions. This would require the issuers of deposit tokens, including financial institutions and others (as described above), to collect and maintain identifying information for each wallet, and to make that information available to the relevant authorities.

Liquidity savings mechanisms

Another important consideration in the design of a payments system is its demands on settlement liquidity. This refers to ensuring payments cascades, in which a series of counterparties are mutually dependent on a series of incoming payments to make a comparable series of outgoing payments, via short-term extensions of credit (e.g., daylight overdraft) or netting services to reduce gross activity (e.g., CHIPS). **This is particularly important when the stock of cash with which to make payments is small relative to gross activity**. In the US, this is clearly the case for wholesale flow (and was even more dramatically so in the era of scarce reserves) where roughly $730bn of excess bank reserves facilitated nearly $3trn of daily gross Fedwire and CHIPS volume in 3Q 2019 (near the low point in the stock of reserves; Figure 10). It is important to note as well that the central role of liquidity savings mechanisms in a system as efficient as Fedwire suggests that any wholesale CBDC would have

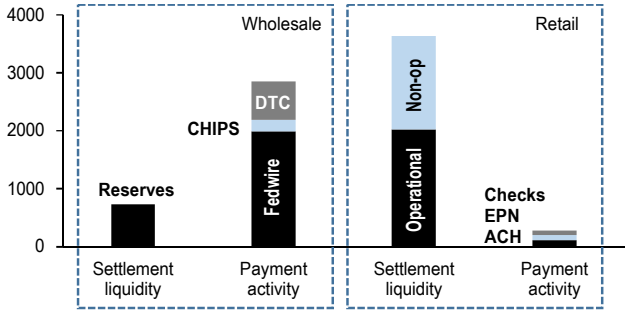
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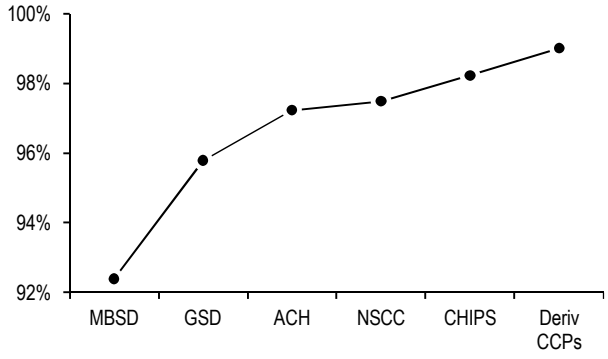
similar if not more stringent requirements. It is, however, less clearly the case for retail payments, where the stock of commercial bank deposits, even restricted only to operational corporate holdings, is much larger than the gross payment needs on any given day.

Figure 10: Large value payments are in principle more reliant on settlement liquidity and netting mechanisms, owing to the much larger volume of payments relative to the stock of reserves
Settlement liquidity versus payment activity for wholesale and retail payments; $bn



Note: Wholesale settlement liquidity consists of reserves held by domestic banks, and for retail includes operational and non-operational corporate deposits (taken from LCR disclosure). Wholesale payment activity includes gross Fedwire and net CHIPS and DTC activity, and for retail we include net payments from ACH, EPN, and checks.
Source: J.P. Morgan, FRB, company disclosure, BIS

Figure 11: Liquidity savings mechanisms for retail payments, wholesale payments, and securities settlement in the US are all very efficient
Average net versus gross payments for each venue; %



Source: J.P. Morgan

Are liquidity savings mechanisms still important? **In the case of interbank payments, use of daylight overdraft has dwindled to a small fraction of former activity—less than $14bn at peak in Q4 2019 versus more than $185bn in mid-2008—as policymakers have pursued an abundant reserves regime**. Net settlement services like CHIPS, DTCC, and others, however, remain important, taking on a sizeable fraction of overall large value payment volumes at a very high efficiency (Figure 11). **For retail payments, we would caution that while there is little evidence of a global need for significant netting or intraday liquidity, these facilities can be important for specific depositors**. As a consequence, banks routinely extend significant daylight credit to their corporate clients, and ACH operates at a very high level of efficiency as well.

This all suggests that digital currency should include liquidity savings mechanisms as part of their initial design.[8] Overdraft is rather straightforward, at least for uncollateralized programmable tokens; issuers can simply mint temporary coins and that are automatically burnt over some horizon or subject to certain conditions, with interest applied to permanent holdings. This is an advantage of CBDCs, again both wholesale- and retail-only, over purely private stablecoins (see references in the Introduction). Net settlement systems are somewhat more difficult on a distributed ledger but have been implemented in some proof of concept studies (BoC, Project Ubin). To the extent there are other advantages to moving retail payments to a distributed ledger, incorporating this functionality will be an important part of the design phase.

Conclusions

Putting it all together, CBDCs are likely a more efficient and effective way to deliver the benefits of digital money than either free-floating cryptocurrency or private stablecoins. The specific use cases, including financial inclusion, some cross-border payments, and financial stability monitoring, are perhaps not as compelling as the ubiquity of projects in this area would suggest. However, **the potential for a non-USD alternative set of payment rails to gain traction is arguably a geopolitical risk factor worth managing**. There are a number of choices in the design of a CBDC that are critical to its success and transformative potential. First and foremost, a retail token runs the risk of disrupting fractional reserve monetary systems and disintermediating banks. This argues for a segregation between central bank and private money, even if both are migrated to a digital token-based architecture. The choice of protocol is key to efficient processing of

[8] It is worth noting that in some context, particularly retail payments where the stock of 'cash' (i.e., bank deposits) is sufficiently large relative to turnover, it is possible that gross settlement of a well-designed token is fast enough to operate efficiently without net settlement or other systems. That said, the experience of account-based B2B payments suggests overdraft would still be an important feature.

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payments and compliance with applicable privacy laws, as is access to short-term liquidity (i.e., daylight overdraft) to avoid gridlock. **Taken together, there is a reasonable case to be made for CBDCs, and a way to introduce them at a minimum of disruption while preserving their benefits, but a corollary is they are unlikely to have the transformative impact that some have speculated**.

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Global Research
J.P. Morgan Perspectives
18 February 2021

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China's CBDC: Constrained by capital controls and slow progress in RMB internationalization

- **China has expanded its trial program on CBDC, as do countries in EU and SG.**
- **We don't expect China's CBDC to take material market share from incumbent ePayment providers. But it may lead to slower volume growth and downward pressure for fee rates for existing players.**
- **Some countries, such as SG and Russia, are exploring opportunities to conduct cross-border payments via CBDC. But in our view, CBDC is unlikely to be a means for China to reduce dependency on the dollar or SWIFT, as capital controls and slow progress in RMB internationalization are the key constraint.**

Latest update on China's CBDC trial scheme

China has entered the trial stage for its central bank digital currency (CBDC). In May 2020, the governor of the PBOC, Mr. YI Gang, disclosed that China's CBDC will be used in a trial scheme in certain regions, including Shenzhen, Suzhou, Xiong'An, Chengdu, and Beijing (i.e. the Winter Olympic Games). China's large banks (ABC, BOC, CCB, ICBC, BoCom, & PSBC), along with three telecommunication carriers, and leading internet players participated in the CBDC trial program, according to media reports (Caixin).

In Aug-20, local media (Caixin) reported that the big 4 banks were testing the digital wallet app under different use scenarios internally. The mobile app displayed the new digital currency features, including making payments using QR codes and sending & receiving funds without an internet connection.

In Oct-20, the government of Luohu District (Shenzhen) dispersed RMB10mn CBDC in 50,000 red packets to local citizens (each red packet with RMB200 CBDC). People who received the CBDC via a lottery need to log into the DC wallet of the big 4 banks, then save these CBDC in the big 4 bank account and spend it in around 3,400 local stores, through online payment (i.e., QR code).

In Dec-20, the government of Suzhou City dispersed RMB 20mn CBDC in 100,000 red packets to local citizens as well (each red packet with RMB200 CBDC). The list of deposit banks increased from 4 to 6 (added BoCom and PSBC). In Suzhou, customers may use these CBDC in some online shops (i.e. JD online stores). Some customers may also use offline NPC payment, which may help customers make payments with no or weak internet connection.

In Jan-21, PSBC conducted a CBDC test in a hospital in Shanghai, where doctors used a digital currency wallet designed by PSBC to buy food at the hospital restaurant.

In early Jan-21, Shenzhen started the second round of CBDC trial. RMB20mn worth of CBDC was dispersed to local citizens in 100,000 red packets. Over 10,000 stores participated in the trial, compared to 3,400 in the previous round. Citizens can use offline NPC payment in addition to the QR code payment. On Jan 20th, Shenzhen started the third round of CBDC trial, and another RMB20mn CBDC will be dispersed.

International development of CBDC

Since 2015, central banks & financial institutions started to participate in the research and development of central bank digital currency (CBDC). According to the BIS, over 80% of the world's central banks are conducting research on CBDCs, with the majority progressing to the trial development phase. We summarized that there are mainly three development stages on CBDC.

United States seems more cautious on CBDC

The US government has been cautious on making progress on CBDC. The Federal Reserve is concerned with potential risks (i.e., monetary stability, legal framework and regulation), according to a virtual panel between the IMF and Jerome Powell, Chair of the Federal Reserve, in Oct-20. While the government is cautious on assessing the impact of CBDC on financial system, private companies, such as J.P. Morgan and Facebook, are the ones trying to push forward DCEP development. However, without the endorsement by regulators, it is difficult to push for wider application of DCEP, even if the stablecoins are launched successfully, in our view.

Some countries have entered into the trial stage for CBDC

Aside from China, we noted that a number of countries have made process in application of CBDC:

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- **European Union (EU):** EU's central banks took the lead on the research of CBDCs. The French central bank, the Bank of France, trialed its CBDC, the digital euro, for interbank settlements on a private blockchain platform in 2020.
- **Sweden:** Sweden conducted several rounds of tests on its CBDC, e-krona, with Accenture throughout 2020. The Swedish central bank announced in Dec-20 it will pilot test payment, deposit, and transfer capabilities for the e-krona in its third trial.

Countries that venture into using CBDC as a way for cross-border payment:

- **Singapore:** The Monetary Authority of Singapore (MAS) is exploring the use of wholesale CBDC to make cross-border payments more efficient through Project Ubin. In the most recent iteration of Project Ubin, MAS collaborated with J.P. Morgan and state-backed conglomerate Temasek to use CBDCs in multi-currency transactions.

Competition with 3rd party payment providers

We don't expect China's CBDC to take material market share from incumbent ePayment providers (i.e. Tenpay), at least not in the near term.

- CBDC will be issued by the PBOC at zero cost, but it still needs to be circulated through the existing infrastructure, including banks' eWallets or those of existing ePayment providers. Thus, CBDC is one of the funding sources for existing eWallets.
- Digital currency is a form of M0 and it will substitute a portion of paper cash note based transactions. Third party payment providers facilitate transactions of M1 and M2 as paper cash notes are not a source of funds for digital payment. As such, the real question to ask, in our view, is will the introduction of digital currency lead to M0 gaining usage share from M1 and M2? Our answer is no because a rational consumer or corporate would only keep enough/minimum paper cash notes for peace of mind as paper cash notes don't generate interest.
- CBDC transactions via offline channels may bypass the existing ePayment providers, but offline transactions are unlikely to be material, in our view.
- Our conversation with the central bank suggests that the government does not have the intention to create a super app to rival with the existing ePayment providers, be it banks or Fintech companies.

Nonetheless, it does not mean that there is no disruption. One could also argue the introduction of digital currency could slow down the volume gains of digital payments from cash based transactions given that paper cash note based transactions were one of the largest sources of volume gains by digital payments in the past few years. We believe the negative impact on digital payment industry TPV growth will be insignificant as most of the portable paper cash note based use cases have already been migrated to digital payments operated by 3rd party payment operators (JPMe China's digital consumption payment exceeded 80% penetration in 2019).

Another disruption is that the introduction of CBDC could lead to downward pressure on fee rates charged by ePayment providers. While the issuance of CBDC is free, as it is a public good, the circulation of it is not. However, experts we spoke to believe that the fee charged to merchants on CBDC transactions will be lower than the current ePayment's level. This may limit the ability for ePayment providers to increase fee rates on consumption transactions (currently around 15bps-20bps).

Potential use in cross-border payment

CBDC is a legal tender and thus it is subject to the same cross-border or FX controls when adopted into cross border payment. Thus, aside from the technical aspect, one factor holding back using China's CBDC in cross-border payments will be capital controls and the under-representation of RMB (i.e. RMB's share of cross-border payments was only ~1.9% in SWIFT in 2019, while China contributed to ~13% of global export in 2019).

However, it is possible that countries that have mature domestic application of CBDC may form a consortium for technology integration for CBDC; then members in the consortium may be able to conduct cross-border payments using CBDC. This, in theory, will reduce dependency on the existing system (i.e. SWIFT), but it will take years, if ever, for this to materially take market share from the current system, in our view.

- In 2018, the Monetary Authority of Singapore (MAS) announced it conducted a successful experiment with Canadian central banks for cross-border and cross-currency payments using CBDC. The experiment

involved connecting the two separate domestic payment networks running on different technologies without a trusted third party as an intermediary.

- Central Bank of Russia (CBR) has been working on its Digital Ruble project and intended to release it as a trial in Crimea some time in 2021. The Central Bank of Russia said in October 2020 that the Digital Ruble would facilitate international payments and reduce the pressure on current payment systems, thus easing the country's reliance on the US dollar.

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The Japanese case: Two moves toward establishment of Digital Currency and the impact on payment flow

- **Private sector-led digital currencies are expected to be issued in Japan as early as 2022. Meanwhile the BOJ plans to begin PoC (Proof of Concept) of central bank digital currency (CBDC) in early 2021 but currently has no specific plans for issuance.**
- **The Digital Currency Forum, which aims to launch private-sector digital currencies, comprises over 30 major corporations in the banking, telecommunications, transport, retail, and financial sectors. Given the forum's cooperation with authorities, we think the prospects for issuing currency seem realistic.**
- **The goal for private digital currencies is to have a common platform in use in the first half of 2022. PoC is to begin April 2021.**
- **Private-sector digital currencies are expected to have a two-layer structure of "common domain" and "supplemental domain." Interoperability between wide ranges of e-monies is to be realized in the common domain, while the supplemental domain will be the realm of innovation for payments services.**
- **If CBDC is issued by the BOJ, it would fill the role of common domain for private digital currencies, existing alongside them without conflict.**
- **The issuance of private digital currencies is expected to improve efficiency in a broad range of industries, as well as create new businesses. Specific use cases are to be discussed.**
- **If digital currencies are created, their interoperability between payment services and e-monies is expected to further promote the cashless shift in Japan.**
- **Even in the new payment system, banks are expected to be the starting point for digital currencies. New payment service providers might have to rethink their strategies for capturing customers with those services.**

Moves toward the issuance of private digital currencies

Two developments in the drive to issue digital currencies

In Japan, digital currencies led by the private sector are expected to be issued as soon as 2022. Aiming to put private digital currencies into practical use, a Digital Currency Study Group (chaired by Hiromi Yamaoka, board director of Future Corporation and former Director-General of the BOJ's Payment and Settlement Systems Department) released a final report on digital currencies in November 2020. It states an intent to have digital currencies in practical use as early as 1H 2022. PoC (Proof of Concept) is to begin from April 2021 with the goal of having a common platform in place by 1H 2022. The BOJ indicated in October 2020 that it planned to start CBDC proving tests in early 2021, although there are currently no specific plans for issuance.

Looking to issue a private sector-led digital currency, a global rarity

As in Europe and China, the CBDC considered by the BOJ assumes indirect issuance under a two-level structure. Private digital currencies launched without waiting for a CBDC would be a rarity on a global basis.

The Digital Currency Study Group evolved into an organization called the "Digital Currency Forum." Participants grew to over 30 major corporations in the banking, telecommunications, transport, retail, insurance, and securities sectors that aim to put digital currencies into practical use. With related authorities (FSA, MOF, BOJ, and METI) participating as observers, we think the prospects for issuing currency seem **realistic**.

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Table 1: Members of the Digital Currency Forum

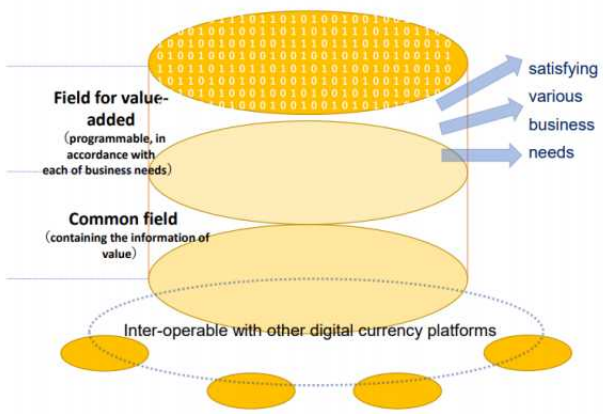
(Panel Chair) Hiromi Yamaoka (Future Corporation Director; former Director-General of the Bank of Japan's Payment and Settlement Systems Department)	Internet Initiative Japan Inc.
MUFG Bank, Ltd.	Accenture Japan Ltd.
Sumitomo Mitsui Banking Corporation	SIGMAXYZ Inc
Mizuho Bank, Ltd.	Mori Hamada & Matsumoto
Japan Post Bank Co., Ltd.	Mitsubishi UFJ Research and Consulting Co., Ltd.
Sumitomo Mitsui Trust Bank, Limited	AEON Co., Ltd.
Seven Bank, Ltd. (Seven & i Holdings Co., Ltd.)	FamilyMart Co., Ltd.
Sony Bank Inc.	Lawson, Inc.
Tokio Marine & Nichido Fire	ANA Group
Sompo Holdings, Inc.	East Japan Railway Company
Mitsui Sumitomo Insurance	Hitachi, Ltd.
Sumitomo Life Insurance Company	Kyocera Corporation
Daido Life Insurance Company	Secom Co., Ltd.
Tokyo Financial Exchange Inc.	Sohgo Security Services Co., Ltd. (ALSOK)
Nomura Holdings, Inc.	Chubu Electric Power Co., Inc.
Daiwa Securities Group Inc.	THE KANSAI ELECTRIC POWER CO., INC.
NTT Group	Dentsu Inc.
KDDI Corporation	Toppan Printing Co., Ltd.
TIS Inc.	Kesennuma City
JCB Co., Ltd.	

Source: J.P. Morgan based on the final report of the Digital Currency Study Group
Note: As of November 19, 2020.

Creation of digital currency under two-level structure

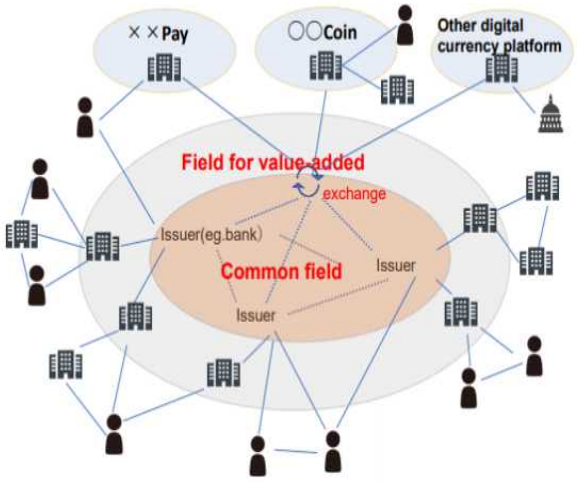
Private digital currencies are expected to assume a two-level structure comprising a "common domain" and "supplemental domain." Whereas the common domain will realize interoperability between numerous payment services and electronic monies, the supplemental domain will house innovations for the payment services. Note that bank deposits are to be used to guarantee creditworthiness. If CBDC is issued by the BOJ, it would underpin the "common domain" of private digital currencies and exist alongside those currencies without conflict.

Figure 1: Two-level structure of private-sector digital currency



Source: Digital Currency Study Group (image used with permission)

Figure 2: Interoperability of payment services via private digital currency



Source: Digital Currency Study Group (image used with permission)

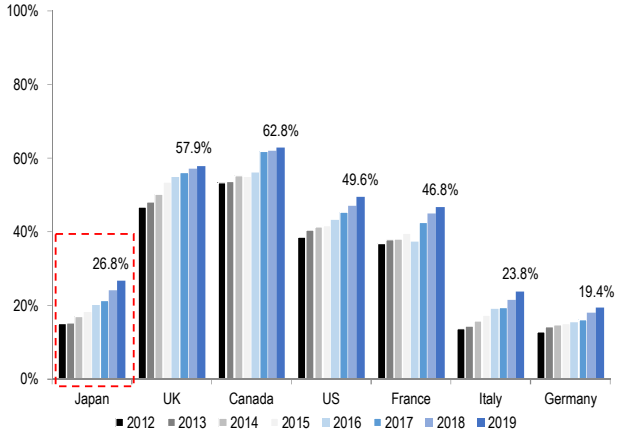
Digital currencies will propel cashless shift, provide interoperability between proliferating payment services/electronic monies, and increase convenience

In Japan, internet and telecom companies have been entering the QR code payment business one after another, triggering sharp growth in unique smartphone-based payment services. The resulting glut of payment services and electronic monies has become an issue. Private digital currencies would allow for exchange between such services and electronic monies. Even consumers and corporations possessing only one specific payment method would be able to use various payment services laterally via digital currencies. Both consumers and companies would enjoy greater convenience because they would not have to enroll in numerous payment

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services. We would expect such interoperability between the multitude of payment services and electronic monies to help propel the cashless shift further forward.

Figure 3: Trends in cashless payment share



Source: BIS, World Bank, J.P. Morgan Notes: excludes direct debit and bank transfer

Impact on payment service providers

Amid the trend toward new payment methods, **banks are expected to be the starting point for digital currencies.** In this sense, the position of banks seems unlikely to change. The cost for non-bank payment service providers to access digital currency should be reduced. Digital currencies would reduce cost in the intra-bank payment system as well. Credit card companies might benefit from the cashless shift, but at the same time, see an impact from replenishment of electronic money balances being switched to digital currencies. The interoperability between payment services seems likely to result in pressure on new payment service providers, such as Rakuten and PayPay, to retool their strategies for capturing customers with proprietary payments services. As of January 2021, these companies are not members of the Digital Currency Forum.

Table 2: Size of cash, bank deposits and payments service market

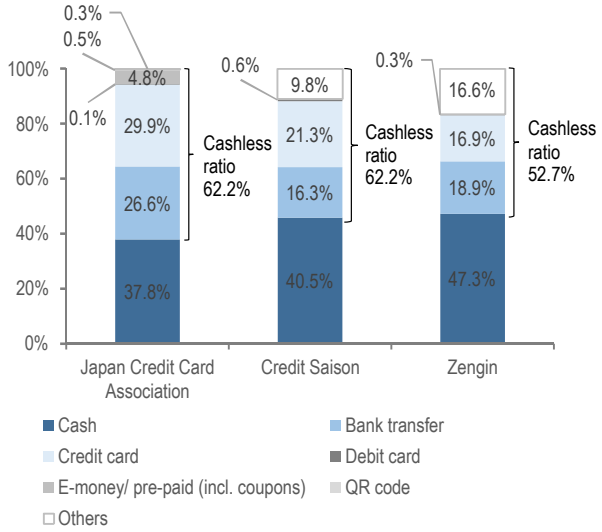
¥ trillion

	Amount	As of
Cash	118.3	2020
Bank deposits	802.9	2020
Payment value		
e-money	5.2	2019
Credit card	63.1	2019
Debit card	1.7	2019

Source: Bank of Japan, Japan Credit Association

Figure 4: Proportion of payment measures (2019)

Cash is most used payment measure in Japan



Source: J.P. Morgan based on Japan Consumer Credit Association, Credit Saison, and Japanese Bankers Association

Diverse use cases for digital currency

Moreover, use cases for digital currency are expected to be wide-ranging. They include 1) partnering on payment settlements with manufacturing industry supply chains, retail industry supply chains, and distribution/delivery providers; 2) use of digital currency for MaaS; and 3) use in electric power transactions. Within financial services the range of potential uses is quite broad, including trade finance and overseas remittance, as well as financial asset transactions using security tokens to increase efficiency and reduce risk, interbank settlements, and tie-ups between electronic money and digital currencies. The Digital Currency Forum has subcommittee meetings scheduled for each sector in April 2021, where specific use cases are to be considered.

1) Using security tokens to make financial asset transactions more efficient and less risky

In recent years the application of blockchain/distributed ledger technology (DLT) has expanded to the management and movement of financial assets. Security tokens are a prime example. By using blockchain/DLT, delivery-vs-payment (DVP) reduces risk and greatly increases the scope for streamlining and efficiency gains in back-office operations.

2) Tie-ups between electronic monies and digital currencies

Prepaid electronic money (stored value) in Japan has maximums for how much money can be placed on a card, and services are provided that replenish the electronic money from a credit card once the value on the e-money card drops below a certain level. Based on this, we see potential for replenishment of electronic money balances with savings deposits via digital currency, which suggests that some credit card payments could shift to digital currency payments.

3) Utilizing digital currency in finance

With respect to syndicate loans, we think possibilities include the loan payments of borrower corporations being converted to digital currency by agent banks and then automatically allocated to principal and interest payments. Moreover, the use of digital currency could be considered for use in bank lending for the ability to have the capital usage restrictions listed in the "covenants" written on the digital currency itself and as a method to trace the use of the loan capital. Such applications could lower the monitoring costs of the bank side, and the transaction history and inventory data collected from the borrower company's use of digital currency could be used by the bank in the loan review process.

4) Using digital currency to send money overseas

One possibility is, rather than using a correspondent bank that uses the current correspondent transfer network, changing the transfer amount into digital currency, transmitting cross-border, and having the receiving bank change it into local currency, thereby achieving a quick and low-cost method for overseas remittance. In the event the digital currency used is yen-denominated, the need remains for the yen-denominated digital currency to be changed into local currency in the destination country. Whether the use of blockchain/DLT provides economic benefit in areas other than the exchange of digital currency for local currency is therefore a key point.

Toward the issuance of central bank digital currency (CBDC)

PoC to start in 2021

Although it currently has no plans for issuance, the BOJ announced last October 2020 that it would conduct proving tests for the issuance of standard-use central bank digital currency (CBDC) in 2021.

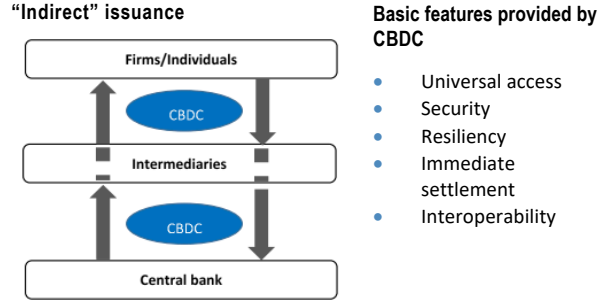
The main users of general-use CBDC are expected to be individuals and a broad range of general corporations.

In the event the BOJ issues CBDC in the future, the central bank plans to have a two-layer structure mediated by financial institutions, the same way cash is handled now. This is because having financial institutions mediate allows for the services and innovations of private companies to be incorporated. Moreover, if individuals were to directly hold accounts at the BOJ, deposits could be shifted from private financial institutions to the central bank.

Proving tests will start with the basic functions needed for currency issuance and circulation, before moving on to the testing of adding interest components and setting maximum holding limits. As for the third-level pilot test, the BOJ will consider having private business operators and consumers participate.

Given the indirect issuance of CBDC based on a two-layer structure, it should feature characteristics such as universal access, security, resiliency, and interoperability for immediate settlement.

Figure 5: General-use CBDC: Format of issuance and basic characteristics



Source: Bank of Japan

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Payments & Processors: Modern providers gained ground over legacy with consolidation to come

- **Modern versus legacy debate will rage on.**
- **Consolidation will likely step up as players add breadth over depth.**
- **Banks fight back harder as fintechs gain ground.**
- **Pricing pressure likely up, but SMB recovery could mask this.**
- **Contactless, BNPL, and Crypto to overshadow QR-codes at POS.**
- **Debit usage likely to stay elevated versus credit, but not at 2020 levels.**
- **B2B payments to advance via niche intermediaries, as scale vendors watch.**
- **Nationalism a key risk to monitor.**

Modern versus Legacy Debate Will Rage On

A big lesson learned from the pandemic was that payment providers with modern platforms adapted better than legacy processors in serving the digital needs of consumers/merchants. Modern providers were quick to develop pandemic-friendly solutions like curbside pick-up, contactless check-out and omni-comm, which relegated legacy on-premise solutions as dated and ill-equipped in the eyes of many in the investment community. This sentiment stigmatized legacy processors with decades-old technology, compiled via M&A, as being burdened with tech-debt, driving a bigger valuation wedge between the modern and legacy payment service providers. We see potential for some mean reversion on valuation differences post a vaccine, but well-capitalized modern providers like Square and Shopify, as well as pending IPOs are likely to extend their product lead and keep this debate active in 2021. As an example, Square is expected to spend up to an incremental $800mn in operating expenses in 2021 surrounding product development and sales and marketing, while Lightspeed just acquired two ISVs for nearly $900mn, which compares to traditional player Fiserv planning to spend $500mn over the next five years on new technology.

Consolidation Will Likely Step Up as Players Add Breadth over Depth

M&A activity understandably calmed down during the pandemic, but we expect it to pick up in 2021 with the worst of the pandemic behind us and macro visibility improving. Look for scale processors and banks to add digital assets and expand breadth of product offering, while nextgen providers acquire into new geographies and/or adjacencies to enhance customer LTV. **Driving engagement and monetization by "banking" users will be a key theme**. Stripe's recent unveiling of Stripe Treasury (banking-as-a-service) and Square's purchase of Credit Karma's tax prep solution are precursors to more of this theme. Likely consolidators in our space include FLT, GPN and PYPL.

Banks Fight Back Harder as Fintechs Gain Ground

Look for traditional banks to step up organic and inorganic investments to narrow the technology gap versus fintechs. We expect banks to leverage their balance sheets and offer more competitive lending products as a way to compete versus fintechs that might fear taking on too much credit revenue to the detriment of valuation. Banks will be challenged by the aforementioned tech debt, greater regulatory scrutiny, and lack of an innovation culture, but the time is now to fight back. Don't underestimate banks forming tech partnerships to combat share loss, even if relegated to a wholesale model, which could be a boon to the winning bank tech partners of choice.

Pricing Pressure Likely Up, But SMB Recovery Could Mask This

The pandemic drove a reduction in high-yielding in-person SMB and cross-border spending, and an increase in spend at lower-yielding, large online retailers (e.g., Amazon, Walmart, etc.) and marketplaces (e.g., Seamless, Shopify, Uber Eats, etc.). We learned how high decremental margins can be from declining revenue caused by a pandemic, and we suspect incremental margins will not be as high in a recovery. This should partially be driven by the need for vendors to invest in R&D to stay modern. But more concerning could be pricing pressure related to buying power, with more volume being handled by large enterprises (e.g. Amazon, Walmart) and marketplaces (e.g. Seamless, Shopify, Uber). Incumbent banks and scale processors could also use pricing as a weapon against fintechs. That said, pricing power could emerge from a recovery in spend at SMBs, where spreads can be at least three to five times higher than enterprise (Square's net spread is over 120bps versus

Adyen's at ~22bps). This is why we recommend having exposure to traditional SMB players like EVOP and GPN in merchant processing and TNET in HRO. However, industry spreads could be weaker overall if more spending is concentrated at larger merchants and marketplaces.

Contactless, BNPL, and Crypto to Overshadow QR-Codes at POS

Online checkout was put into the spotlight with the pandemic, driving an increase in card on file usage and wallet adoption, benefiting the likes of Apple Pay, Google Pay, PayPal and Shop Pay, making it hard for network option Click to Pay to catch up. Online checkout options have been further complicated by the popularity of Buy Now Pay Later (BNPL), with a glut of brands for consumers to choose from. BNPL is a great product, giving the near-prime or debit-centric consumer a convenient way to spread payments over time without falling into the trap of real debt. It's unclear if BNPL can extend into the physical world as easily, but QR-codes could be the bridge. Contactless cards and mobile payments at physical POS are clear winners in the US, crowding out QR-code check-out, in our view, but the utility of BNPL tied to a QR-code could be enough for consumers to present a QR-code over the convenience of tap-and-pay. Lastly, Bitcoin mania reached a new high in 4Q20, and we expect platforms like PayPal and Square to transition from facilitating Crypto trading to enabling Crypto as a funding source for purchases in 2021, and depending on how that goes, we could see some Crypto adoption as a situational medium of exchange from traditional peers.

Debit Usage Likely to Stay Elevated Versus Credit, But Not at 2020 Levels

Spending on debit cards in the US grew at a 30-plus point premium to credit cards during the pandemic, twice the premium observed during the global financial crisis. We explain the popularity of debit to stimulus, greater comfort in using it online, and more disciplined spending, evidenced by the savings rate going up. J.P. Morgan's economists think the savings rate should stay elevated relative to pre-pandemic norms, forecasting it will average around 12% in 4Q21, almost 5%-pts above the 4Q19 level. Elevated debit is fine for revenue trends in our coverage, but positive for margins on merchant of record models like PYPL and SQ. It also bodes well for Visa, which has a high debit mix in the US relative to Mastercard.

B2B Payments to Advance via Niche Intermediaries, As Scale Vendors Watch

The B2B payments TAM is large (~5x larger than retail payments) and underpenetrated, but tends to be "a year away from being a year away" in terms of needle moving for established public processors. In 2021, we look for niche B2B intermediaries like Bill.com and Coupa to carry the momentum built by COVID-19 and deliver premium growth in not only revenue, but also new sales bookings and marquee partnerships. We expect this to set the stage for more interoperability as a precursor to consolidation longer term. Watch the networks (MA and V) and their partnerships for clues on which strategic channels are best placed. We expect Fleetcor to be a consolidator.

Nationalism a Key Risk to Monitor

Post pandemic, local regulators might take a more serious look at promoting domestic schemes and local PSPs to minimize dependency on foreign-owned entities. Witness efforts in Brazil with PIX, in India with UPI, and the European Union's ambitions with EPI. Creating proper governance and innovation to compete against global scale networks and processors will be difficult, especially in developed countries where habits have been formed, but large developing nations can overcome this under mandates. Mastercard and Visa run the greatest risk here of seeing their TAMs shrink, making it more important for them to embrace their multi-rail strategies and value-added services to build on top of local alternatives and participate in the global electronification of payments.

For more details, please see *Payments & Processors: 2021 Outlook – Prefer FISV, GPN, and PYPL*, T. Huang, et al., 11 December 2020.

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Global Equity Research
J.P. Morgan Perspectives
18 February 2021

J.P.Morgan

US regional banks positioned as endgame winners in the digital age

- **We now see many regional banks in the catbird seat to be the endgame winners in the digital age of banking.**
- **With technology a means to the end, customer satisfaction scores prove to us that many regional banks are pulling ahead.**
- **Although the regional banks are in a very strong competitive position, many are leaving the backdoor open for fintechs.**
- **Could there be a plot twist? Is stakeholder capitalism a backdoor for banks into B2B/B2C fintechs' customers?**
- **M&A a key tool for regional banks to thrive in the digital age, but new metrics are needed.**

We now see many regional banks in the catbird seat to be the endgame winners in the digital age of banking

We now firmly believe that regional banks are in a *very strong position* to emerge as the *endgame winners* in the digital age of banking. In fact, we now conclude that ***many of the regional banks are themselves the challenger banks in the digital age***.

With that said, however, we are unable to conclude at this juncture that they will all indeed be *the* endgame winners tied not only to how fast the industry is evolving in the digital age but even more importantly to what we also discovered through our research as a key vulnerability (in which many regional banks are leaving a back door open for fintechs to gain access to their customers). On an overall basis, however, we conclude that while the current situation remains a bit of a jump ball between regional banks, US mega banks, foreign banks and fintechs, we are not only very encouraged by the current positioning of regional banks but now actually see this game as *being theirs to lose*! The competitive advantage that regional banks bring to customers in the digital age is a model of high tech meets high touch, where empowered employees serve as a competitive advantage. In fact, although regional banks have always competed with relationships as their secret sauce, with the combining of high tech along with high touch, ***we see the relationship model as now being on steroids in the digital age***. In fact, as the PPP program results demonstrated, with regional banks being more nimble than their larger competitors and more tech savvy than the smaller community banks, we firmly now believe that many of the endgame winners in the digital age of banking will be from the group of companies that we analyzed in the full report (see *U.S. Mid- and Small-Cap Banks: Technology Disruption Report: With a New Breed of Regional Banks Emerging, Many Are Positioned as Endgame Winners in the Digital Age*, S. Alexopoulos et al., 15 December 2020).

Generally speaking, the value proposition for regional banks has historically been deeply rooted in relationship banking. Whereas the largest banks tended to compete on brand and scale, the edge for smaller banks was being involved in the local communities. Whether it be on the soccer field, on the local hospital board, or supporting the local chamber of commerce, regional banks competed by providing more personalized service for customers. While their customer bases tended to be somewhat more commercial in nature, this also applied to consumers who would visit their local branch and be greeted by a familiar face. As we conducted interviews with almost all of our banks under coverage, the approach being taken by most was to use technology to *empower their people* to deliver even *better service*. We would note that this is in direct opposition to companies in many industries (particularly fintechs) which have made it all but impossible to get a human being on the line to discuss an issue. Rather than looking to replace that human-to-human connection, the regional banks are very effectively now using technology to improve customer service by not only providing specific products and services that make it easier to connect with a human but also by using technology to take low value tasks off the plate of front line bankers so that they have more time to spend on high value interactions with customers.

With technology a means to the end, customer satisfaction scores prove to us that many regional banks are pulling ahead

With us now concluding that technology is a means to an end, with the actual end being the convenience proposition to customers, the needed report card was whether the efforts from the regional banks were starting to bear fruit. To this end, we turn to customer satisfaction scores from J.D. Power and were very impressed with the results from the vast majority of regional banks.

Looking at the individual bank NPS results, First Republic tops the charts with an NPS that is nearly

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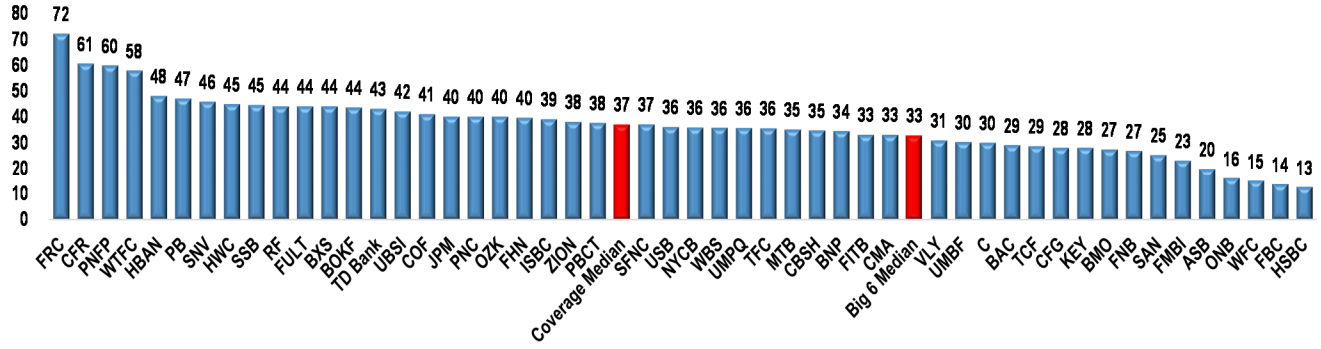
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double the median for our coverage universe and more than double the median NPS for the big six banks. With First Republic the epitome of "high tech meets high touch" in terms of what the company is doing to improve the customer experience in every channel, the company should serve as a role model for what is possible for other banks. To this end, banks that also stood out as having outstanding NPS scores included Cullen Frost, Pinnacle, Eastern Bank, FB Financial, Huntington, and Synovus. From this group, however, the bank that stood out to us the most as being the most forward in terms of combining cutting-edge technology with very customer-friendly policies was Huntington. In fact, even though Huntington rates well above the typical bank in customer satisfaction as well as NPS scores, we would not be surprised if in the next several years the company moves into a top three position.

If we zoom out and take a wider view of the banks in our coverage universe and compare this cohort to the top 50 banks (screened for branches above 50 and enough of a sample size to generate a reliable customer satisfaction score), one can see that many of the regional banks under coverage remain in a position of strength with only Wintrust and Prosperity being added into the top seven on an NPS basis. Moreover, if one notes the location of the big six bank median on the chart, it's impressive for the regional banks how many are positioned favorably to this benchmark cohort. We would note that the J.D. Power's overall satisfaction score weighs a variety of metrics (such as account opening, communication and advice, problem resolution, branch, convenience, etc.) while the net promoter score measures the percentage of "net" customers likely to recommend a company or product. While both are valuable measures, the added benefit of net promoter score is that the metric is comparable across industries while the displayed overall customer satisfaction metrics would be mostly applicable to the bank industry.

Figure 1: J.D. Power 2020 Net Promoter Scores for Top 50 Banks (Plus Select Foreign Banks) by Assets



Source: J.D. Power and company reports. Note: FRC 2019 NPS is from company reports. Big 6 banks include BAC, C, JPM, PNC, USB, and WFC. Data excludes BKU and CADE due to fewer than 100 survey respondents. Data excludes AMAL, FHB, MCB, SBNY, SIVB, and TCBI due to fewer than 50 nationwide branches or other reason not in J.D. Power survey. BNP = Bank of the West. SAN = Santander. Net promoter score ranges from -100 to 100.

Although the regional banks are in a very strong competitive position, many are leaving the backdoor open for fintechs

Even though we think the vast majority of regional banks have made significant strides over the past several years in terms of improving the client experience, for the most part we consider most regional banks as being only in the 2nd to 3rd inning of their digital journey with many improvements on the client-facing front to take place over the intermediate-term. Even though we see many regional banks as being in the catbird seat to be endgame winners in the digital age of banking at the current juncture, we consider the situation to be somewhat of a jump ball between regional banks, mega banks, foreign banks, big tech, and fintechs. The reason that we conclude the situation is a jump ball with regional banks being only potential winners is that the vast majority have left the backdoor open into accessing their customers.

With many fintechs, such as Chime and Robinhood, seeing valuation levels soar, the common denominator is that these new entrants are seeing a surge in customer acquisition. While many of them offer a cutting edge experience for customers, what is also a key point of differentiation is that many fintechs don't charge customers fees for many products and services that the legacy bank industry has become reliant on. For example, pure-play fintech banks such as Chime and Varo do not charge industry standard nuisance fees such overdraft.

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This is compared to the bank industry where the standard overdraft fee charged by most is still in the $30+ range, even for a small ticket overdraft. What the industry does not seem to realize is that a company can deliver best in class service and then end up turning net promoters of their company into demoters by charging fees in which customers see little value. This is similar to us to airlines which started charging fees for customers to check baggage. These actions create friction points with customers that create the opportunity for customer-friendly fintechs to enter the henhouse.

Perhaps best illustrating our point is First Republic, which has the highest net promoter score in the industry yet derives the smallest contribution of revenue from nuisance fees. In fact, if someone is a customer of First Republic and they use a foreign ATM and incur a fee, First Republic will cover the cost of that fee (charged by another bank) for their customers. By creating a frictionless experience for customers, First Republic is then able to marry high tech and high touch to deliver an unmatched experience for customers. Although many banks we spoke to seemed very reluctant to reduce nuisance fees being charged (given that these fees are now supporting top line growth), it is our firm view that if the regional banks end up not being endgame winners in the digital age it will be the over-charging of nuisance fees that does them in. To this end, the bank that also appears to be a cut above the rest is Huntington, which offers some of the most consumer-friendly products in the industry. Demonstrating perhaps that the resistance of banks to move to more customer-friendly practices being more business model than financial, it was very interesting to observe that along with the announced HBAN/TCF merger, it was going to cost only ~$15mm (net of the expected benefits such as improved retention) to expand Huntington's very customer-friendly business practices to TCF. If TCF had implemented these changes on their own, it would have reduced our 2022e EPS for TCF only in the 5% range. In our view, trading off 5% off earnings for the prospects of much higher client satisfaction scores is a no-brainer.

As we have studied disruption across sectors, the story is the same with new entrants exploiting incumbent vulnerabilities. Although these weaknesses are in plain sight, with incumbents clinging on to legacy revenue streams in many cases, hard choices need to be made and rather than quickly pivot (and completely eliminating friction points), incumbents that have failed historically have done so by slowly adapting to the new environment, fully allowing new entrants through the back door. In an efficiency ratio obsessed industry, bank managements have a tough choice: take the pain now and be the one doing the disrupting or, rather, continue to cling onto legacy practices that cause friction with customers and get disrupted. Keep in mind, we are not suggesting that banks eliminate all fees but rather whittle the friction points related to nuisance fees down to the point that the backdoor for fintechs is hammered shut!

Could there be a plot twist? Is stakeholder capitalism a backdoor for banks into B2B/B2C fintechs' customers?

Although we currently see areas such as nuisance fees as a backdoor for fintechs to gain access to bank customers, regional banks are in a position to not only close the door, but more importantly, open a back door themselves into fintechs' customers. The competitive advantage of fintechs offering banking services direct to consumers and/or businesses is very clear, with many of them creating a frictionless experience for clients that includes not only not charging many traditional bank fees but helping customers to avoid these fees. From the conversations that we've had with the regional banks, although it's very clear that, while many are working to reduce friction points with customers, the group as a whole seemed far less receptive toward eliminating friction points tied to nuisance fees being charged.

With that said, however, with stakeholder capitalism becoming more mainstream we see this as an opportunity for banks to dramatically reduce (or eliminate completely) the nuisance fees that impair client satisfaction scores as well as move to a stronger position of advice for customers which focuses on financial wellness and includes helping customers to avoid being charged fees. By banks becoming advocates for their customers on top of offering differentiated delivery channels, which includes branches and experienced bankers, we see a new breed of regional banks as being in a position of strength to drive market share gains. Moreover, charging fewer fees on customers as well as becoming stronger customer advocates will help consumers, businesses and communities—which collectively are the fabric of stakeholder capitalism. Although many management teams may be hesitant to eliminate fees given the potential for unhappy *current* shareholders, with long-term survival at stake we see no end around it with nuisance fees over time becoming a thing of the past with the only question being whether regional banks used this as an opportunity to win market share or donate market share. To this end, however, we see another tool unique

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to regional banks which could unleash *a new era* in the convenience age of banking. Enter stage left: M&A.

M&A a key tool for regional banks to thrive in the digital age, but new metrics are needed

Although the market enthusiasm for bank M&A has diminished over the past several years, however, following our deepest dive into the technology platforms of the regional banks we are increasingly viewing consolidation as one of the key tools to thrive in the digital age of banking. Albeit, it's not for the reason that is commonly assumed.

While the increased scale argument doesn't seem to have much merit in justifying M&A given the *significant decline in technology costs over the past several years*, there is another key reason that we see consolidation as a powerful tool for a bank to thrive in the digital age of banking. With that said, traditional thinking as it related to bank M&A needs to change. In a traditional bank M&A transaction, several of the key questions typically asked include (1) how large are the cost saves, (2) what is the EPS accretion, and (3) what is the TBV earnback period. While these served as key measurements of bank M&A for many decades heading into the digital age, we see these traditional measures as needing to be placed on the back burner for a period of time.

It's very clear that in the convenience age of everything, banks need to eliminate friction points with customers. These friction points come in a variety of forms, such as (1) charging customers nuisance fees for which they see little or no value, (2) needing to improve areas of weakness, including problem resolution for many banks, and (3) needing to improve the availability and simplicity of self-service channels, including online, mobile and ATMs. The common denominator of these friction points, however, is that they will cost the bank money to rectify—either in the form of fees being reduced and/or eliminated or in the form of increased investment into areas such as infrastructure and training.

While it might be tough for a bank to come on their earnings call and guide to either a material reduction in fee income and/or increase in investments, particularly given an efficiency ratio obsessed analyst community, consolidation could prove to be an ideal vehicle to reach the end goal (of improved client experience) and on a significantly faster time frame. With that said, however, rather than the focus on bank M&A being on earnings accretion and TBV earnback, the focus needs to be on how many friction points can be eliminated post the transaction closing. With that said, however, without a specific level of earnings accretion for investors to hold management teams accountable, transparency of what is being promised needs to move to a new level.

In fact, if a bank management were to go on their call post an M&A deal being announced and, rather than talk about net cost saves, they focused on the specific areas that the cost saves would be used to *improve the client experience*, this is something we believe investors (and the market) would find far more welcoming. Keep in mind, however, we are talking about specific areas such as (1) post this transaction we are lowering our overdraft fee from $35 to $5, or (2) post the deal we are investing $25mm to roll out a new suite of customer facing apps, or (3) post the deal we intend to improve our problem resolution satisfaction level from X to Y over the next year.

In the decades heading into the digital age, the goal of M&A was to own the targets and then sell once the deal was announced. In the new age of bank M&A, however, the real litmus test for us will be how many investors want to buy shares in the new company *after* the deal has been announced. We would also point out, however, that with fewer cost saves falling to the bottom line, TBV earnback periods are likely to extend considerably. While historically we considered anything in the 3-5 year period as reasonable, so long as a bank was laying out a compelling case on how the client experience levels were likely to improve materially post the benefits of the transactions were realized, we could see TBV earnback periods even as high as the 10-year range as being a lucrative trade-off for shareholders.

While some investors might balk at such a long earnback period, we would argue that if the company delivers on the promises laid out with the deal and client satisfaction scores actually improve, even on a lower level of TBV, shareholders will come out ahead given improved top line growth potential (and a higher multiple). The purpose of improving client satisfaction, however, is not to either "level the playing field" or "improve a sub-par customer satisfaction core to a less egregious level of client satisfaction." Rather, it is a tool to be used by banks with a business model that *already has at its core client satisfaction* with the deal a tool to be used to further improve client satisfaction levels above peers. In fact, we long for the day that a deal is announced and a bank includes in their deal slide deck that because of the deal they will now install a new core or they are eliminating

specific friction points or that they will be using cost saves to create a new tech hub with plans to insource 85%+ of their technology (as was the goal achieved by global tech leader DBS Bank in Singapore as well as by M&T Bank). To think that the same M&A playbook that dates back 50 years is still relevant in the digital age is a mistake. In fact, in the convenience age of everything, *M&A should be a key tool used to improve the convenience proposition for customers*.

For banks that are *unable* to drive to a "wow" level of service over the short-run, however, it's time to plan for an M&A exit. In fact, there are now scores of retailers that could not adapt fast enough that wish they had sold their company to one of the endgame winners—and while they were in a position of strength. We believe that the window is still open to create a win-win for bank shareholders, but time will not remain on the side of banks that don't already have in place today a culture that drives high client satisfaction. To this end, the recent merger announcement between Huntington, who is a leader in client satisfaction, and TCF Financial, who is a laggard, is a textbook example of how M&A could be used to create a win-win for shareholders. With that said, once the endgame winners among regional banks have been more clearly identified, the sellers won't have anything of value to offer. On the flipside, we see many banks which today have as their core business model and culture one that promotes client satisfaction as being in the catbird seat to drive industry consolidation with industry leaders at this point dealing from a position of strength including banks such as Pinnacle, Cullen Frost, Huntington, M&T, Synovus, Zions, People's United, Umpqua, and Eastern Bank.

While we see consolidation as an additional tool for regional banks to pull ahead in the digital age, this new approach for regional banks will require bold leadership and management teams being willing to deviate from the status quo. To this end, however, although banks such as First Republic, Pinnacle, Cullen Frost, Huntington, and Synovus are already in a position of strength from a client experience viewpoint, the field is wide open for additional leaders to emerge and *accelerate* the timeline toward providing a "wow" level of service to customers. Even though not every bank we cover scores at the upper-end of the client satisfaction scores today, we can confidently report to shareholders that a new breed of regional banks are indeed emerging.

For more details, please see the full report: *U.S. Mid- and Small-Cap Banks: Technology Disruption Report: With a New Breed of Regional Banks Emerging, Many Are Positioned as Endgame Winners in the Digital Age*, S. Alexopoulos et al., 15 December 2020.

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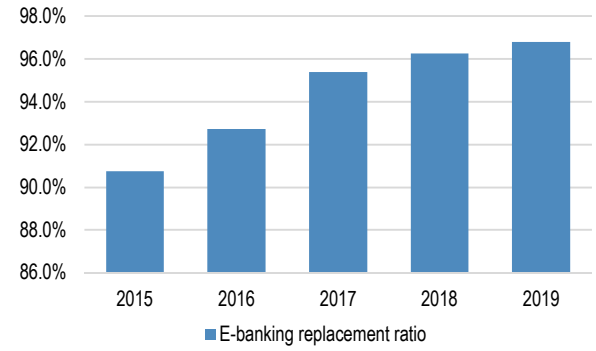
China Banks: Going Mobile – Evaluating Banks' Digital Push

- **China banks have braced up to competition from Fintech players by delivering notable progress in digitalization of banking services.**
- **COVID-19 is a positive driver for digitalization, evidenced by rising MAU (monthly active users) growth and transaction volume of mobile banking.**
- **CMB is the apparent leader and winner in digitalization, which partly contributed to its low deposit cost and robust financial products sales.**

Material improvement on digital capacity

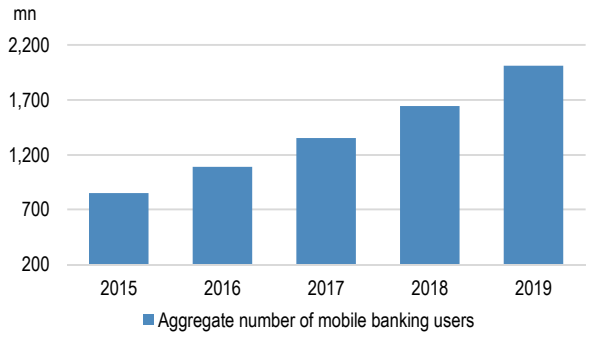
The aggregate mobile banking users and transaction volume of thirteen listed SOE and joint-stock banks went up at a CAGR of 21% and 47%, respectively, from 2015-2019. As a result, the average e-banking replacement ratio reached 97% in 2019 (vs 81% in 2013, 91% in 2015) (Figure 1). Banks continued to beef up on IT investment, which reached RMB105bn (+20% y/y) in aggregate for the top thirteen listed banks in 2019, equivalent to 2.5% of banks' revenue (vs 2.3% in 2018) (Figure 4).

Figure 1: China national listed banks' e-banking replacement ratio on average showed an upward trend from 2015 to 2019



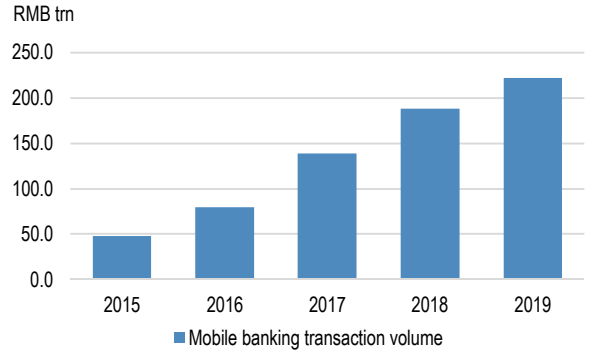
Source: Company reports.

Figure 2: Aggregate number of registered mobile banking users (with overlapping) of 13 major listed banks went up at CAGR of 21% from 2015-2019



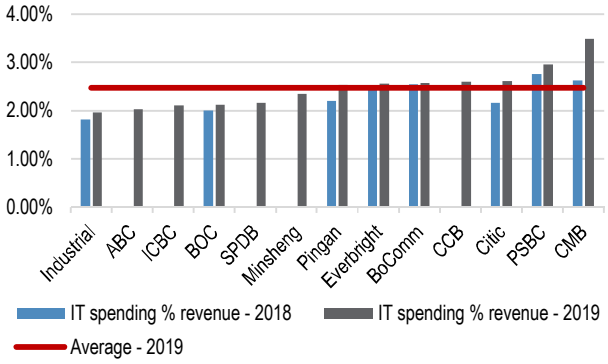
Source: Company reports. Note: For comparison purposes, only banks with consistent disclosure of mobile banking transaction volume were taken into account, namely PSBC, ICBC, CCB, ABC, BOC, BoCom, Citic, CMB, MSB, Industrial, CEB, SPDB, and PAB. PSBC did not disclose data in 2015, Minsheng in 2018, and BoCom in 2019, so we put estimated numbers.

Figure 3: Aggregate mobile banking transaction volume 2015-2019



Source: Company reports. Note: For comparison purposes, only banks with consistent disclosure of mobile banking transaction volume were taken into account, namely PSBC, CCB, ABC, BOC, BoCom, Citic, CMB, and SPDB.

Figure 4: China national listed banks' IT spending as % of total revenue continued to rise in 2019



Source: Company reports.

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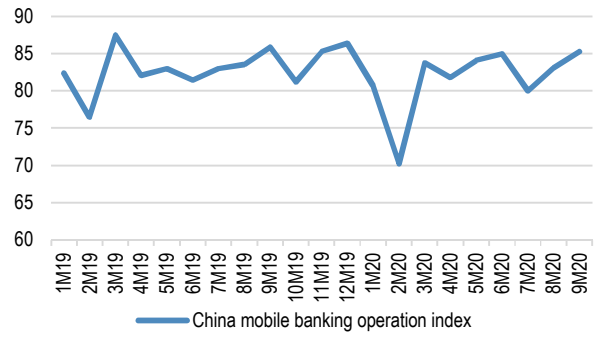
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Since 4Q20, financial regulators in China announced tightening measures on Fintech companies, focusing on online lending business. For banks which cooperate with Fintech companies on lending business, this may lead to a slowdown of online loan growth, but is unlikely to disrupt the general strategy on banks' digital push.

COVID-19 could be a positive driver for digitalization

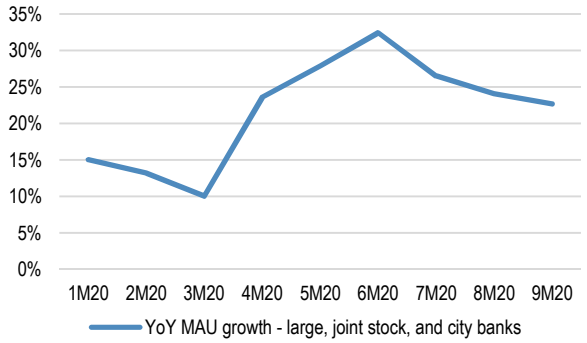
Mobile banking operation index and MAU growth dropped in February 2020, likely on the back of reduction in business activities due to COVID-19 disruption (Figure 5 and 6). However, we have witnessed a strong rebound in 2Q20 with MAU going up 9% q/q or 28% y/y. We believe the COVID-19-led lockdown induced wider acceptance and usage of mobile banking, leading to a strong rebound in mobile banking MAU and transaction volume in 2Q and 3Q20 (Figure 7), when activity levels recovered.

Figure 5: China banks' operation index dropped in Feb-20, but recovered since Apr-20



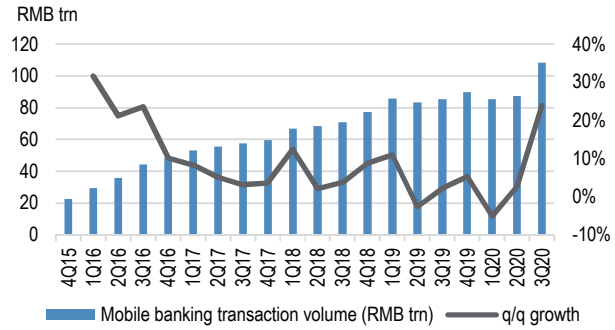
Source: Analysys, CEBNET.

Figure 6: China banks' MAU y/y growth dropped in Feb-20, but recovered since Apr-20



Source: Analysys, CEBNET.

Figure 7: China banks' mobile banking transaction volume dropped in 1Q20, but rebounded in 3Q20



Source: Analysys, CEBNET.

Banks are planning to step up technology investment, and the focus is on enhancing financial product distribution capacity online. This includes embedding financial services into user scenarios, by conducting direct banking business (i.e. launch of internet bank as a separate entity) and cooperating with internet companies. Note that in December 2020, CMB (3968 HK), a leading retail bank in China, announced plans to launch a direct bank venture, in which it holds a 70% stake and the remaining will be owned by FinTech company JD Digits. Postal Savings Bank also announced that it obtained a direct banking license on 21 December 2020.

In general, banks are creating a contingency plan of conducting full banking services online, in case there is another major disruption, such as the regional lockdown in January and February 2020.

Digitalization is a key driver of revenue growth and credit risk management, but the marginal benefit on cost-saving is waning

China banks' cost-income ratios (CIR) have contracted by 5.7pt from 2015-2019 to 32% in 2019 (Figure 8), with management attributed to digitalization as a key driver on cost saving; but room for further cost-optimization is limited. First, China banks' CIR is the lowest among Asia banks (Figure 9). Second, when the e-banking replacement ratio reached 97%, there was little progress on closing down redundant outlets or trimming headcounts, partly due to "social responsibility." The potential upside from digitalization is on offering cash management services in order to lower deposit costs, driving sales of high-margin products to improve fee income and lowering credit costs by leveraging fraud detection technology and big data analytics.

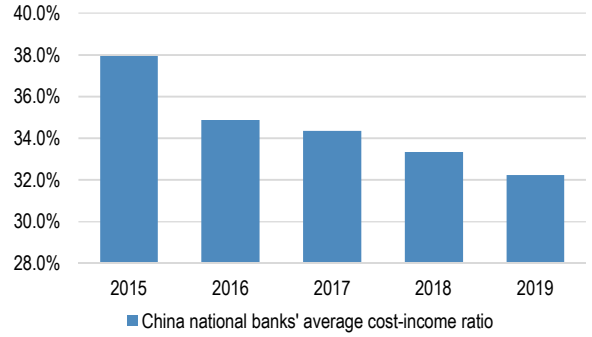
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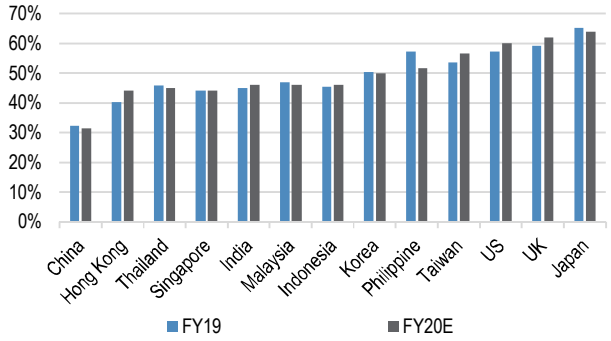
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Figure 8: China major listed banks' average cost-income ratio contracted from 2015 to 2019



Source: Company reports. Note: this includes listed SOE banks and joint-stock banks.

Figure 9: China banks' cost-income ratio is lower when compared to banks in other markets for both FY19 and FY20

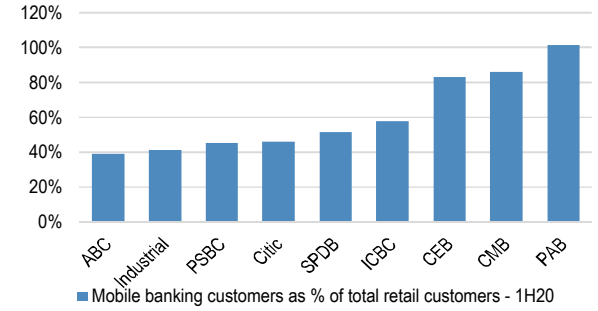


Source: Company data, J.P. Morgan estimates.

CMB is industry leader in digitalization of banking services

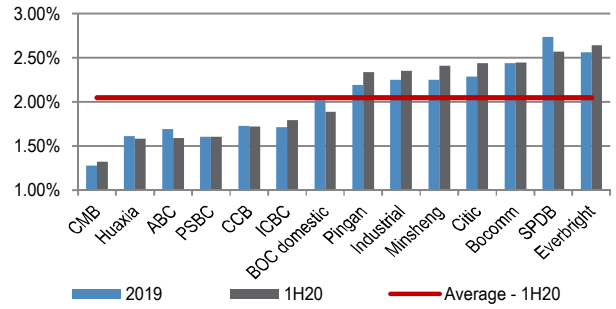
CMB invested equivalent to ~3.5% of revenue into technology in 2019, highest among all China banks (average ~2.5%). This paid off as CMB's mobile banking app has been ranked #1 for three consecutive years, its mobile banking transaction per user is the highest among China banks, and ~86% of its retail customers use its mobile banking app (vs industry average of ~61%) (Figure 10). As a result, CMB's funding cost is lowest among mid-size banks (Figure 11), and 78% of its wealth management products (WMP) are sold online in 1H20 (vs 43% in 2017) (Figure 12); WMP sales fee was a key revenue growth driver in 1H20.

Figure 10: CMB's number of mobile banking customers as % of number of retail customers in 1H20 ranked No.2 among peers



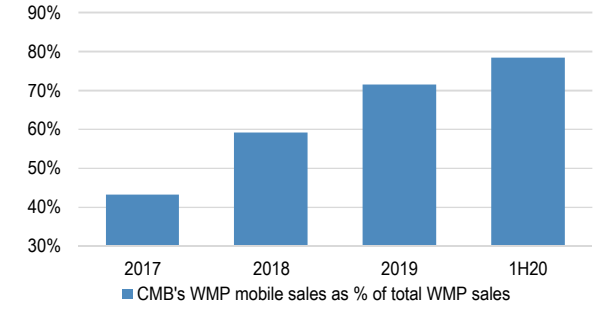
Source: Company reports. Note: PAB's number of mobile banking customers as % of total number of retail customers was over 100% in 1H20, as it used the number of mobile registered customers as mobile banking customers and the number was slightly larger the than number of retail customers.

Figure 11: CMB's retail deposit costs were lowest among all listed national banks in 2019 and 1H20



Source: Company reports.

Figure 12: CMB's WMP mobile sales as % of total WMP sales continued to rise since 2017



Source: Company reports.

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Global Equity Research
J.P. Morgan Perspectives
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FinTech in ASEAN: Going mainstream

- **The end-game is the better ability to create value in the course of delivering financial services.**
- **Banks maintain advantages from deposit franchise, risk management and regulation.**
- **Digital banking licenses are allowing competition from players without a banking background, which is a powerful driver of innovation.**
- **Digital solutions are scaling up in third party payments; we estimate over US$1.5trn total addressable market, with scope for growth as penetration remains low (2%).**
- **Lending and insurance are emerging opportunities in FinTech; non-life insurance players may scale up more easily due to simpler product structure.**

The ASEAN FinTech Landscape

Multiple players vying for revenues

FinTech has gone mainstream, with banks, insurers, telecoms, e-commerce and platforms vying for revenue slices. Payments have been most disrupted. Lending and distribution are next. Within these, remittances, wealth management, personal finance, regulations and crypto are the areas where digital solutions are being scaled up.

From an investor perspective, the key difference between challengers and incumbents is the focus on the top line versus the bottom-line. Moreover, regulatory requirements are established for banks and insurers, while they are evolving for the rest. This suggests a drawn-out path towards competition and co-operation.

Table 1: Key FinTech players in Asean

Country	Key players
Indonesia	OVO, Gopay, DANA, LinkAja, ShopeePay
Vietnam	MoMo, AirPay, ZaloPay, GrabPay by Moca, VNPay, True Money
Thailand	True Money, AirPay, Rabbit Pay
Philippines	Gcash, PayMaya, GrabPay, ShopeePay, Lazada wallet
Malaysia	GrabPay, Boost, ShopeePay, Lazada wallet
Singapore	Dash, PayLah!, GrabPay, ShopeePay

Source: J.P. Morgan.

Banks' competitive advantage

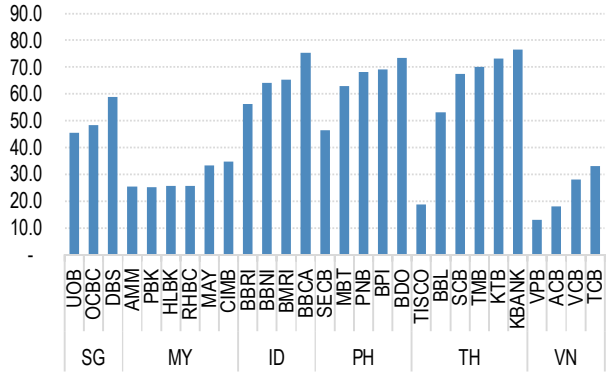
Investor and regulatory shifts will shape 'co-opetition' between 'Fin' and 'Tech' players, as well as convergence of aims. Rewarding topline growth has led to market share focus at new-economy companies. In contrast, RoI fixation at banks and insurers is a result of bottom-line emphasis, by investors and regulators. A surge in digital adoption by customers in the last 12 months has led to large-scale proof-of-concept, accelerating the pace of convergence.

Fundamental functions of banks in the economy are: a) collecting liquidity as deposits; b) liquidity/duration transformation to lend money/support transactions. In simpler term, banks collect cheaper granular deposits, which they use to make larger and longer duration loans. In the process, the banks make the spread and fees.

In addition to lending and deposit taking, banks also perform the utility function of facilitating financial transactions, including payments. This function allowed banks to extract rent, which is now getting challenged.

Drivers of deposit franchise: The ability of banks to collect deposit is the key source of their competitive advantage. This is driven by trust, which gives depositors comfort to put their savings in a bank and confidence that they would be able to withdraw at will. Deposit insurance helps to cement this trust. All else equal, the convenience of accessing deposits and using them for transactions is a factor in deposit gathering. This is reflected in branch network, ATM network, and electronic channels like app and internet banking.

Figure 1: Asean Banks: CASA ratio as of 2019 (%)



Source: Company data, J.P. Morgan.

The differences in value proposition and broader banking sector liquidity show up in CASA Ratio and cost of funds

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variations across banks. It takes time for banks to earn trust, which makes banks valuable.

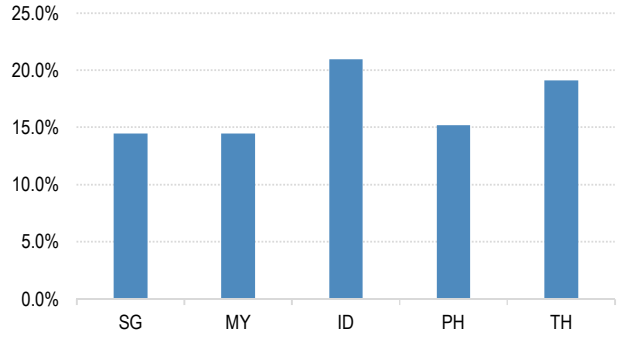
Earlier, it used to take time to ramp up the branch/ATM network, which made it difficult for a new player to compete with incumbents. This is changing with electronic channels.

Trust and regulations

Banks are highly regulated, partly to ensure that they are able to maintain the trust of depositors. Regulatory limits on liquidity ensure enough cash at hand to manage periods of stress. Capital requirements ensure that bank owners can absorb losses before depositors get impacted.

Further, regulations ensure that banks, which are highly levered (7-10x A/E across Asean) and acting as agents of depositors, don't take excessive risks. Second, to provide confidence in the banking system, most countries have deposit insurance. If banks are going to benefit from deposit insurance, to avoid moral hazard, it is only fair that banks' activities are monitored and regulated.

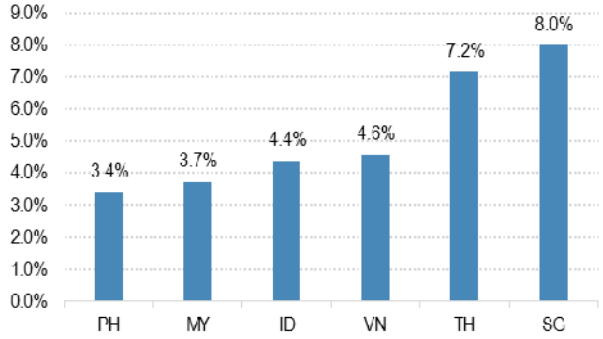
Figure 2: Asean Banks CET1 ratio (2019)



Source: Company data, J.P. Morgan.

Hence, for fintech players to attract deposits at scale, they would need to play by the same rules as the banks. This would involve them accepting capital and liquidity requirements. These could erode the RoEs. If the fintechs don't accept these requirements, it would limit their ability to raise deposits at scale. Hence, they would need to become channel partners of source of funds (P2P, partnership with banks, etc.), or access securitization (higher funding costs), or use their own funds.

Figure 3: Asean Banks: Payment fees as % of revenues (%, 2019)



Source: Company data, J.P. Morgan.

Payments and distribution most at risk

Asean banks make ~30% of revenues from non-interest income. These revenues include payments, remittances, wealth management, investment banking, cash management, trade finance, etc. Parts of these revenues are at risk, especially those related to payments, remittances, and increasingly wealth management. Pressure on corporate fees (trade finance, FX, IB) remains limited.

To counter these risks, banks with leading digital franchises in every country are moving to build offerings, and in some cases are willing to cannibalize select existing products in a bid to squelch competition. This is becoming apparent in remittances and payments.

Evolving regulatory framework for digital banks

Regulators in ASEAN have moved to develop frameworks for digital banks. In Singapore, MAS awarded full digital banking licenses to SEA and a consortium of Singtel and Grab.

Initial focus of the licensees is on young consumers & professionals and SMEs. Moreover, the licenses enable growth in product suite when the broader ASEAN FinTech is evolving from payments to distribution of financial products.

The neobanks will likely compete for deposits based on price. The segments where they may have an edge (at least in the short term) will include customers on which these players have better data. These effectively are linked to the supply chain within the ecosystem of Sea, Grab and SingTel.

Similar developments are happening elsewhere in the region, including the launch of a digital banking framework in the Philippines. These are likely to drive

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the accelerated entry of digital banks, which could lead to concerns around market share for incumbents. In this regard, large banks which are able to move faster in building digital offerings, will gain a lasting edge.

For more details, please see *ASEAN TMT: Implications of digital baking licenses for SE, Singtel* (6 Dec 2020) by Ranjan Sharma and Harsh Modi, *ASEAN Banks: Neobanks come to Singapore* (7 Dec 2020) by Harsh Modi and Ranjan Sharma and *Philippine Banks: Digital banking framework in making* (4 Sep 2020) by Harsh Modi and DA Tan.

Rapid growth in ASEAN e-payments

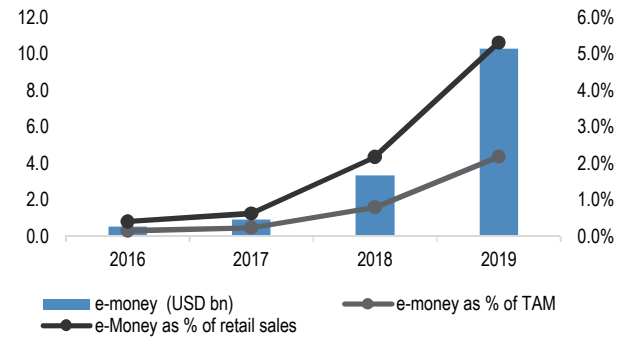
Online payments (3rd party payments, or TPP) is the infrastructure of transaction based business such as e-commerce, O2O and financial product distribution.

ASEAN has begun to witness a rapid growth of TPP, partly driven by: a) proliferation of internet services and smartphones, b) explosive growth in the internet economy, c) increasing non-cash settlement transactions, d) increasing financial inclusion, and e) better user experience.

This proliferation of online payments has been most profound in Indonesia, the market with amongst the biggest and most well-funded fintech companies. We calculate online payments (or e-money as defined by BI) have grown >1000% in 2017-2019. We find growth in online payments of 80-120% over the last two years in Malaysia and Thailand. The strong growth is coming off a low base.

Despite the strong growth, the online payment industry is relatively nascent. As percent of retail sales, we find 3rd party payment penetration of 4-7% in 2019. As percent of overall TAM (including retail transfers), we calculate penetration at ~2% in Indonesia, Malaysia and Thailand.

Figure 4: Indonesia: Penetration of third party payments



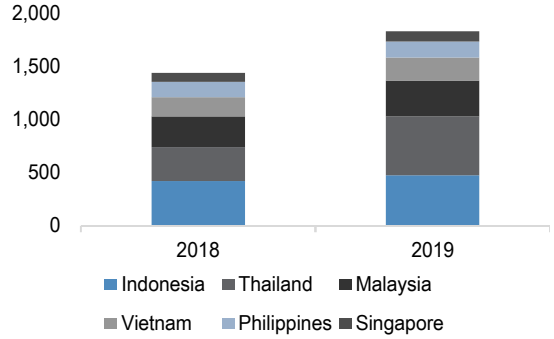
Source: BI, J.P. Morgan.

Estimating 3rd party TAM at >US$1.5trn

In the ASEAN 6 countries (Indonesia, Thailand, Singapore, Malaysia, Philippines, and Vietnam), we calculate that total addressable market (TAM) for online payment companies could theoretically be >$1.5trn (by TPV, or total payment value). In our TAM calculation, we include cash payments, payments by cards and retail transfers.

Up to 70-80% of retail transactions can be settled in cash in ASEAN countries. Hence, online payments can see significant growth from cash.

Figure 5: Retail payment TAM: Value of non-bank 3rd party payment (US$ Mn)



Source: J.P. Morgan estimates, central bank websites.

As banking penetration is relatively low in ASEAN, the ecommerce companies support a number of different ways to pay. TPP is one of the key ways for consumers to make online purchases. Hence, ecommerce is an important use case for online payments and it is driving the adoption of online payments.

Payments can be profitable in ASEAN

Payments can be profitable (at gross margin level) in ASEAN due to the relatively low cost of funds. For bank transfers and convenience stores (amongst the more preferred methods to top-up e-wallets) transaction fees can be as low as ~USD0.10/transaction in some markets. In Vietnam, banks might charge 0.2-0.4% of the value of the top-up. Top-ups through cards tend to be more expensive.

TPP companies generally do not disclose the Merchant Discount Rates (MDRs) charged for online and offline transactions. Hence, handling fees charged to sellers by ecommerce marketplaces like Shopee and Lazada can be indicative of main online MDRs charged by 3rd party payment companies.

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This assumption implies that main online MDRs for companies like ShopeePay are between 1.5-2%, excluding Indonesia. Some payment companies are even charging up to 2.5%.

From our conversations with TPP companies and banks, we find that online MDRs are generally higher than offline MDRs. For instance, the introduction of standardized QRIS in Indonesia has led to offline MDRs of 0.70%. In countries like Vietnam, it can be between 1-2%.

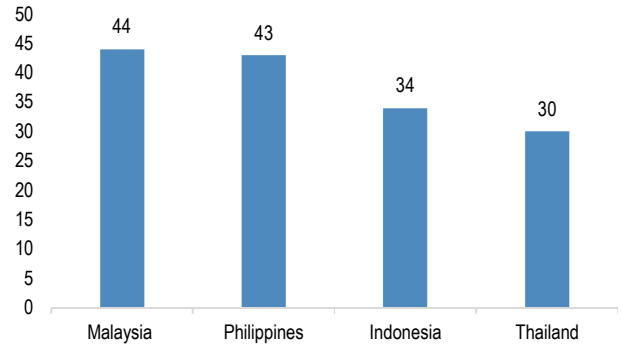
Table 2: Seller transaction fees charged by Shopee and Lazada

Country	Shopee	Lazada
Indonesia	paid by buyers	1.80%
Vietnam	2.00%	n/a
Thailand	2.00%	2.00%
	except credit card installment: 5%	
Philippines	1.50%	2.24%
Malaysia	2.00%	2.00%
Singapore	2.14%	2.00%

Source: Company websites.

On the other hand, third party payment is an intensely competitive and fragmented industry with 30 or more e-money issuers across Indonesia, Thailand, Philippines and Malaysia. All the companies compete for scale and users as payments has the highest usage frequency in online financial services. This is key to enhancing user stickiness and developing cross-selling opportunities.

Figure 6: Number of e-money issuers in Asean



Source: BI, BOT, BSP, BNM websites.

The nascent online lending scene

High rates, but risk management is key

Online lending by major Asean FinTech companies seems to have commenced in 2018. In its 2018 fundraising, Grab raised funds to launch Grab Financial Services which would offering digital lending through smartphones in SE Asia. OVO and Shopee launched lending services in 2019.

The online loans from the FinTech companies tend to be of short duration and carry relatively high interest rates. We find interest rates offered are between 2-5% a month. This is a significant premium to the interest rates charged by ASEAN banks.

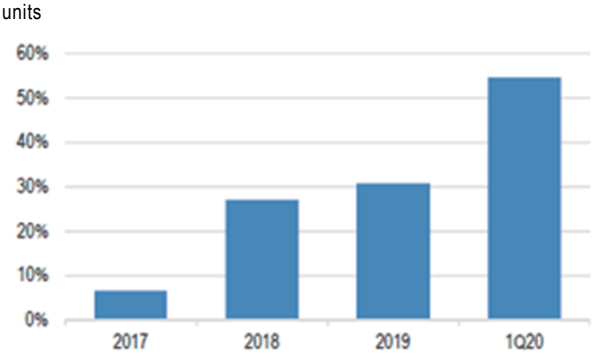
Table 3: Relatively high interest rates offered in Indonesia by FinTech companies

	Monthly interest	Loan period
OVO PayLater	2.90%	3-12 months
Traveloka PayLater	2.14-4.78%	1-12 months
Gojek PayLater	n/a	1-12 months
Shopee PayLater	2.95%	1-6 months

Source: Company apps.

High interest loans by FinTech comes with higher risk of bad debt. For instance, MELI launched MercadoCredito to issue loans to sellers and buyers, taking credit risk. MercadoCredito was first launched in Argentina (May-2017), then in Brazil (Jan-2018). In 2Q19, MELI began offering loans to consumers to purchase away from the marketplace in Argentina. Bad debt as a percentage of loans has been high for MELI at 25-30% in 2018/2019.

Figure 7: MELI bad debt has been relatively high (P&L provisions as % of gross loans)



Source: Company reports, J. P. Morgan

Opportunities in online insurance

Online market share could increase to 7% from 3%

The ASEAN insurance market is expected to be US$116bn in FY21 from US$110bn; online product could have ~7% market share in the next two years from ~3% in 2019 generating ~US$800mn sales commission, based on our estimates.

Due to the simpler and standardized nature of products in the non-life space, it might be easier for non-lifers to shift a larger portion of distribution to online channels (~6-10% of total premiums).

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With growing consumer adoption, ASEAN FinTech companies have begun offering insurance products on their platforms. The distribution of financial products can be an exceptionally high margin business. JPM's China internet team estimates 90% Gross Profit Margin for third party distribution of financial products. We think this sales commission margin should be wholly valid in the ASEAN insurance market given there is little differential in the product design and commission level on insurance policies across Asia.

Table 4: Revenue from online distribution for digital platforms

In USD mn	2020E	2021E
Indonesia	199	271
Malaysia	81	91
Thailand	138	237
Singapore	103	179
Philippines	31	34
ASEAN Online market TAM	**552**	**811**

Source: J.P. Morgan estimates.

Emergence of online distribution

The ASEAN life insurance market is dominated by term life, whole life and endowment policies, whereas the majority of non-life insurance products are motor, fire and health and personal accident products. In terms of distribution, the life market is dominated by both agency and bank channels.

However, starting from 2016, ASEAN regulators have become more liberal in allowing insurers to sell products through direct channels such as online channels. As a result, key major players have expanded their distribution to online channels through their own websites and/or digital insurers and/or web aggregators. The typical products offered in the life insurance biz are low coverage and low premium term life, critical illness and health insurance products.

In non-life markets, online sales are majorly contributed by motor insurance and other microinsurance products such as travel insurance, etc. Apart from existing insurers, new InsurTech startups such as Sunday (Thailand) are offering competitive (cheaper, customized) products online.

Players in online insurance

Among FinTech players in ASEAN, InsurTech appears to be a relatively new space and has only been offered by several players in Indonesia and Philippines. The insurance products offered by these players are all in partnership with known underwriters or another FinTech company that specializes in insurance or is an insurance aggregator marketplace.

In Singapore, major online players include NTUC Income and traditional multinational players such as AIA, AXA, Aviva and also Singapore Life. In Thailand, insurance broker TQM Corp provides non-life insurance policies online. Also, players such as traditional players such as Allianz Ayudhya, Prudential Life Assurance (PLA), Muang Thai Life, FWD Thailand.

In Indonesia, we note that Pasar Polis (insurance aggregator) partnered with two leading payment companies, namely GoPay and DANA. In contrast, OVO chose to directly build a partnership with the underwriter, Prudential. Meanwhile, in the Philippines, GCash partnered with both an insurance aggregator and the underwriter for its InsurTech business. The InsurTech products that are currently being offered by these players include both life and non-life.

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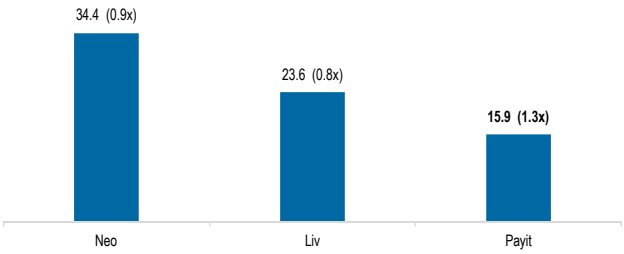
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UAE Digital Banks[1]: Non-banks are growing fast compared to the rest of MENA

- **Neobanks, which are fully mobile/web-only banks with no physical presence, are growing fast in the UAE compared to the rest of the MENA region which is seeing a rapid shift to digital.**
- **Neo and Liv are the two existing neobanks launched in UAE in 2017-18; Yap is the third neobank likely to be launched in the coming months.**
- **Newly set up ADQ Digital could compete directly with these neobanks.**

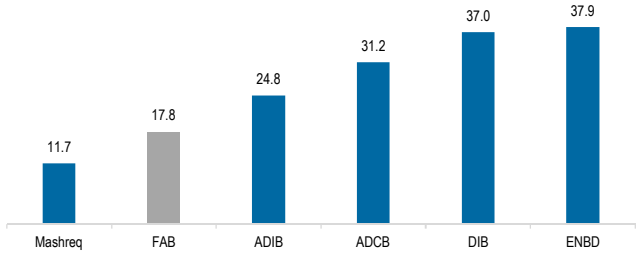
We think that emergence of ADQ / FAB digital bank in UAE (referred to as ADQ Digital for the purpose of this note) is a bigger challenge for Neo and Liv, which the new entity will directly compete with, rather than immediately affecting the overall strategic proposition of FAB's own e-wallet, Payit, which has thrived in recent months. Although cannibalization into some areas of Payit by ADQ Digital cannot be denied, we see opportunities that Payit can offer with more agility (e.g., taking a cue on issuing from its Saudi peer, STC Pay). This note is intended to initiate an industry discussion on UAE digital banking with an expectation that FAB will clarify to investors, in more detail, the endgame of its move to participate in the creation of ADQ Digital amid fast growth of 100% peer-backed neobanks in the UAE and lower take-up of its own digital banking.

Figure 1: Daily active users * ('000) of UAE Neobanks / e-wallets in the past 6M (multiple of the 12M avg.)
Neo is 100% owned by Mashreq, Liv 100% by Emirates NBD, Payit 100% by FAB



Source: Apptopia; NOTE: * number of unique devices that create at least one log in per day

Figure 2: Daily active users * ('000) of UAE banks' mobile apps (6M; '000)



Source: Apptopia; NOTE: * number of unique devices that create at least one log in per day

Summary of our thoughts

ADQ Holding and FAB have announced plans to set up a digital bank in the UAE (Bloomberg, 5 Oct). ADQ Digital will be created via transfer of ownership of the legacy First Gulf Bank license, which was retained through the FGB-NBAD merger (that led to creation of FAB), into the new digital bank. The existing value of this license on FAB's books has not been disclosed. Against this contribution, FAB will get a 10% stake in ADQ Digital. FAB has also secured an option to acquire another 10% stake in ADQ Digital at the time of the latter's IPO. FAB secured shareholder approval for the sale of this license at the General Assembly Meeting on 20 Oct. ADQ is the newly created strategic sovereign entity of Abu Dhabi holding a diverse portfolio of companies to ensure generation of sustainable financial returns for the Abu Dhabi government.

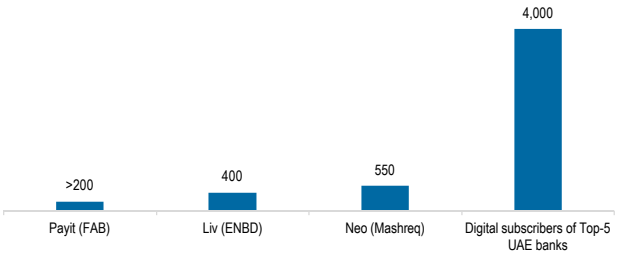
Neobanks are growing fast in UAE. The term digital banking encompasses: i) the digital front-end of the traditional brick and mortar banks and ii) neobanks, which are fully mobile/web-only banks, with no physical presence, and which typically cater to niche segments, mainly retail and also to SME. Global examples of neobanks include Revolut and N26 in UK/EU and Nubank in LatAm; these banks have enjoyed fast growth, especially amid the pandemic lockdowns, with Nubank seeing its number of subscribers this year grow 50%yoy to 30mn (Economist). Neo and Liv are the two existing neobanks launched in UAE in 2017-18. Their uptake has been rapid, underpinned by UAE's unique characteristics like a young population, high smartphone and internet penetration (>90%) and >200% mobile penetration. Both neobanks have garnered around 950k subscribers in total in the past three years compared to the approximate 4.0mn digital banking subscribers of the top-5 traditional

[1] Note: This is a slightly modified reprint of a research piece originally published on 15 October 2020. See *Banks: DATA-Driven: How Payit evolves amid creation of ADQ / FAB Digital Bank*, N. Bilandani, 15 October 2020.

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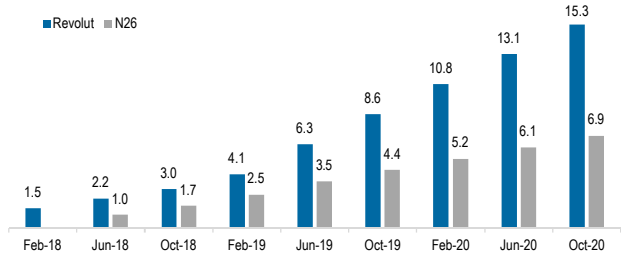
UAE banks (JPM est.). Neo has a bigger customer base, at around 550k, compared to Liv with around 400k customers (JPM est.). ***Liv's subscriber base grew over 50%yoy as of 2Q20 (company data) while Mashreq has guided that 75% of all new retail customer acquisitions are now coming from Neo (Gulf News 27 September).***

Figure 3: Estimated number of neobank / digital / e-wallet subscribers ('000) in the UAE



Source: J.P. Morgan estimates, company data, Apptopia

Figure 4: Estimated number of subscribers (mn) of international neobanks

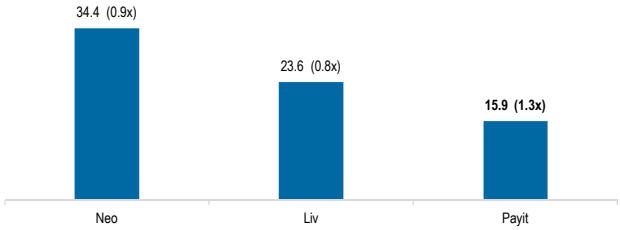


Source: Statista

ADQ Digital could compete directly with these neobanks. Although the geographic split of UAE neobank customers is not known, we think that Neo and Liv are likely to have higher customer concentration in Dubai versus Abu Dhabi given their backing by Dubai-based parents. Neo is 100% owned by Mashreq Bank and Liv is 100% owned by ENBD. In this regard, ADQ Digital—with its Abu Dhabi sovereign backing—is likely to have a greater allure for Abu Dhabi retail clients in our view vs. the incumbents.

FAB's answer to neobanks is its eWallet, Payit, which has seen increasing usage during COVID-19. eWallets are a store of monetary value or payment mode (e.g. credit card) that can be utilized over retail POS or ecommerce for transactions. FAB launched Payit in Q4'18 and this wallet has garnered over 200k subscribers since its inception. Although eWallets differ as a proposition compared to neobanks, if we compare the growth of Payit to Neo and Liv, using Apptopia, we find that Payit's take-up has significantly increased in the recent lockdown months. ***For example, we find that daily active users of Payit have risen to 17k daily in the past 3 months and 15.9k daily in the past 6 months compared to the avg. of 12.5k daily over the past 12 months (1.3-1.4x).*** On the other hand daily active users of Neo and Liv in the past 3/6m, although higher than Payit, have dropped slightly compared to the 12-month average (note the multiples shown in brackets in the chart below).

Figure 5: Daily active users * ('000) in the past 6M (this user base as a multiple of the 12M average)



Source: Apptopia; NOTE: * number of unique devices that create at least one log in per day

We think Payit's increasing acceptance recently is underpinned by a host of features. These include:

a) ***its cheaper, real-time remittances*** on a greater number of corridors than UAE neobanks (indicating extensive usage in the recent lockdown months as traditional exchange houses remained shut leading to a secular shift of users into Payit);

b) ***its rising acceptance by merchants*** due to instant cash settlement into merchant accounts compared to peer payment processors taking 24-48 hours (and Payit's lower MDR compared to credit cards);

c) ***its differentiated features*** to register household help for cashless payments by the employer subscriber (especially useful given that most blue collar / domestic help workforce in UAE do not have easy access to the banking system so their salaries are typically paid in cash);

d) ***its recent feature of instant cash loans*** to users registered for this service (Money on Demand); and,

e) ***no minimum balance requirement*** (useful for blue-collar workforce) compared to UAE neobanks which generally (although not always) require maintenance of a minimum account balance, failing which attracts a monthly maintenance fee.

On the other hand, Payit's core functionality is not too different from a neobank account; ***subscription on Payit generates an IBAN from FAB linking the subscriber into the global financial network for two way transactions.***

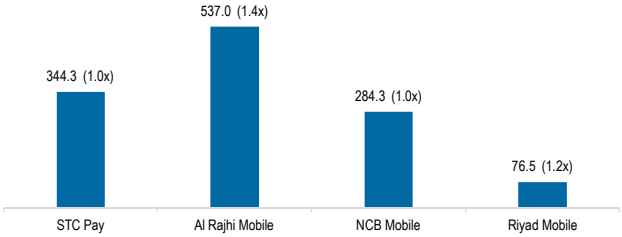
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ADQ Digital is unlikely to cannibalize materially into Payit's customer base, at least in the early stages of inception. We do not disagree that ADQ Digital can offer competition to Payit in certain areas like remittances in a shorter time period after its launch. However, in our understanding, Payit is attempting to target a wider customer base e.g. mid-tier expats, blue-collar workers in addition to young adults and SMEs, which look like an unlikely early target segment for ADQ Digital.

We base this view on Payit's technology. For example, Payit offers customers the ability to pay using sound-based payments; this is an inclusive technology which enables customers to conduct a contactless payment from lower-end smartphones which do not have the NFC chip. Another example of this is the QR-code payment interface of Payit (similar to Alipay) which also enables lower-end phones to conduct cashless transactions at the till directly from Payit. On the other hand, we are inclined to think that ADQ Digital's majority customer base, at least to start with, is likely to compose Abu Dhabi citizens and mid-tier / youth expats whose phones are highly unlikely to be limited on tech specs nor is this segment likely to have issues of banking inclusion (i.e. owners of credit or debit cards with higher end smartphones have little need of QR code technology).

Payit can take a cue from STC Pay to compete further with neobanks. A key area that can make a difference is commencement of issuing capability in Payit, i.e. card enablement. We take an example of STC Pay in Saudi Arabia whose wallet design and functionality looks comparable to Payit's (e.g. STC Pay also offers QR code for contactless payments). ***STC Pay's usage is markedly higher given that over 344k users have used its app daily in the past 6 months (in context of a 33 million population of Saudi Arabia) compared to Payit app's daily usage of 15.9k*** (in a 9 million population of UAE).

Figure 6: Daily active users ('000) in the past 6M (this user base as a multiple of the 12M average)



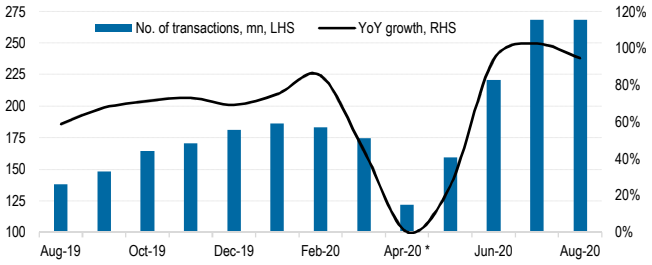
Source: Apptopia

STC Pay started issuing virtual Visa-branded pre-paid cards in Saudi Arabia last month, directly from its app. As we sense from the social media hype, these virtual cards are likely to see a significant take-up from the large unbanked population in the country (mix of which is similar to that in UAE including expat domestic household workers, contracting / industrial labor, etc.). There are two key benefits that both STC Pay and the user get from this virtual card:

a) ***a card brings STC Pay and the user more assertively into the global ecommerce payments ecosystem*** (since the wallet can be used for ecommerce only at those local merchants that accept that wallet as a payment method while Visa card can be used anywhere) and

b) **STC Pay cards can be linked to Apple Pay,** and hence can be used more frequently (incl. internationally) at NFC-enabled POS and by higher-end smartphone users. Usage of mobiles for contactless payments on POS is rapidly increasing in Saudi Arabia with 91% of POS transactions conducted via NFC versus 60% 12 months ago, as seen in the chart below, wherein 24% of NFC transactions are conducted via mobile phones (i.e., card embedded in the wallet) versus 7% 12 months ago.

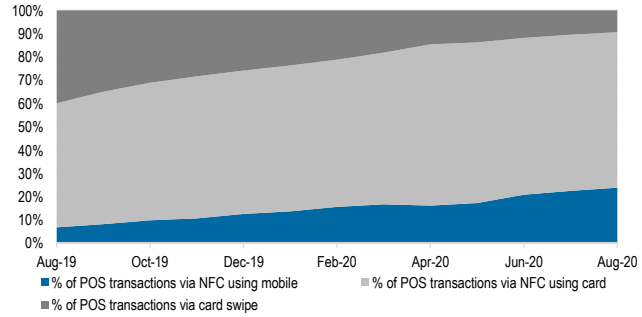
Figure 7: YoY growth in the number of POS transactions in Saudi Arabia



Source: SAMA; NOTE: * lock-downs commenced from 3rd week of Mar-20

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Figure 8: Rising mix of Saudi POS transactions where mobile phone (via NFC) is used for payment



Source: SAMA

We also think Payit can push further into credit offering to compete with neobanks.

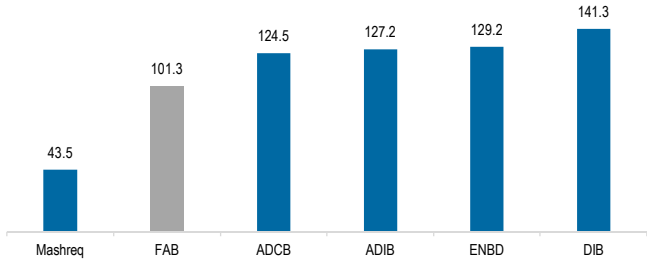
a) KYC for Payit subscription is already linked to Emirates ID, which is a digital ID that is mandatory for all UAE residents including expat workers. ***Linking this registration further with the Etihad credit bureau is the next step in Payit's evolution in our view.*** It can enable FAB to offer instant credit into Payit to a broader user base vs. its current offering which is limited to Ratibi card holders (Payit's Money on Demand for users earning up to AED5k p.m. and whose employers have registered with Payit).

b) FAB has recently linked up with Tabby to offer Buy Now Pay Later (BNPL) functionality to its merchants; a credit link into Payit can also enable Payit to be used for BNPL enhancing its penetration further into the customers' lifestyles.

In our understanding, a similar credit evolution for STC Pay would not surprise us; but, comparatively, ***Payit benefits from the fact that it already has a banking sponsor in place (its parent, FAB) allowing it liquidity / credit risk management benefits, which STC Pay may still have to work to*** (given that its parent is a telco operator).

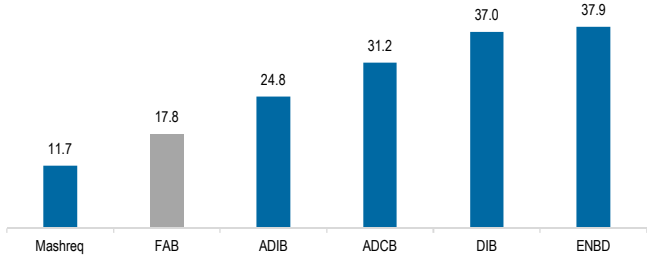
All said, a sense of urgency and clarity is required from FAB. Investor feedback garnered from our recent interaction calls for a better disclosure from FAB regarding its future strategy given its planned banking license sale for a minority stake in ADQ Digital, especially when FAB has frequently communicated its intentions to penetrate further into the digital arena. Key concerns that we have heard from investors include questions like: a) why shouldn't FAB pursue this route itself or at least as a majority holder rather than relinquishing control; b) what does this transaction imply for Payit and c) what are FAB's plans to enhance usage of its own digital banking. We expect to hear from FAB in more detail in the coming months but based on our initial thoughts, discussed above, ***there is a significant room yet for Payit to evolve which ensures FAB not being totally on the sidelines while its peers surge ahead in digital offerings.*** It is worthwhile to note that Liv has already forayed into Saudi Arabia recently, after a 3-year experience in its UAE home market. This highlights the need of urgency and clarity in strategy from FAB especially at a time when the take-up of its own digital offering remains lower versus its peers as we show below from usage of UAE banks' mobile apps.

Figure 9: No. of downloads of UAE mobile bank apps (6M; '000)



Source: Apptopia

Figure 10: Daily active users of UAE banks' mobile apps (6M; '000)



Source: Apptopia

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CEEMEA Banks: COVID-19 catalyzing digital banking acceleration

- **Internet banking penetration grew 3x since 2010, to 49%.**
- **Turkey and Greece growing fastest, at 7x.**
- **App usage data show a U-shaped recovery last year after the COVID-19 shock.**
- **First movers and banks with an established digital network have the edge.**

Promising digital backdrop with internet banking penetration up 3x since 2010: As internet infrastructure has expanded within emerging markets and digital literacy has improved, the penetration of internet banking in our CEEMEA markets has increased significantly, up threefold on average in the last ten years compared to 1.75x in the EU. Czech Republic has the highest penetration, followed Poland and Hungary, yet it is Turkey and Greece where penetration gains of 7x over ten years has been most impressive, and where further gains look most promising, given 30-35% penetration levels compared to the CEEMEA average of 49% and 55% in the EU.

Forced behavioral shift most notable in Greece and Turkey: our analysis of high frequency data shows that, as the global pandemic hit, finance app downloads across CEEMEA saw a 6% y/y decline in 1Q20 (versus for example a 3% decline in China). However, as clarity on the extent of lockdowns followed, customer behavior clearly shifted to increased usage of digital channels to continue banking and finance activities. Greece and Turkey stand out, where finance app downloads in April and May have recovered to +16% and +9% (y/y) respectively (9% growth in China). In these markets, daily downloads of the specific apps of our covered stocks show a 2x and 4.5x increase, respectively, compared to daily download levels immediately before COVID-19 struck. This clear v-shaped recovery in digital banking usage compares to what we believe data in CEE and Russia suggests shall be a u-shaped recovery, similar to the China experience, with daily active usage reaching a trough c.60-days after lockdowns were implemented, appearing now to be inflecting up towards pre-COVID-19 levels.

Supply appears an important accelerator too; Turkish state bank app downloads 2x private bank peers: a notable trend in Turkey is that State banks experienced a 4x jump in daily app downloads in the 1-month period following lockdown, compared to a 30% decline at private banks in the same period. Daily average usage at the state banks is now twice that of private peers, which we attribute to the continued lending push that state banks have delivered despite the pandemic (36% loan growth in 2020 through 5th June versus 12% at private banks). The trend is similar in Greece, where app downloads saw a 2x increase over the month following lockdown, with the increase highest at Alpha Bank.

Digital champions continue to excel: our analysis of the data shows a much more robust trend at banks arguably considered more digitally advanced. Moneta and Tinkoff (not covered) and OTP (within the franchise-leading incumbents group) stand out given that usage for these banks' apps has held up broadly at pre-COVID-19 levels throughout the lockdown. This compares to the 15% drop-to-trough in daily active users experienced by other banks immediately post lockdown.

App usage data implies U-shaped recovery post lockdown

As governments globally have implemented social distancing measures in the face of the COVID-19 pandemic, customer foot fall in branches understandably has declined significantly since March. Some banks, such as Komercni, have reported that only 70% of their branches remained open in the weeks following the implementation of restrictions, whilst most other banks reported closing certain locations (such as branches within malls and other public places) and most have reduced operating hours at those branches that remained operational.

Consequently, this seems to be accelerating opportunities for banks to focus on digital channels to deliver banking operations. With the growing reach of internet and digital literacy among customers, internet banking penetration has improved significantly over the last decade with some countries like Czech Republic standing out at 68% in 2019 vs. just 18% ten years ago. Yet, there is still significant opportunity to increase penetration as the majority of CEEMEA economies (49% on average) remain below the EU average of 55% and materially below the c.95% level at leading countries like Norway/Denmark.

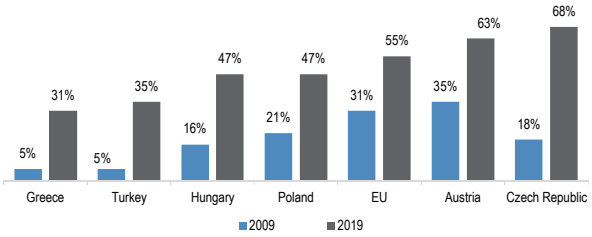
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Figure 1: 3x increase in internet banking penetration on average in CEEMEA

Internet banking penetration in population in the age group of 16 to 74 yrs



Source: Eurostat: Individuals using the internet for internet banking.

Given the ease of customer acquisition, scaling and cost efficiencies associated with online banking, most banks have been investing in digitalization in recent years, with some more ahead in the process than others. We think the pandemic could accelerate this transformation across all players as banks seek digital offering enhancements in order to mitigate the drop in customer activity otherwise introduced by the pandemic. Similarly, those customers lagging in terms of technology adoption so far may be forced to adopt remote banking owing to lockdown restrictions or might simply find it "safer" to carry out transactions without physical contact at branches.

Looking at high frequency data for downloads and usage of banking and finance-related apps across CEEMEA, we observe that with the slowdown in economic activity following the implementation of lockdown, finance app downloads saw a 6% y/y decline in 1Q20 on an average in CEEMEA versus a 3% decline in China. However, with customers switching to online channels to continue banking and finance activities more recently, the trend has improved in the first two months of the second quarter. Greece and Turkey stand out with app downloads up 16% and 9% respectively, vs. 9% growth in China. We think downloads shall see a further uptick as the pace of recovery improves in the rest of the regions.

We track daily active users (DAU) at top banking apps in each country in our coverage to compare trends pre and post the implementation of lockdown. Greece and Turkish State banks stand out with most impressive rise in app downloads and usage following the lockdown with customers quick to adopt online channels, resulting in app downloads and DAU levels reaching all-time highs in a limited time. Downloads at Greek banks peaked around a month after the start of lockdown, reaching double the levels versus the beginning of the year. In Turkey, we observe DAU for state banks' apps are now 1.5x higher than private peers and are showing a strong correlation to TL lending growth at these banks, which has been up 36% in 2020 through 5th June (vs. 12% at private banks) supported by various loan campaigns introduced in order to continue credit flow to the economy.

Trends across the broader region, however, are slightly different. In the rest of CEE, we observe a drop in downloads and app usage in the couple of weeks following the start of lockdown and a steady pick up thereafter. Banks have reported a decline in new origination of loans and other transaction activities in the weeks following implementation of COVID-19 restrictions. Komercni, for example, reports sales of consumer loans and mutual funds dropping to c.50% vs. pre-COVID-19 levels in the weeks following lockdown. However, the reduction in online activity has been less severe as compared to offline. Tinkoff, for instance, reported volume of online card transactions dropping by 20% in March but picking up back to pre-COVID-19 levels by the end of April, yet, card transactions in offline channels continue to remain 30% below pre-COVID-19 levels.

While the immediate dip in online banking is justified as a result of slowdown in overall economic activities, we think the recovery trajectory could be interesting to watch, as a prolonged pandemic period could result in customers and banks bringing more of their daily operations online resulting in a steeper growth. As experienced to date, we think going forward the trend in CEE and Russia could be very similar to China, which has been ahead of the pandemic curve versus the rest of the world. Following a decline in downloads right after the lockdown was first implemented, banking apps in China have shown a U-shaped recovery and have already reached higher levels than pre-COVID-19.

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Early movers have held strong so far – Moneta, Tinkoff and OTP stand out

Perhaps unsurprisingly, banks broadly understood to be leaders or differentiators in the digital space have held strong so far; while CEE and Russia saw a 15% drop to trough following the lockdown, Moneta and Tinkoff (not covered) stand out with app usage remaining at or even surpassing pre-COVID-19 levels. Of the franchise-leading incumbents, it strikes us that OTP shares this trend.

Elsewhere, it is interesting to note that app usage at Turkish state banks has grown at twice the level of their private bank peers, which we attribute to the solid push to underwrite new lending amid the pandemic.

Going forwards, we believe the focus shall shift to those players that emerge out of the pandemic with an enhanced digital transformation and capacity to take out cost, as recently highlighted by banks like Komercni, Moneta and Bawag.

Banks with an existing well-established digital network have an edge in continuing business online

Taking a closer look at daily app downloads and usage data at the stocks we cover, we observe that State bank apps in Turkey saw a 4x jump in daily downloads in a 1-month period post lockdown, as these banks continued to push business growth amid the pandemic. This compares to 30% reduction in daily downloads at private banks in the same period. Daily average usage (DAU) on average at Halkbank, Vakifbank and Ziraat (not covered) is now twice that of private peers. The trend is similar in Greece, where app downloads saw a 2x increase over a month post lockdown, with the increase highest at Alpha Bank. In CEE, while most countries have seen a dip in online activity immediately post lockdown (-15% to trough), the impact is less severe at digitally advanced banks. Moneta, Tinkoff (not covered) and OTP stand out as usage for these apps has held up broadly at pre-COVID-19 levels throughout the lockdown. As restrictions ease across countries, key focus will be on banks which are able to continue growth in digital app usage instead of customers going back to branches.

The COVID-19 outbreak led a number of banks to step up their digitalization processes and take this as an opportunity to achieve cost efficiencies via branch network optimization. During 2020, Czech banks were ahead of all in announcing cost optimization plans on the back of digital growth, which seems viable given the structural digital advancement in the Czech economy. For example, Komercni reduced its branch network by up to 27% over a five-month period post 1Q20, bringing down its 2020 op-ex guidance to flat y/y from in-line with inflation levels previously. Moneta guides for 8% lower op-ex for the FY 2020 period, a part of which is due to the reduction in its branch network footprint it managed to deliver in line with digital development. Among other regions in our coverage, Bawag now sees op-ex for FY20 going down 5% y/y with the shift from physical to digital/home-offices, as well as redefining digital initiatives in light of the pandemic.

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Companies Discussed in This Report (all prices in this report as of market close on 17 February 2021)
EVO Payments(EVOP/$26.50/OW), Global Payments(GPN/$192.85/OW), Signature Bank(SBNY/$214.92/OW), TriNet(TNET/$78.52/N)

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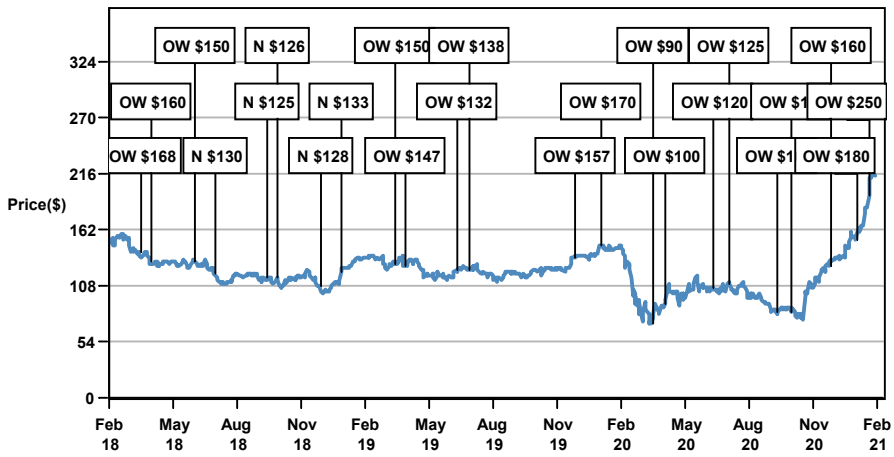
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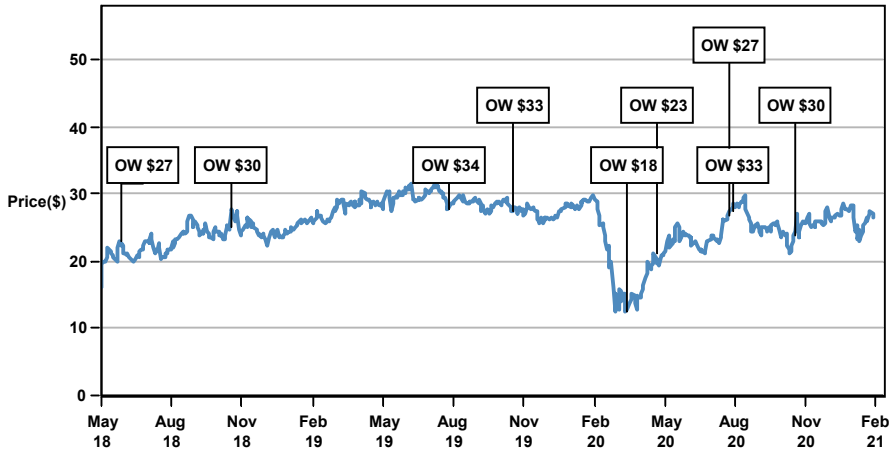
Signature Bank (SBNY, SBNY US) Price Chart



Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Apr 14, 2008. All share prices are as of market close on the previous business day.

Date	Rating	Price ($)	Price Target ($)
06-Apr-18	OW	140.15	168
20-Apr-18	OW	130.93	160
22-Jun-18	OW	131.98	150
20-Jul-18	N	118.71	130
04-Oct-18	N	115.92	125
19-Oct-18	N	116.25	126
18-Dec-18	N	107.97	128
18-Jan-19	N	121.32	133
04-Apr-19	OW	128.78	150
18-Apr-19	OW	128.06	147
02-Jul-19	OW	123.24	132
19-Jul-19	OW	122.78	138
17-Dec-19	OW	135.75	157
22-Jan-20	OW	147.50	170
06-Apr-20	OW	72.01	90
24-Apr-20	OW	90.52	100
01-Jul-20	OW	106.92	120
22-Jul-20	OW	109.56	125
01-Oct-20	OW	82.99	105
21-Oct-20	OW	83.12	100
15-Dec-20	OW	128.15	160
22-Jan-21	OW	151.76	180
09-Feb-21	OW	195.43	250

EVO Payments (EVOP, EVOP US) Price Chart



Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Jun 18, 2018. All share prices are as of market close on the previous business day.

Date	Rating	Price ($)	Price Target ($)
18-Jun-18	OW	23.00	27
07-Nov-18	OW	24.94	30
15-Aug-19	OW	27.78	34
07-Nov-19	OW	27.43	33
03-Apr-20	OW	12.54	18
11-May-20	OW	21.11	23
13-Aug-20	OW	26.80	27
17-Aug-20	OW	27.42	33
06-Nov-20	OW	23.94	30

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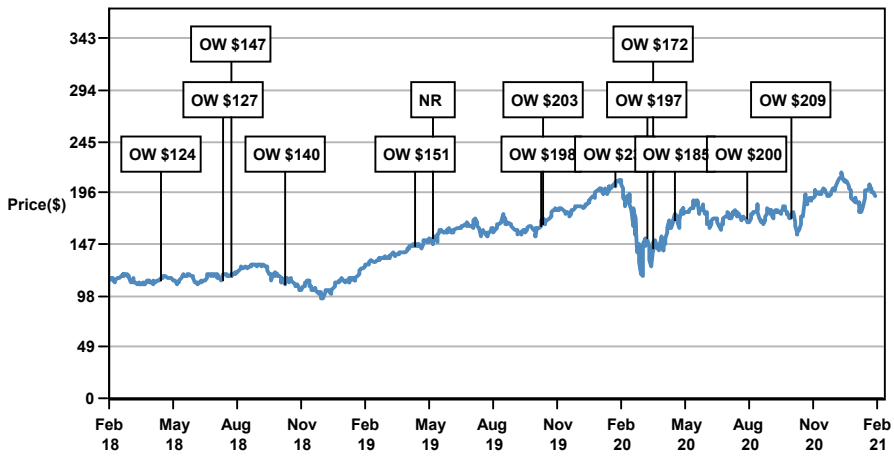
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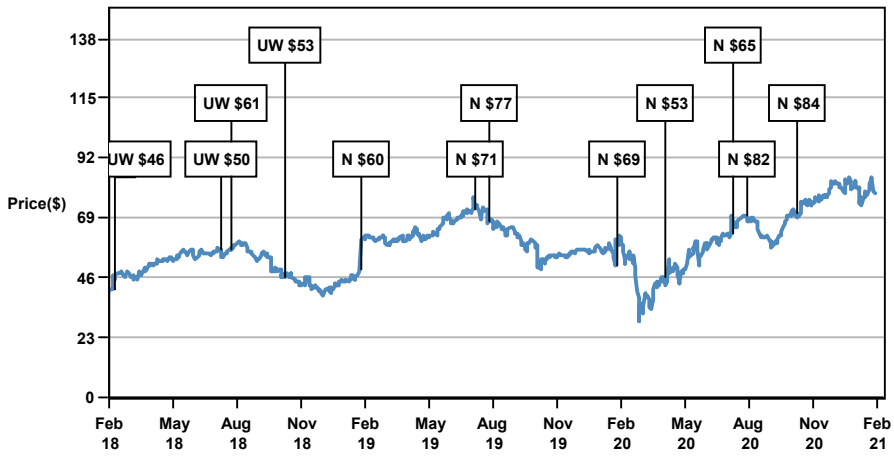
Global Payments (GPN, GPN US) Price Chart



Date	Rating	Price ($)	Price Target ($)
04-May-18	OW	113.35	124
02-Aug-18	OW	111.90	127
14-Aug-18	OW	116.94	147
30-Oct-18	OW	108.84	140
03-May-19	OW	144.33	151
28-May-19	NR	153.44	--
30-Oct-19	OW	163.20	198
31-Oct-19	OW	165.54	203
13-Feb-20	OW	201.65	230
27-Mar-20	OW	152.87	197
07-Apr-20	OW	143.74	172
07-May-20	OW	170.10	185
17-Aug-20	OW	172.50	200
20-Oct-20	OW	171.97	209

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Nov 20, 2001. All share prices are as of market close on the previous business day.

TriNet (TNET, TNET US) Price Chart



Date	Rating	Price ($)	Price Target ($)
28-Feb-18	UW	41.58	46
30-Jul-18	UW	56.90	50
14-Aug-18	UW	56.96	61
30-Oct-18	UW	46.42	53
15-Feb-19	N	49.53	60
26-Jul-19	N	72.23	71
15-Aug-19	N	67.70	77
14-Feb-20	N	50.84	69
23-Apr-20	N	45.85	53
28-Jul-20	N	63.01	65
17-Aug-20	N	69.79	82
27-Oct-20	N	70.50	84

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage May 06, 2014. All share prices are as of market close on the previous business day.

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Coverage Universe: Alexopoulos, Steven: Amalgamated Bank (AMAL), BankUnited (BKU), Cadence Bancorporation (CADE), Comerica Incorporated (CMA), Cullen/Frost Bankers Inc. (CFR), First Hawaiian (FHB), First Horizon Corp (FHN), First Republic (FRC), Huntington Bancshares (HBAN), KeyCorp (KEY), M&T Bank (MTB), New York Community Bank (NYCB), People's United Financial (PBCT), Pinnacle Financial Partners (PNFP), SVB Financial Group (SIVB), Signature Bank (SBNY), Synovus Financial Corp. (SNV), TCF Financial Corporation (TCF), Umpqua Holdings Corporation (UMPQ), Valley National Bancorp (VLY), Webster Financial Corporation (WBS), Zions Bancorp NA (ZION)
Lei, Katherine: Agricultural Bank of China - A (601288.SS), Agricultural Bank of China - H (1288.HK), Bank of China - A (601988.SS), Bank of China - H (3988.HK), Bank of Communications - A (601328.SS), Bank of Communications - H (3328.HK), China Cinda Asset Management Co Ltd (1359) (1359.HK), China Citic Bank - A (601998.SS), China Citic Bank - H (0998.HK), China Construction Bank - A (601939.SS), China Construction Bank - H (0939.HK), China Everbright Bank - A (601818.SS), China Everbright Bank - H (6818.HK), China Merchants Bank - A (600036.SS), China Merchants Bank - H (3968.HK), China Minsheng Banking - A (600016.SS), China Minsheng Banking - H (1988.HK), HSBC Holdings plc (0005) (0005.HK), Huaxia Bank - A (600015.SS), Industrial Bank - A (601166.SS), Industrial and Commercial Bank of China - A (601398.SS), Industrial and Commercial Bank of China - H (1398.HK), Lufax Holding (LU), Noah Holdings Ltd (NOAH), Ping An Bank - A (000001.SZ), Postal Savings Bank of China (1658) (1658.HK), Shanghai Pudong Development Bank - A (600000.SS), Standard Chartered Plc (HK) (2888) (2888.HK)
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Nishihara, Rie: Aozora Bank (8304) (8304.T), Chiba Bank (8331) (8331.T), Concordia Financial Group (7186) (7186.T), Fukuoka financial group (8354) (8354.T), Japan Post Bank (7182) (7182.T), Mitsubishi UFJ Financial Group (8306) (8306.T), Mizuho Financial Group (8411) (8411.T), Resona Holdings (8308) (8308.T), Shinsei Bank (8303) (8303.T), Shizuoka Bank (8355) (8355.T), Sumitomo Mitsui Financial Group (8316) (8316.T), Sumitomo Mitsui Trust Holdings (8309) (8309.T), Suruga Bank (8358) (8358.T)
Yao, Alex: Alibaba Group Holding Limited (BABA), Baidu.com (BIDU), Bilibili (BILI), China Literature Limited (0772) (0772.HK), Focus Media - A (002027.SS), Huifu Payment (1806) (1806.HK), Kingsoft Cloud (KC), Meituan (3690) (3690.HK), NetEase (NTES), OneConnect Financial Technology (OCFT), Tencent (0700) (0700.HK), Tencent Music Entertainment (TME), Tongdao Liepin Group (6100.HK), Trip.com Group Ltd (TCOM)

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IB clients**	53%	49%	35%
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