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Nexus Between Payments Digitalization and Cash Demand in the Philippines

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ABSTRACT

The emergence of innovative contactless payment technology is revolutionizing the retail payment markets, with the expectation that cash usage would be tempered over time. The literature suggests that payments digitalization has had some considerable impact on cash usage in some advanced economies that began their digitalization journey much earlier, but less so in others.

Based on limited payments digitalization data available, preliminary empirical estimates for the Philippines indicate that the pandemic induced some substitution of cash with digital payments, but not yet on a significant scale. While the remarkable inroads in retail payments digitalization and demographics are expected to bring about behavioral shift in cash usage, the pace and extent of substitution would be contingent on policy reforms aimed at widening access to affordable digital payment services, secure digital infrastructure, and privacy protection, among others. Policy mix must also give equal weight to addressing vulnerability to cyberattacks and the risk of exclusion of individuals, who lack the capacity to access and make informed choice about the use of digital payment solutions.

Further research and reliable granular data are needed to deepen understanding of the evolving interplay between payments digitalization and cash usage, and align strategies that ensure fair access to safe and reliable payment options, including cash. After all, financial inclusion is about empowering consumers with safe access to and capacity to choose from wide array of financial services and payment options that suit their lifestyle and preference. Thus, both cash infrastructure and digital payment infrastructure would need to progressively adapt to changing times to ensure that the freedom of choice in payments is safeguarded.

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Disclaimer: The views expressed in this discussion paper are those of the author and do not represent the official position of the Bangko Sentral ng Pilipinas or the BSP Research Academy.

I. Introduction

Money, regardless of form, primarily functions as a unit of account, a medium of exchange, and store of value. These fundamental functions of money require a well-functioning, safe, efficient, and inclusive payment and settlements systems that are recognized, trusted, and conventionally used by government, businesses, and individuals.

Existing monetary systems are anchored on public money issued by a central bank in the form of banknotes and coins, and central bank reserves, while private money is issued by commercial banks in the form of deposits and by non-bank financial institutions in the form of digital money. Banknotes and coins are the only form of public money available to the general public. Banks, in contrast, also have access to public money in electronic form, via central bank reserves.

As innovative contactless payment technology radically transforms the retail payment markets, cash usage is expected to moderate over time. COVID-19 pandemic buoyed up e-commerce and concomitantly sped up and ushered in faster and more convenient digital payment platforms. Digital payments can also potentially open new business opportunities, particularly for small businesses (Tanaka, 2016) by enhancing transparency and security in transactions, and promoting financial inclusion and inclusive growth (Better than Cash Alliance, n.d.).

In the Philippines, digital payment platforms have seen increasing foothold in terms of public acceptance and usage, with exponential growth in the use of PESONet and InstaPay observed during the pandemic. However, the digital transformation of money and the substitution of physical cash are processes that evolve gradually over longer period of time. Expectedly, boundless growth is improbable given the upper limits imposed by external factors. Nonetheless, significant growth spurt can be anticipated when a new and major transformative shock hastens growth to new heights.

The realization of the vision of a cash-lite economy also depends on a number of factors outside the full control of the central bank. Among the factors that would affect the posited substitution between physical and digital cash are (i) preferences and habits, (ii) pace of developments in digital infrastructure, (iii) fee structure, (iv) cultural factors, (v) demographics, and (vi) policies including those on privacy safeguards and consumer protection, and adoption of central bank digital currency (CBDC) at the retail level. Currently, these constitute a large set of unknowns. Hence, there is a need to carefully balance rationalized currency issuance that is reliant on efficient and cost-effective production vis-à-vis the pace of digital retail payments adoption and change in the payment habits of Filipino consumers.

Significance of the study. Available reports and studies delve on the remarkable inroads in retail payments digitalization. The current measurement model by the Bangko Sentral ng Pilipinas (BSP) calculates the volume and value of digital payments in the country made to and by the government, business, individual,[1] thereby facilitating the identification of payments use-cases that may be prioritized for digitalization (Mesina-Romero, et. al., 2022).

However, there is no known empirical study yet that looks into the extent of substitution between cash usage and digital payments in the Philippines, and one that considers the possibility that the digital payment chain, particularly at the retail level, is not yet wholly digitalized. Measuring the extent of substitution would provide important insights on the changing cash demand landscape and its implication on cash cycle management and payment digitalization efforts.

This study fills the gap by providing baseline empirical analysis on the interplay between retail payment digitalization and cash demand. It utilizes unique monthly data on aggregate data on bank currency withdrawals from the BSP and payment digitalization from the Electronic Payments and Financial Transactions (EPFS) of Philippine banks. Despite limitations in available digitalization data, this study offers some perspectives on the balance between the BSP's exclusive currency issue power and payment digitalization thrust, in support of its vision of cash-lite-and-financially inclusive society.

This paper is organized as follows: Section 2 examines the literature on cash usage and digitalization. Section 3 discusses stylized facts on cross-country trends and the Philippine experience. Section 4 describes the data and empirical methodology. Section 5 offers insights into preliminary empirical estimates, and Section 6 concludes.

II. Review of Related Literature

With the exception of few jurisdictions, cash remains widely used in both leading and emerging economies around the world despite considerable strides in payment digitalization. However, the future of money is also rapidly changing with sustained advances in technology and adaptation by both issuers and users,.

In the 2022 Central Banking benchmarking study, majority of the surveyed central banks expect increases of between zero to 20 percent, suggesting that the demise of cash is nowhere imminent. In similar vein, Central Banking (2023) reports that almost two-thirds of the central bank respondents institute access-to-cash policies while nearly half of the respondents maintain minimum cash service levels for commercial banks. The report further notes that the European Commission has drafted regulation that would require Eurozone countries to safeguard sufficient and effective access to cash.

The experience of Sweden, which is considered as a country that will fast transition toward an almost cashless society, provides valuable insights on the payments digitalization drive as well as admonition on the need for policy

[1] There are twenty-four (24) payments use-cases based on the different types of payments. These are represented in a 3 x 3 payment grid with 9 possible payment combinations between the government, businesses and individuals. The payment grid represents the percentage share of each payment combination to the total monthly payments.

balance to ensure that no segment in society is marginalized in access to payment.

In a 2018 conversation with *Knowledge at Wharton*, Hedman emphasized the multifaceted drivers of this trend. Use of payment cards and digitalization of bank accounts began in the 1950s-1960s. Internet infrastructure and internet banking were already set up in the 1990s with strong government support such that by the 2000s, the central bank started to outsource its printing and distribution of cash. He also underscored the legal framework that enshrines precedence of contract laws over banking and payment laws. These factors provided the fodder for behavioral shift among the consumers. Even with sizeable reduction in cash usage, he cautioned about the implications of the payment digitalization trend on anonymity and on less-technology savvy segments of the population, including elderly people afflicted with dementia. Benedictus (2021) reported that contrary to news brandished in social media platforms, the Swedish government has not made any policy pronouncement on going cashless, and banknotes and coins will continue to be produced.

There are observed immediate and gradual changes in the use of physical cash and digital payments in other jurisdictions. In the Euro area, cash is still the most frequently used means of payment at point of sale based on the 2022 study on the payment attitude of consumers in the Euro area (SPACE), a regularly conducted survey on payment trends. However, there has been a considerable decline from 72% in 2019 to 59% in 2022. While the reason for this decline is yet to be determined, it may be inferred that the consumption and payment behavior adapted to the pandemic and may have been retained post-pandemic.

Even if growing use of electronic means of payment reduces the demand for cash, it is still far from approaching zero at least in the medium term, largely because of consumer preference (Cabezas & Jara, 2021). This is evident in the case of China, in which the two leading platforms for payments and digital services, WeChat Pay and Alipay, accounted for 91 percent of digital payments in 2021. The cumulative digital payment value in China is set to reach 3.5 trillion US dollars, making it a global powerhouse in digital payments. On the other hand, Schirmer (2022) reported that cash on delivery remains the preferred online payment method in China. Assurance of quality before payment, and lack of online payment accounts (e.g., senior, rural citizens) explain preference for this method of payment.

The same is true for Japan. In the study by Saito (2021), demand for cash continued to expand in all regions of Japan, except Kinki, with positive net supply of cash by the Bank of Japan despite long history of payment digitalization. The study highlighted that while cashless payments can be linked to credit and debit cards, a large portion of the financing came from charging by cash, which may reflect consumers' concern with credit card or debit card information as well as precaution against unmonitored expenses. Precautionary holdings of cash increased during periods of uncertainty such as COVID-19, natural calamities, power outage, and ATM system malfunction. Zero deposit interest rate may have also made the public indifferent to hold deposits or cash. Naoko (2022) cited results of a survey that showed less than 30% of companies are considering implementing the government's plan to implement digital salary payment due to system and increased operational costs.

Increased usage of electronic payment was found to have small substitution effect on cash demand (Chucherd, 2019; Srouji 2020). The consumers' decision to use contactless payment is an endogenous choice, thus the overall effect on cash usage remains unaffected (Trutsch, 2020). The varying motivations for using cash in different jurisdictions and cultures underline the persistence of physical cash usage. In Europe, the share of senior population, the level of digitalization, and the average size of card transactions are the identified drivers of cash usage (Alonso et. al., 2018).

Flannigan & Staib (2017) found that cash usage continued to rise in Australia along with the size of the economy. They found that despite the increase in card payments over cash, the value of banknotes in circulation continued to grow with the economy, supporting the transactional demand for cash. For Indonesia, Wasiaturrahma, et al. (2019) reckoned that in the short term, credit cards and e-money are not significant for real money demand. But in the long run, they found credit cards to have significant negative effect. Only debit cards have significant positive effect on cash circulation.

A recent IMF Working paper by Khiaonarong & Humphrey (2023), used panel of 14 advanced and emerging market economies that represent half of the world's population. The study found that on one hand, cash is still strongly used for payments in some countries using CIC as a ratio to GDP. When measured as the ratio of the value of cash withdrawn from ATMs to GDP, use of cash seems to be falling. The authors attributed the divergence to the fact that CIC includes cash used for payments, hoarding, and even illegal use while ATM cash is focused more on the use of cash payments alone.

The preference in using digital payments, physical cash, or both may also come down to a business decision. The research by Arvidsson, Hedman, and Segendorf in 2017 gained currency as it predicted Sweden's rapid transition to a cashless society by 2023 at the earliest. They estimated a threshold of 7% cash transactions over total payment transactions for Sweden, below which "*it becomes more costly to manage cash than the marginal profit on cash sales.*"

Botta et. al (2022), highlighted that even with the continued dominance of cash in Africa, offline channels, especially agent networks, represent an important element of the growing African e-payments infrastructure. These networks have extended beyond cash-in, cash-out (CICO) services and facilitated the expansion and complexity of electronic payments as a platform for financial services. These include SANEF in Nigeria, Mukuru in Southern Africa, and Fawry in Egypt are just a few examples of non-telecom agent networks. For banks, these networks with their lower operating costs have become a critical channel for customer acquisition and servicing, enabling access to a new segment of customers. In Latin America, the overall point of sale (POS) transactions have rebounded from 2020 slump and cash also remains the leading payment method (Cash Matters, 2022).

For all the benefits of going cashless, policymakers would still have to manage individual's fundamental concerns about privacy, anonymity, and security. Like Sweden, Norway is considered as one of the pioneers in the shift to digital payments, with a plan to eliminate paper money by 2030. Vipps is a dominant mobile payment app deployed by Norwegian banks, with 69 percent of their

population using it to pay online. About 53 percent of online transactions are via mobile commerce, reportedly to be more than that of similar advanced economies like France and Germany. But despite the lofty goals set by the government, there remains a strong lobby for the continued use of physical cash, mainly for privacy and security reasons Cash Essentials (n.d.).

Available empirical estimates on the impact of digitalization on cash usage put the impact at less than one percentage point.

Table 1. Estimated Impact of Digitalization on CIC

Author	Results of the Study	Estimates of Impact of Digitalization on CIC
Raj J. et. al. (2020) Reserve Bank of India	The change in the value of transactions is found to be statistically insignificant; however, the number of transactions is found to be [marginally] statistically significant and negative (with one period lag).	• ΔLog of value of digital transactions = 0.009 • ΔLog of value of digital transactions (-1) = 0.023 • ΔLog of number of digital transactions = -0.027 • ΔLog of number of digital transactions (-1) = -0.052*
Monetary Policy Group, Bank of Thailand (2019)	E-payment usage led to a slight decline in money demand and shows gradual substitution impact. Cash remains as the most preferred payment method.	• Retail e-payment = -0.058** • Card payment = -0.089*** • Internet and mobile banking = -0.054** • e-Money = 0.023
Qin (2017)	Using data of central bank in China during 1999 to 2010, electronic money has a negative impact on M0 (CIC), but a positive impact on M1.	• Relationship between e-Money and M0 = -0.13 • Relationship between e-Money and M1 = 0.74
Kartika and Nugroho (2015)	Analyzing electronic money and the velocity of money in ASEAN, it is found that GDP, M1, and velocity of money had a positive and significant effect on electronic money transactions	• Relationship between e-Money and M1 = 0.1
Hataiseree and Banchuen (2010)	Given the low degree of debit card usage for making payments and the slow change in the payment behavior, it is unlikely that this development will have noticeable impact on the future use of cash	• Relationship between e-Money and CIC = -0.15

*Note: ***, **, * = significant level at 0.01, 0.05, and 0.1, respectively*

III. Stylized Facts on Currency and Payment Digitalization Trends

3.1 Demand for Cash

Data gathered on 16 selected economies show that the ratio of currency in circulation (CIC) to gross domestic product (GDP) has generally been rising, except for China, Norway, and Sweden. Expectedly, the same trend is observed when CIC is measured against personal household consumption expenditures (PHCE). The ratio of CIC to M1 (narrow definition of money), on the other hand, is

on a general downtrend, with Malaysia, South Korea, and India bucking the trend, although a nascent post-pandemic decline is observed for these three economies. Velocity of CIC is likewise on a declining path, except for China, Norway, and Sweden.

The trend for the Philippines is consistent with the general experience of other jurisdictions. The ratio of CIC to GDP has been rising until the 2020 pandemic and declined thereafter, a similar trend experienced during the 2008-2009 Global Financial Crisis (GFC). CIC velocity has also been on a downtrend until 2020, and has gradually risen since then, albeit still below historical average.

In terms of ratio to different aggregate measures of money, CIC-to-narrow money (M1) was on a steady decline from 2002 until mid-2013. It started to rise thereafter and stabilized at roughly around 30 percent (Figure 1). Consistent with robust growth performance, the CIC trend has become steeper since 2016 with marked gyration in the cyclical component in recent years (Figure 2). This may be traced to a number of significant shocks since 2019, which is mirrored in banks' withdrawals from the BSP.

The shocks include bankruptcy of major banknote paper supplier; pandemic that led to substantial precautionary demand for cash; introduction of Cash Service Alliance (CSA) that mobilizes and recirculates largely high-denomination fit currencies; retail payment digitalization; and high inflation environment that affected currency demand dynamics at the denominational level. As such, the recent downtrend cannot be attributed solely to a specific shock. Moreover, it remains to be seen whether the pandemic-induced shocks are (i) transitory and thus mean-reverting, or (ii) structural in nature and would thus, lead to new steady state level of CIC.

Figure 1. Ratios of Currency to Different Measures of Monetary Aggregates

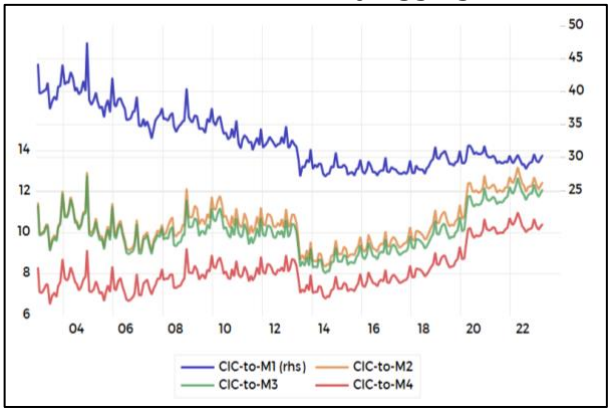
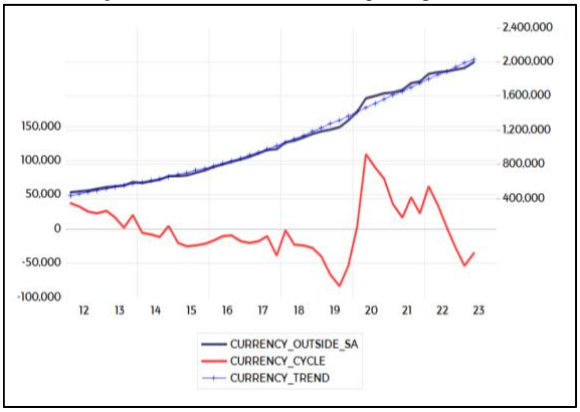


Figure 2. Trend and Cyclical Components of Seasonally-Adjusted CIC



Authors' estimates.
Source of basic data: DCS Website

It is also important to consider that the dynamics in currency denominational mix make bank withdrawals more nuanced, especially during periods of large shocks. In 2020 when the pandemic struck, the value of bank withdrawals from the BSP grew, largely for precautionary reasons. The growth was largely on account of the two largest denominations i.e., 1000-Piso and 500-Piso (Figure 3a). Volume-wise, however, the growth of bank withdrawals plunged due to low demand for low denomination banknotes and coins, following the imposition of mobility

restrictions. Post-pandemic, volume growth started to rebound, driven by high demand for low denominations against the backdrop of persistently high inflation environment (Figure 3b).

Fig. 3a Growth Rate of the Value of Withdrawals from the BSP of High and Low Denominations (%)

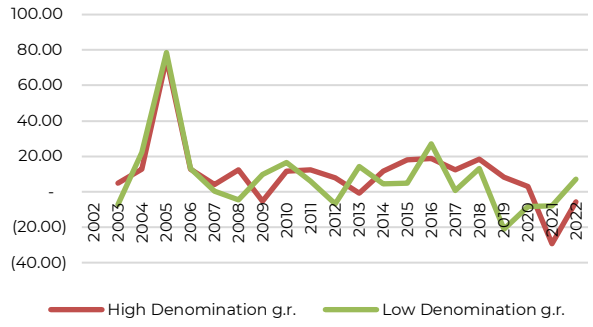
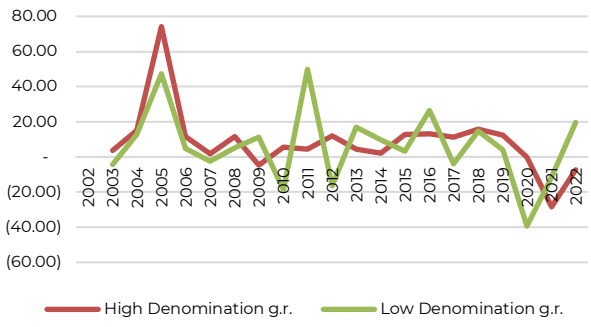


Fig. 3b Growth Rate of the Volume of Withdrawals from the BSP of High and Low Denominations (%)



Authors' estimates. Source of basic data: Regional Operations Sub-Sector

Providentially, the two automated clearing houses (i.e., PESONet and InstaPay) were already fully operating when the pandemic hit. With heightened public concerns on hygiene and mobility restrictions, the availability of digital platforms facilitated wider use of digital payments during the pandemic.

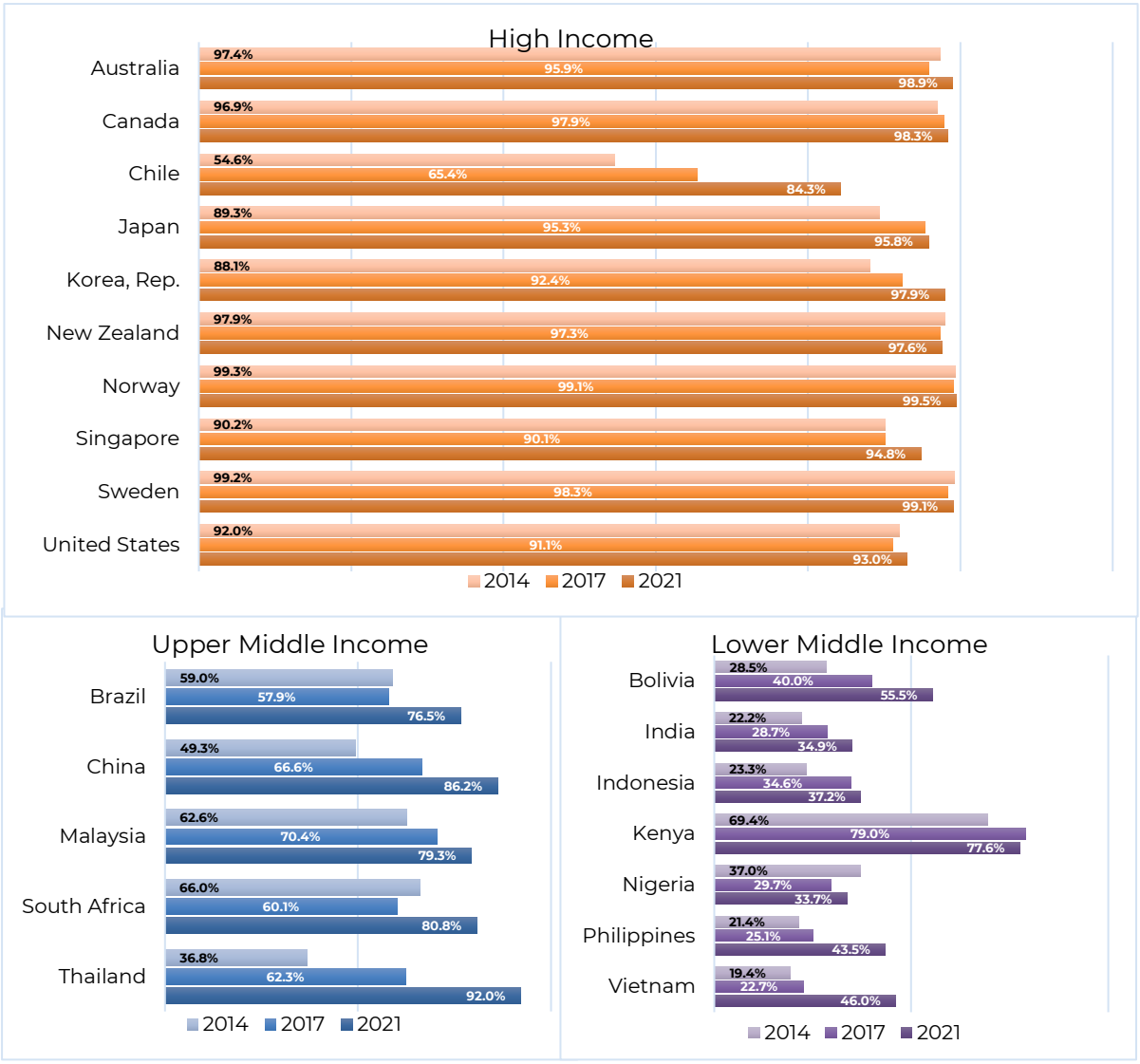
3.2 Retail payments digitalization [2]

Based on the Global Financial Inclusion (Global Findex) database,[3] the share of adults making or receiving digital payments in developing economies grew from 35 percent in 2014 to 57 percent in 2021, while in high-income economies, the share of adults making or receiving digital payments is nearly universal at 95 percent. Moreover, there is a 10-20 percent growth in the use of digital financial services in the upper middle and lower middle-income economies from 2017 to 2021. This rise can be attributed to the impact of the COVID-19 pandemic, as payment digitalization initiatives were strongly implemented worldwide amid large-scale community lockdowns (see Figure 4).

In the area of mobile money, Sub-Saharan Africa dominates, accounting for 70 percent of the global market. In 2021, the digital transactions were driven by the increase in mobile account ownership, almost 50 percent of which were used for digital transactions. With wider network of service providers, mobile money has become highly prevalent in so-called under or unbanked areas. They utilize mobile money to send remittances to family and friends within the country. Further, partnerships of mobile money platforms with banks, health care services, and even agricultural sectors has been observed in the past few years, reinforcing mobile money's key position in the financial ecosystem (Global System for Mobile Communications Association, as cited in Onyango (2022).

[2] Annex 2 synthesizes some notable payment digitalization developments in selected jurisdictions.
[3] Launched by the World Bank in 2011 which provides in-depth data showing how people save, borrow, make payments, and manage risk.

Figure 4. Global Digital Payments Trends



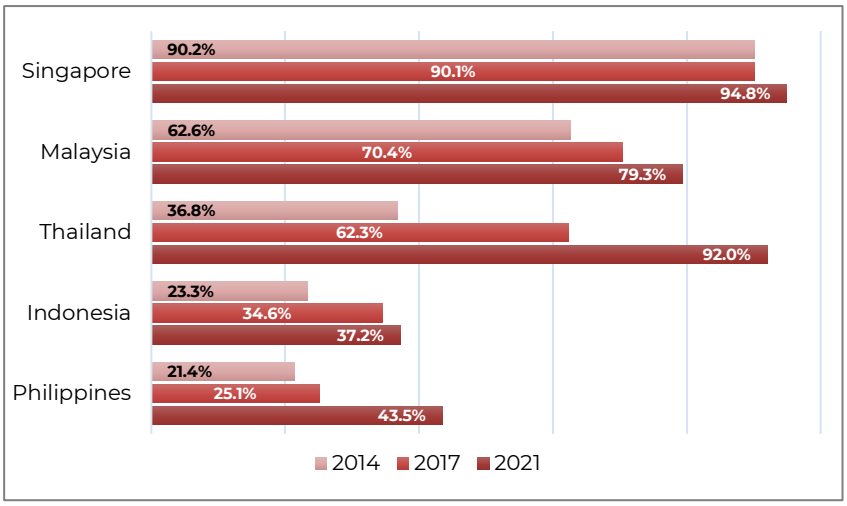
Source: The World Bank, Global Findex Database 2021

Among the ASEAN-5 economies, digital transactions in Thailand tripled from 2014 to 2021 (Figure 6). Other than the effect of the COVID-19 pandemic, this significant increase in digital payment usage is also attributed to the implementation of the Bank of Thailand's (BOT) Payment Systems Roadmap[4] and the National E-Payment Master Plan,[5] aimed at promoting safe, efficient, and smooth operations to support high level of trade and financial transactions. Likewise in Malaysia, the steady growth in digital transactions is reported to be driven by regulatory policy, global development and active competition, greater use of technology, and consumer behavior.

[4] The BOT set up the Payment Systems Committee (PSC) on 27 August 2001 to formulate policies of promoting safety and efficiency in the national payment systems. The PSC approved three roadmaps for the payment systems, which are the Payment Systems Roadmap 2004, the Payment Systems Roadmap 2010 and the Payment Systems Roadmap 2012 - 2016.

[5] The National e-Payment Master Plan is a national strategy created by the Ministry of Finance and the BOT, in cooperation with related government and private entities, in 2015 in order to push the development of payment infrastructures and to promote the use of electronic payment services in all sectors.

Figure 5. ASEAN-5 Digital Transactions



Source: The World Bank, Global Findex Database 2021

In the Philippines, the increase from 25.1 percent to 43.5 percent in digital transactions from 2017-2021 was buoyed by regulatory reforms that were established by the BSP under the National Retail Payment System (NRPS) Framework to enable Filipino consumers, businesses, and the government to smoothly transition to payments digitalization. The value and volume of PESONet (Figures 7a and 7b) and InstaPay transactions (Figures 8a and 8b) spiked during the pandemic and decelerated thereafter.

Fig. 6a Value of Pesonet Transactions

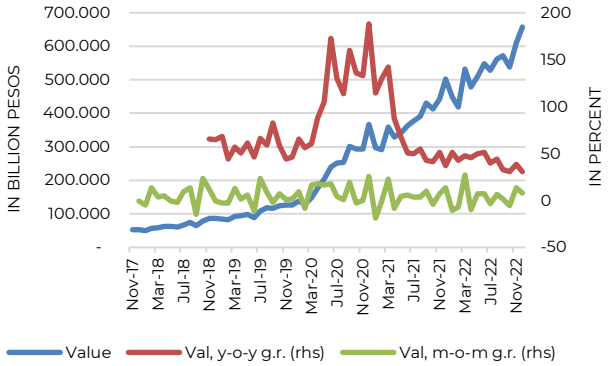


Fig. 6b Volume of Pesonet Transactions

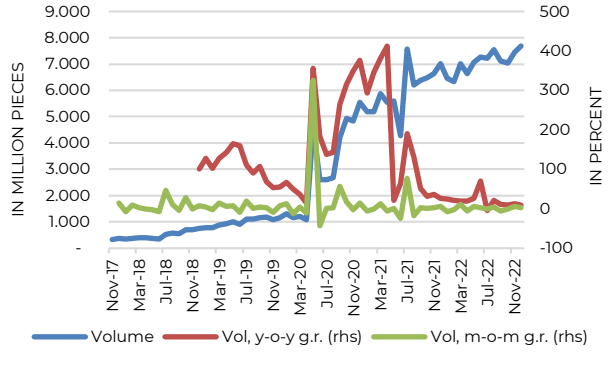


Fig. 7a Value of Instapay Transactions

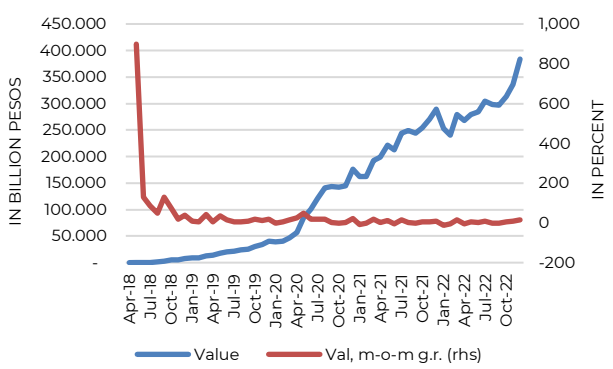
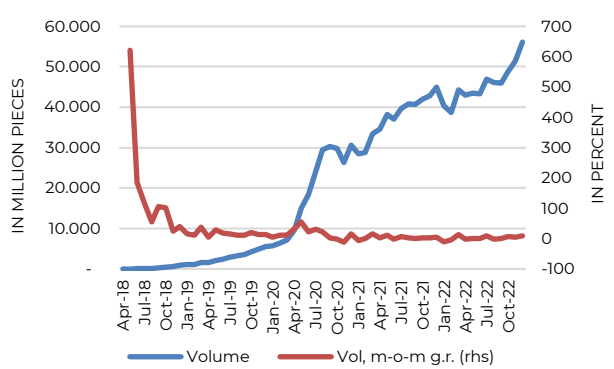


Fig. 7b Volume of Instapay Transactions



Authors' estimates. Source of basic data: BSP Website - Payments and Settlements - National Retail Payment System

The growth in digitalization of retail payments also saw concomitant rise in e-money accounts. Without corresponding bank accounts for cash-in transactions, however, holders of e-money accounts would still require cash to enable digital transactions. Even with bank accounts, income constraints and transaction fee may also hinder end-to-end retail digital transactions. Thus, there is no one-to-one mapping between higher digital payment transactions and reduction in cash usage. It can be reasonably inferred that while there may be some substitution, it is far from complete. In contrast, there may still be high degree of complementarity rather than outright substitution.

As depicted in Figures 8a and 8b, digital payments facilitated by electronic money issuers (EMIs) still entailed substantial cash requirements.

Fig. 8a Value of Cash-in and Cash-out Transactions of EMIs (in bPhP)

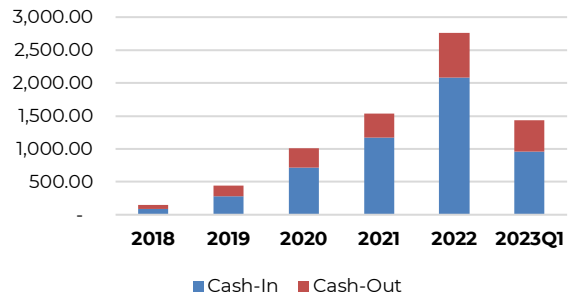
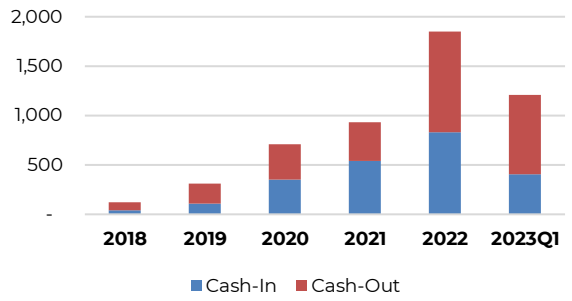


Fig. 8b Volume of Cash-in and Cash-out Transactions of EMIs (in millions)



Authors' estimates
Source of basic data: EMI Reports, PPDD;
Note: Data capture is incomplete for 2019, 2021, 2022; Data for 2023 is up to end-March 2023

Another important consideration is the recognition that institutional, infrastructure, and cultural factors play important roles in determining the magnitude of substitution between physical and digital cash. In terms of competitiveness indicators, we have yet to see in the global ranking the sustained impact of reforms and initiatives. The Philippines ranks lowest among ASEAN-5 economies in terms of ease of doing business score and digital competitiveness index.

Table 2. Ease of Doing Business Scores

	2019	2020
Brunei Darussalam	69.6	70.1
Cambodia	53.8	53.8
China	74.0	77.9
Indonesia	68.2	69.6
Lao PDR	49.8	50.8
Malaysia	81.3	81.5
Myanmar	43.5	46.8
Philippines	60.9	62.8
Singapore	85.8	86.2
South Korea	84.0	84.0
Thailand	79.5	80.1
Vietnam	68.6	69.8

Source: Ease of Doing Business Scores, WB https://archive.doingbusiness.org/en/scores

Table 3. IMD Digital Competitiveness Index 2023

	Rank	Score
China	19	84.4
Hong Kong	10	93.6
Indonesia	45	60.4
Mongolia	63	43.0
Malaysia	33	75.3
Philippines	59	48.3
Singapore	3	97.4
South Korea	6	94.8
Thailand	35	70.5

Source: IMD World Digital Competitiveness Ranking, 2023

IV. Empirical Methodology

The empirical estimation was carried out using aggregate bank currency withdrawals (BCW) from the BSP as the dependent variable, which is the micro-level representation of currency demand. Following the work of Khiaonarong and Humphrey (2022), BCW proxies for ATM or over-the-counter withdrawals by the public. This is premised on banks acting as conduits for currency distribution to the public. Given that it is costly to maintain significant cash holdings, banks are presumed to maintain reasonable level of cash for servicing the public's requirements.

The quantitative impact of digitalization on BCW was estimated on the following specification using simple ordinary least squares method. The payment digitalization undercurrent is seen to induce some substitution, hence, expectation of a negative sign.

$$\boldsymbol{log(BCW_t) = \alpha_0 + \alpha_1 \Delta \log (CIC_t) + \alpha_2 log(Digital_t) + \alpha_3 log(Demography_t) + \epsilon_t}$$

The change in CIC, primarily driven by economic growth and inflation, embodies the impact of macroeconomic developments on currency demand, with an expected positive sign. Further, demographic shifts and their impact on payment preference are represented by birth rates and death rates. The higher inter-generational replacement through higher birth rate and death rate means that an increase in the proportion of younger population, who are adept and comfortable in using digital transactions, reduces preference for cash.

The specification did not anymore control for the pandemic because of the shortness of the digitalization series and occurrence of simultaneous shocks that render it difficult to disentangle its effect. It is important to underscore that the unprecedented nature of the pandemic has led to widespread disruptions in economic, social, and healthcare systems, creating a complex web of interconnected variables that can confound statistical relationships. For instance, the sudden shift to remote work, changes in consumer behavior, and government interventions such as lockdowns have introduced new variables that were not present before the pandemic.

Moreover, the temporal nature of the pandemic, with its evolving phases and varying degrees of severity across different regions and time periods, adds an additional layer of complexity to regression analyses. Apart from the brief period of time for the data series that covers the pandemic, there is still the challenge of disentangling the direct effects of digitalization from the indirect effects mediated by the pandemic-related factors.

V. Data and Presentation of Results

5.1 Data and Limitations of the Study

The digitalization indicator is given by the value of extracted digital component of the monthly aggregate data from the Electronic Payments and Financial Transactions (EPFS) of Philippine banks for the period 2018 to June 2022. The EPFS data were also cleaned to remove cash component and avoid double counting of digital transactions. For 2018-2019, however, only annual EPFS data

are available. As such, temporal disaggregation technique was employed for these years to generate monthly observations. Otherwise, the sample size would not be ideal for regression analysis. Variables are expressed in logarithms, except for the intervention variable. Hence, estimated coefficients correspond to elasticities.

Currency demand at the micro level is given by the aggregate bank currency withdrawals from the BSP. Demographic factors such as birth rate and death rate are obtained from the Census of Population and Housing by the Philippine Statistics Authority (PSA).

Table 4 Summary of regression variables

Variable name	Description	Source of basic data
BCW	Bank currency withdrawals from the BSP, in value	BSP
CIC	Currency in circulation, in value	BSP
Digitalization	Digital payment transactions via Pesonet, Instapay, ATM, Internet, Mobile, and POS transactions, sans cash component, in value	BSP
Birth	Birth rate corresponding to the number of live births per 1,000 people	PSA
Death	Death rate corresponding to the number of deaths per 1,000 people	PSA
Covid	Period of Covid mobility restrictions	dummy indicator that takes value of 1 for the period March 2020 – December 2021

5.2 Estimation Results

Different model specifications were tested to gauge the impact of various digitalization indicators on bank withdrawals. Preliminary results show that holding other factors constant, the elasticity of BCW with respect to digitalization BCW is negative, albeit small, indicating some substitution between cash and digital payments. Proxying for generational payment preference, death rate has a consistent statistically significant negative impact on BCW.

The results signify that for the Philippine case, population age structure and policies that support adoption and ease of access are important in understanding the evolution of the interplay between digitalization and cash usage. The results also underline that notwithstanding substantial policy reforms and uptake of digital transactions, there remains huge scope to expand the reach of digital modes of payment and raise the volume of digital transactions. Policy reforms on credit push payment for person-to-merchant transactions, competitive pricing policy framework, interoperable transit payment systems, feeless micropayments, and liberalization of access to satellites for internet connectivity are important in deepening the traction of payments digitalization. Complementary upgrading of cash cycle infrastructure and management processes is essential in achieving the vision of cash-lite-and-financially inclusive society.

Table 5. Summary of Estimates on the Impact of Digitalization on Bank Currency Withdrawals from the BSP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	11.46 ***	12.88 ***	12.29 ***	12.98 ***	11.42 ***	12.83 ***
Change in CIC	7.21 ***	7.35 ***	7.25 ***	7.10 ***	7.09 ***	6.98 ***
Digitalization	-0.10	-0.19 ***	-0.18 ***	-0.12 *	-0.10	-0.12 *
Birth rate	0.50 **	0.24 **		0.64 ***	0.54 **	0.68 ***
Death rate	-0.41 ***		-0.24 **	-0.43 ***	-0.49 ***	-0.53 ***
Lagged BCW	0.11	0.11	0.11		0.10	
Covid					0.06	0.07
R^2	0.84	0.82	0.84	0.83	0.84	0.83
D.W.	1.95	1.94	1.94	1.86	1.94	1.87

CPID Estimates, as of 20 November 2023
*Note: ***, **, * = significant level at 0.01, 0.05, and 0.1, respectively using Newey West covariance method to account for presence of heteroskedasticity of unknown form. RESET test indicates no specification error.*
Sources of basic data: CPID, Depository Corporations Survey, Department of Economic Statistics; EPFS, Payments Policy Development Department (PPDD), and Philippine Statistics Authority (PSA)

VI. Conclusion and Recommendations

Overall, the literature suggests that digitalization has had some significant impact on cash usage in some jurisdictions, particularly advanced economies. However, there is no evidence yet of massive substitution effect of digitalization on cash usage. This is also borne in the preliminary empirical estimates for the Philippines.

It cannot be denied that sustained inroads in payment digitalization will bring about behavioral shift in cash usage over time. However, the pace and extent of substitution would be contingent on policy reforms aimed at widening access through affordable services, secure infrastructure, and strong privacy protection, among others. While the benefits of increased efficiency and convenience from digital modes of payment are undisputable, it is equally important to think and prepare for mitigating potential downsides such as vulnerability to cyberattacks and the risk of exclusion of individuals who lack the capacity to make an informed and empowered choice about the use of digital payment solutions.

Developing database on payment attitudes of consumers, like Euro's biannual SPACE, would also provide important insights on how the dynamics between cash usage and retail payment digitalization develop over time. This would enable adjustments in strategies to ensure that Filipinos have access to safe and reliable payment systems, including cash. After all, financial inclusion is about empowering Filipinos with safe access to and capacity to choose from wide array of financial services and payment options that suit their lifestyle and preference. Thus, both cash infrastructure and digital payment infrastructure would need to progressively adapt to changing times to ensure that the freedom of choice in payments is safeguarded.

Interesting areas of research being explored are the development of digitalization indices from diverse data sources, and a more nuanced examination of currency demand based on age population and digitalization indices. As society traverses

further into the digital age, understanding how different age groups engage with and adopt digital financial tools becomes imperative. Deeper examination could shed light on the preferences, behaviors, and barriers that influence the utilization of cash across age cohorts. Additionally, examining how digitalization indices affect the tempo of socio-economic and financial inclusion would provide valuable insights for policymakers, financial institutions, and technology developers on how they can tailor their strategies to the changing needs and preferences of diverse demographic segments in an increasingly digitized global landscape.

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Annex 1. Cross-Country Trends

To ensure data comparability, the basic data used are sourced from the IMF International Financial Statistics and Federal Reserve Economic Data.

Fig. 9. CIC-to-GDP, 2000-2021

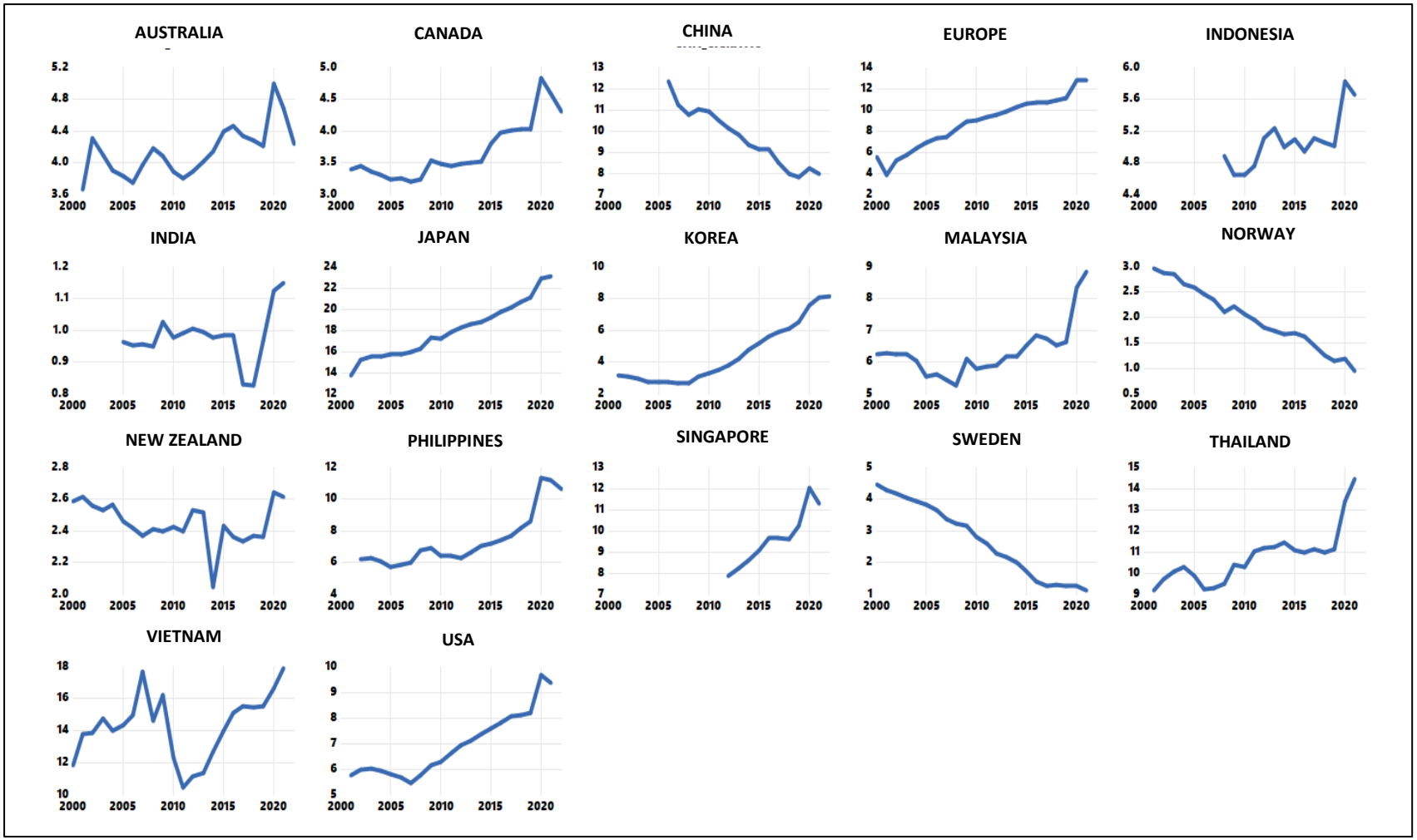


Fig. 10. CIC-to-Consumption, 2000-2021

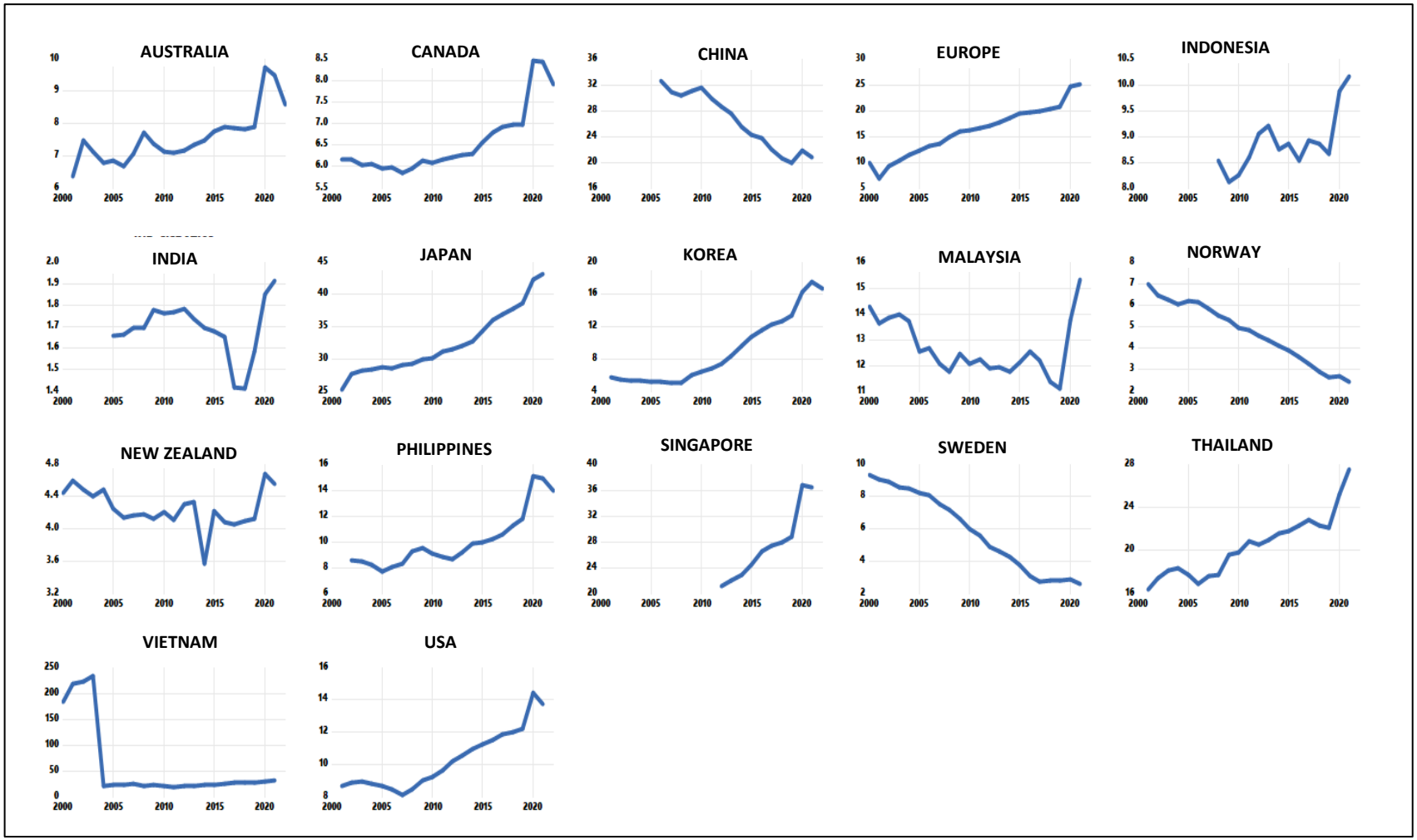


Fig. 11. CIC-to-M1, 2000 – 2021

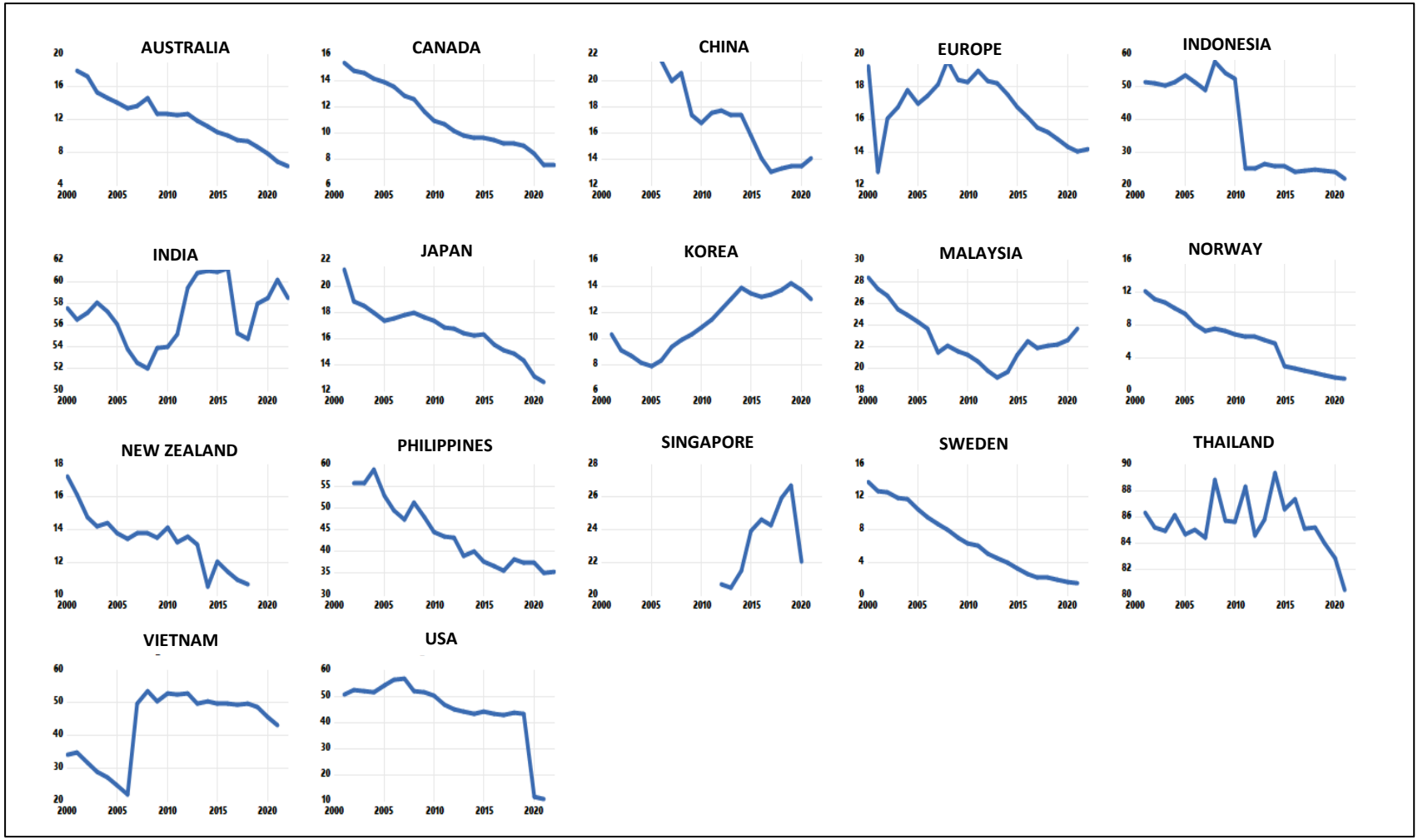
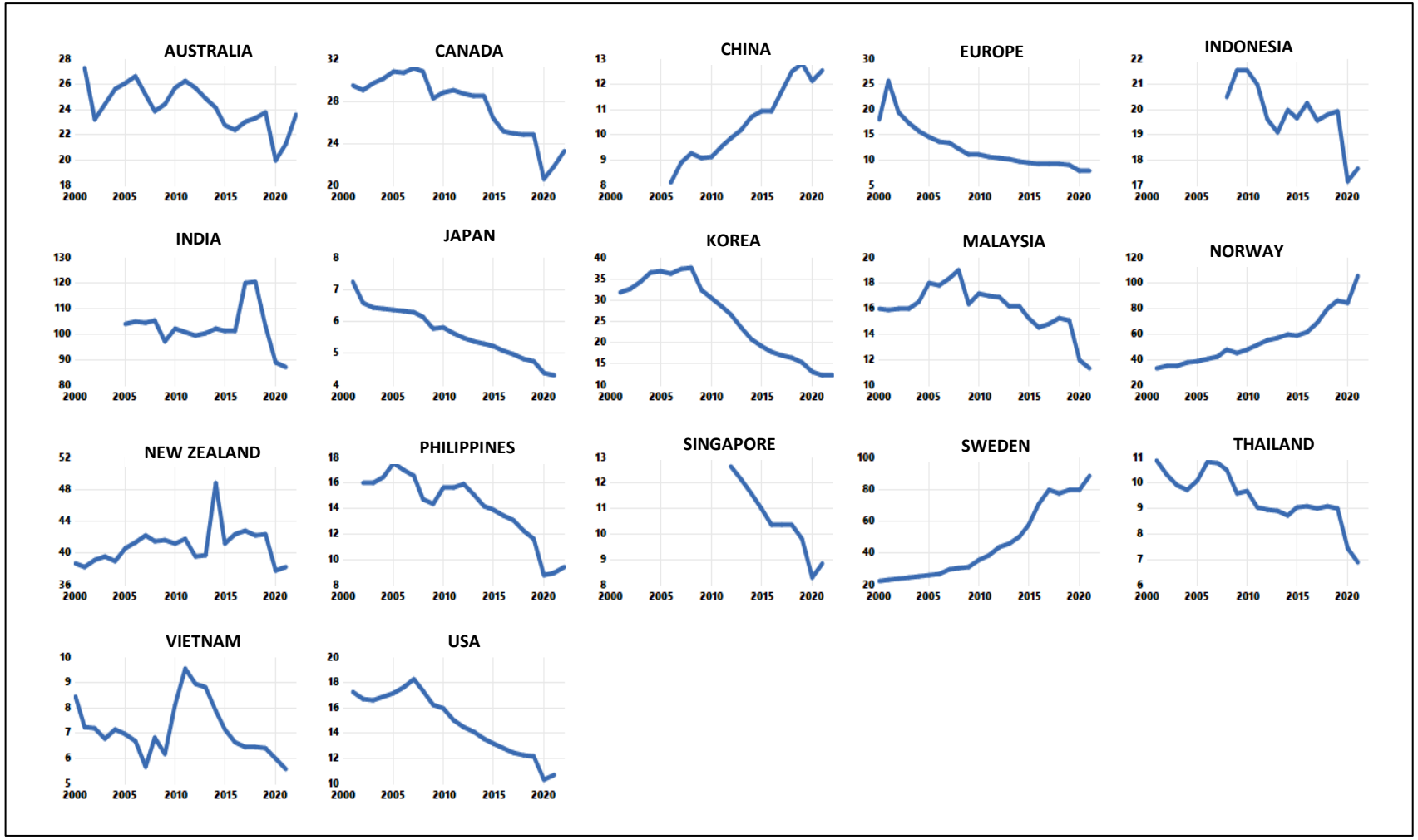


Fig. 12. Velocity of CIC



Annex 2. Cross-Country Comparison of Payments Digitalization Journey

This table provides a snapshot of drivers of payments digitalization in notable cases of rapid payments digitalization.

Sweden	As early as 1950s, when central banking in developing countries was at its infancy, payment cards were already widely used in Sweden. Digitalization of bank accounts shortly followed, and internet infrastructure and internet banking were already set up by the 1990s. By the 2000s, the central bank started to outsource its printing and distribution of cash. These factors provided the fodder for behavioral shift among the consumers.
Norway	Norway plans to eliminate paper money by 2030 (Cash Essentials, n.d.). Norwegian mobile payment app, Vipps, has a reported reach of 69% of their population for online payments. Usage rates for online transactions via mobile have exceeded that of similar advanced economies like France and Germany. On the other hand, there is an equally strong push to retain use of cash for privacy and security reasons.
Kenya	Kenya dominates in mobile money payments, which reached a record of KES 7.9 trillion (or USD 5.7 billion) in 2022 due to increased demand for cashless transactions and establishment new money agents (Wakarima, 2023). This is evident in the success of Safaricom's M-Pesa[6], which has more than 50 million active monthly users across Africa (Armstrong 2022).
Nigeria	Central Bank of Nigeria's cashless policy in 2012 aimed to reduce the amount of physical cash circulating in the economy and to encourage more electronic-based transactions. This paved the way for Nigeria to become Africa's leader in real-time payments and digital payments with 3.7 billion real-time transactions in 2021 (ACI Worldwide Report, 2022). Nigeria's real-time payments scheme, NIBSS Instant Payments, is driven by its leading payments technology company, Interswitch Group, that has been actively driving payments innovation for 20 years (ACI Worldwide Report, 2022).
South Africa	Unlike Kenya and Nigeria, South Africa has been slower to adapt to digitalization of payments, due in part to a more developed traditional banking infrastructure and a lower mobile phone penetration rate (Wachira, 2023). To address this, the South African Reserve Bank (SARB) launched Payshap in 2021, a low-value, real-time digital payment service that stemmed out of its Rapid Payments Programme (RPP)[7] making South Africa a step closer to a more accessible national payment system that will offer safer and faster payment options for all South Africans.
Brazil	The Brazilian government promotes the digital push through Pix, the instant payments platform powered by the Central Bank of Brazil. Since its introduction in 2020, six (6) out of ten (10) Brazilians use it regularly (PYMNTS, 2022). By January 2022, Pix was already used by 71 percent of the Brazilian population. In its latest Brazilian Central Bank reports, Pix generated a monthly volume of BRL 600 million (more than USD 100 million) of funds transferred.

[6] M-Pesa is a mobile banking service which was launched in March 2007

[7] The RPP, which was grounded in the NPS Framework and Strategy: Vision 2025, aims to provide a mobile-friendly instant payments service to assist with financial inclusion and stimulate economic recovery and future growth.

Venezuela	Venezuela's hyperinflation has decimated the country's currency, the bolivar, leading majority of its citizens to live in poverty and lose trust in its currency. Moving to a fully cashless society was deemed favorable to Venezuela as their paper dollars were in too short supply to be useful. Hence, Venezuelans turned to digital payments services to make dollar transactions. However, as Lago (2022) cautioned, Venezuela still needs to have competent management, and develop a reliable, accessible, and pervasive information and communication technology (ICT) infrastructure for the digital economy to be successful.
Chile	The COVID-19 pandemic pushed Chileans to embrace digital payment methods that it has become so entrenched that 62 percent of consumers said they would not patronize a merchant that does not offer some form of digital payment. Bank transfer has also become the most popular digital payment type. These transactions are much less vulnerable to theft and users can easily make payments via banking apps on their smartphones (PYMNTS, 2021). The popularization of digital wallets provides coverage of the industry's means of payment to the digital population in Chile, in addition to providing value-added services to users, such as transfers, savings, and payment of services (The Fintech Times, 2022).
Bolivia	In Bolivia, while internet services remain quite expensive, digital payments and e-commerce transactions keep on growing. The Bolivian government is investing more than 140 million Bolivianos (USD 20.3 million) to build a data center[8] wherein identity information of Bolivians throughout the national territory will be stored. President Luis Arce believes "this project would lead to the digitization of the country" (Swinhoe, 2023).

[8] The new data center would house identity information of the population and support the General Personal Identification Service (Segip) around identity cards and driving licenses.