

Global Cash Index™

a **CARDTRONICS** collaboration

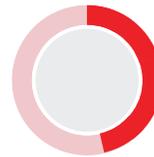
JUNE 2018

ASIA PACIFIC EDITION



\$8.5 TRILLION

Projected value of the Asia Pacific's cash economy by 2021



46.2%

India's projected cash share by 2021

12%

Projected CAGR of the Asia Pacific's eCommerce market between 2018 and 2021

27.3%

Weighted average cash share of the region by 2021

14

Number of bank branches per 100,000 people



CASH USE INDEX CASH USE INDEX

Digital payments might be gaining traction in markets around the world, but cash takes on a very particular economic – and cultural – significance in the Asia Pacific region.

Even with growth in the penetration of smartphones, local consumers continue to prefer and enjoy the convenience of paying for their day-to-day purchases with cold, hard cash. As much as \$5.6 trillion in cash was exchanged between consumers and merchants in the region in 2016, and that figure is expected to reach \$8.5 trillion in 2021.

This growth is even more impressive when we consider that cash exchange as a share of the regional gross domestic product (GDP) is shrinking. The average regional GDP cash share declined by 1.7 percent between 2011 and 2016, and it is expected to drop another 1.8 percent between 2016 and 2021. In other words, there will likely be an increase in the amount of money exchanged via electronic payment channels in addition to regional cash exchange growth.

Digitized commercial exchanges appear to be facilitating – and will likely continue to facilitate – regional economic growth and development, particularly as the banking and financial services industries adapt to evolving consumer demand.



Electronic payment methods are both at the service of and bound by the Asia Pacific's heterogeneous economic composition. Virtual payments are increasing in regional popularity, but the region's extraordinary ethnic, economic and political diversity render the shift toward digital payments geographically variable – and certain nations exhibit more openness to digitization than others.

To understand the intricacies of the Asia Pacific's monetary digitization, it is necessary to examine how each nation-state's cash and digital economy compares to those of its neighbors. Table 1 displays statistics on the region's largest economies and their propensity to use cash.

TABLE 1. SUMMARY STATISTICS, BY COUNTRY

| COUNTRY | POPULATION (MM) | GDP (BILLION DOLLARS) | CASH PROPENSITY | TOTAL CASH GROWTH |
|-----------|-----------------|-----------------------|-----------------|-------------------|
| AUSTRALIA | 24.4 | 1282.0 | 11.2% | -0.7% |
| CHINA | 1382.7 | 10365.4 | 35.9% | 9.2% |
| INDIA | 1299.8 | 2939.5 | 49.3% | 10.5% |
| JAPAN | 127.0 | 5049.4 | 3.4% | -8.5% |
| KOREA | 51.2 | 1458.9 | 4.1% | 2.1% |
| SINGAPORE | 5.6 | 276.3 | 16.7% | 1.6% |

There are trends affecting consumers' use of cash across the region. Dominated by Australia, China, India, Japan, South Korea and Singapore, the Asia Pacific region is home to a massive underbanked population. This segment has historically lacked access to personal bank accounts and credit lines, and digital payment methods have played a large role in helping them manage their personal finances.

This is especially true in China, where payments made via QR codes, WeChat Pay and Alipay are gaining traction. This shift led to the partnership between Tencent and Apple in 2017.¹ Furthermore, China controls 48 percent of the region's GDP, by far the largest share of the Asia Pacific countries. The two next-largest regional economies belong to Japan and India, which account for GDP shares of 24 and 14 percent, respectively. China's propensity for electronic payments or cash therefore has a significant impact on the entire region. As its shoppers go digital so, too, does the surrounding area.

Nevertheless, old habits are hard to break – especially when money is involved. China may be digitizing, but several recent studies suggest that most Asia Pacific consumers still prefer digging through their wallets for coins and bills over relying on digital payments. A 2017 survey conducted by PayPal found 57 percent of East Asian consumers prefer using cash for everyday



transactions, while 24 percent gravitate toward other traditional payment methods.²

The reasons behind this lingering preference for cash vary, though. Many consumers in PayPal's survey cited limited familiarity with newer, alternative payment methods, and others noted privacy concerns as their motivation for steering clear of payment systems that require submission of personal information.³

In addition, previously underbanked individuals are slowly acquiring those much-needed bank accounts, subsequently increasing the demand for ATMs and

¹ Toplin, Jaime. Apple teams up with Tencent in China. Business Insider. 2017. <http://www.businessinsider.com/apple-teams-up-with-tencent-in-china-2017-8>. Accessed May 2018.

² Choudhury, Saheli Roy. Alipay and WeChat Pay may be dominating China, but cash is still king in the rest of Asia, PayPal study finds. CNBC. 2017. <https://www.cnbc.com/2017/08/28/paypal-study-finds-cash-is-still-king-in-asia.html>. Accessed May 2018.

³ Author unknown. PayPal report emphasizes Asia's commitment to cash. PYMNTS. 2017. <https://www.pymnts.com/cash/2017/paypal-report-asia-pacific-cash/>. Accessed May 2018.

the general use of cash. In fact, cash withdrawals in the Philippines, India and Indonesia have all increased in volume since 2011.⁴

Cash still reigns supreme in the Asia Pacific, but the royal court is quickly expanding to include online payment channels. A report by Worldpay revealed that digital payment method usage is increasing in the region, estimating that the eCommerce market will grow by a compound annual growth rate (CAGR) of 12 percent between 2016 and 2021.⁵

This digitization movement has not been entirely organic either, and some national governments have undertaken rash methods to achieve demonetization. The Indian government implemented an aggressive demonetization policy in 2016, with Prime Minister Narendra Modi announcing on Nov. 8 that 86 percent of the country's rupee notes would cease to be legal tender. The highly controversial move threw a wrench in day-to-day operations of businesses big and small, and created unprecedented scarcity of cash in a country which has long adored cash.

The move was widely seen as an attack against rampant corruption and counterfeiting. Digital currency can be easily traced, unlike physical cash, allowing governments to hone in on suspicious market activity and, hopefully, deter illegal transactions.⁶ Modi, much like China's Xi Jinping, is well-known for his verbal commitment to fighting governmental corruption.

Of course, a country with a widely accessible digital payment



structure can also increase its tax revenue by curbing tax evasion.⁷ This topic will be explored in detail in this report's Deep Dive section (p. 11).

Meanwhile, Asia Pacific countries with higher GDPs per capita have been enjoying a relatively organic transition to a digital economy. The word "relatively" is key, however, as the appeal of revenue-generating and traceable digital legal tender has inspired several government-led initiatives in South Korea, Japan and Australia to facilitate implementation of electronic payment systems.⁸

The Global Cash Index™ assesses the importance of cash in some of the largest economies in the Asia Pacific region, examining each economy's reliance on cash according to the amount withdrawn at ATMs, cashback and points of sale. A detailed explanation of our process is provided in the Methodology at the end of this report.

The report distinguishes between two measurements of tangible legal tender: cash use and cash share. Cash use refers to the total number of transactions made with cash. Cash share refers to the total transactions made with cash as a percentage of GDP. The PYMNTS research team examined the political-economic circumstances governing select Asia Pacific nations' drives toward demonetization. In doing so, we hope to demonstrate that effective commercial engagement with merchants and consumers requires an understanding of — and deference to — local attitudes and consumer demands



⁴ Gordon, Colin. Rising ATM use shows case for cash in Asia. NCR. 2017. <https://www.ncr.com/company/blogs/financial/rising-atm-use-shows-case-cash-asia>. Accessed May 2018.

⁵ Author unknown. Global Payments Report 2017. Worldpay. 2017. <https://www.worldpay.com/global/insight/articles/2017-11/global-payments-report-2017>. Accessed May 2018.

⁶ Shepard, Wade. After day 50: The results from India's demonetization campaign are in. Forbes. 2017. <https://www.forbes.com/sites/wadeshepard/2017/01/03/after-day-50-the-results-from-indias-demonetization-campaign-are-in/#99d19c750d19>. Accessed May 2018.

⁷ Rowlatt, Justin. Why India wiped out 86% of its cash overnight. BBC News. 2016. <http://www.bbc.com/news/world-asia-india-37974423>. Accessed May 2018.

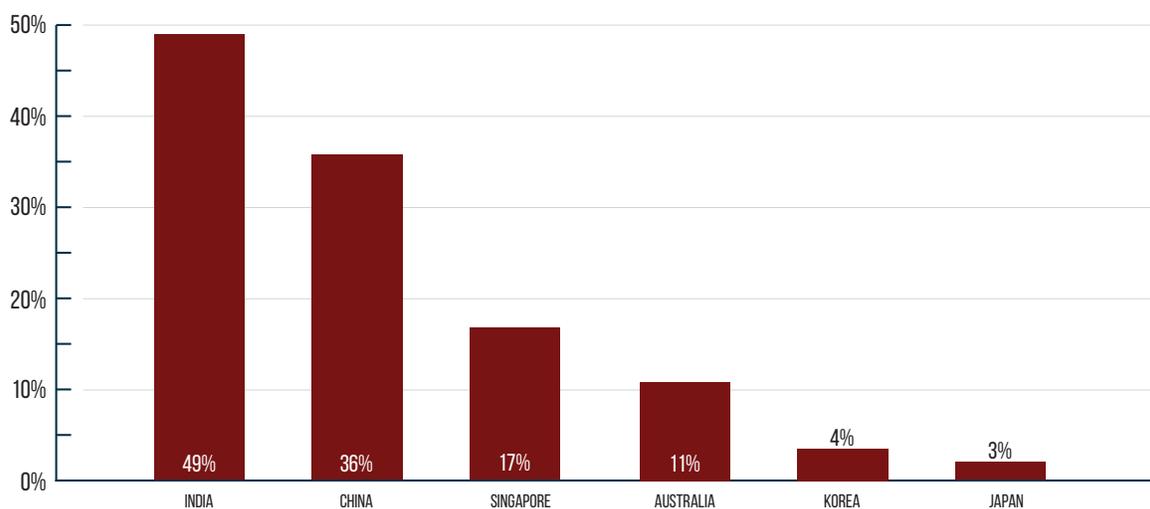
⁸ Wheatley, Alan. Cash is dead, long live cash. IMF Finance & Development. 2017. <http://www.imf.org/external/pubs/ft/fandd/2017/06/wheatley.htm>. Accessed May 2018.

CASH SHARE OF THE WALLET IN THE ASIA PACIFIC

We define “cash share of the wallet” as the amount of cash withdrawn in a country as a share of its annual GDP. This allows us to determine the popularity of physical cash exchange in comparison to that of alternative payment methods. Figure 1 shows the 2016 cash share statistic for selected countries in the Asia Pacific region.

This regional sample was diverse. India and China were the heaviest users of cash, while the least cash dependent were Japan, South Korea, Australia and Singapore. The sample’s medium cash share was 14 percent, and the weighted average was 26 percent.

FIGURE 1. CASH SHARE FOR COUNTRIES IN ASIA PACIFIC IN 2016



China ranks second behind India, meaning its population is still relatively cash-dependent, but its mobile and eWallet market is booming. A study by Analysys reported that China’s mobile payments market volume doubled to \$5 trillion in 2016.⁹ The growth in volume of mobile payments has come with increase in use of Alipay, which is supported by the financial division of eCommerce juggernaut Alibaba, and WeChat Pay, supported by rival Tencent.¹⁰

However, careful inspection of China’s ATM and over-the-counter (OTC) cash withdrawals reveals that cash is still a

hot item within its borders. In fact, ATM withdrawals in the country’s mainland have actually increased in volume in recent years.

This apparent contradiction stems from the vast economic and developmental imbalance between China’s urban and rural populations. Intra-Chinese migration is governed by the tightly regulated Hukou system, which requires rural migrants to obtain governmental approval to settle in larger cities – even if their goal is to find a job.

⁹ Cheng, Evelyn. Cash is already pretty much dead in China as the country lives the future with mobile pay. CNBC. 2017. <https://www.cnbc.com/2017/10/08/china-is-living-the-future-of-mobile-pay-right-now.html>. Accessed May 2018.

¹⁰ A Paulo, Derrick. WeChat phenomenon: How a messaging app helped spark China’s cashless revolution. Channel News Asia. 2017. <https://www.channelnewsasia.com/news/cnainsider/wechat-china-cashless-revolution-9353998>. Accessed May 2018.

A substantial cultural, economic and technological gap between China's urban and rural populations results, with the country's urbanites enjoying widespread internet access and booming job markets. Citizens in rural areas often lack access to such amenities, as it is difficult for technology, money and jobs to travel between districts when their peoples are tied to the ground.¹¹

This urban-rural divide also extends to internet usage. Young Chinese urban professionals generally use WeChat Pay and Alipay for their everyday expenditures, but these payment methods remain unfamiliar and inaccessible to most of China's rural population – many of whom do not use the internet in any capacity. This segment continues to rely heavily on paper notes and coins out of necessity.¹²

China's neighbor and geopolitical rival, India, is one of the most cash-dependent countries on Earth, however. Some studies estimate that as much as 90 percent of all transactions within India's borders are cash based, with most of its merchants refusing to accept any other method of payment.¹³ This context helps demonstrate the impressive ambition of Prime Minister Modi's 2016 demonetization policy.



In contrast with the developing nations of China and India, it appears Japan, South Korea, Australia and Singapore are well on their way toward their own demonetizations. Japan currently enjoys a worldwide reputation as one of the globe's most technologically advanced societies. When it comes to its propensity for electronic payments, this reputation is well-deserved: In some ways, Japan has embraced mobile wallets and prepaid cards even more readily than credit cards.

The Japanese have a societal aversion to credit cards resulting from a widespread fear of overspending. Many of its more optimistic consumers borrowed heavily years ago, when the country's economy was booming, expecting to be able to pay off their debts with relative ease. Japan subsequently descended into an economic slump from which it has yet to fully recover. Those consumers who have just recently been able to pay off their debts understandably want to avoid repeating the process.¹⁴

Consequently, many Japanese-developed electronic payment systems have been based on prepaid accounts. These eliminate the potential to overspend by restricting account holders to spend only as much as they contribute.¹⁵ This phenomenon provides a notable demonstration of how local circumstances can shape both consumer demand and the technology designed to meet that demand.

¹¹ Sheehan, Spencer. China's Hukou Reforms and the urbanization challenge. The Diplomat. 2017. <https://thediplomat.com/2017/02/chinas-hukou-reforms-and-the-urbanization-challenge/>. Accessed May 2018.

¹² Author unknown. How mobile money is spreading. The Economist. 2018. <https://www.economist.com/news/special-report/21741252-payment-industry-undergoing-revolution-how-mobile-money-spreading>. Accessed May 2018.

¹³ Rowlatt, Justin. Why India wiped out 86% of its cash overnight. BBC News. 2016. <http://www.bbc.com/news/world-asia-india-37974423>. Accessed May 2018.

¹⁴ Author unknown. Crisis in slow motion. The Economist 2010. <https://www.economist.com/node/15867844>. Accessed May 2018.

¹⁵ Stark, Harold. Digital wallets are on their way to save the Asia-Pacific. Forbes. 2018. <https://www.forbes.com/sites/haroldstark/2018/01/03/digital-wallets-have-come-to-rescue-asias-unbanked-population/#2a676a0a6682>. Accessed May 2018.

Singapore, another famously tech-savvy East Asian economy, is nevertheless having difficulty convincing its population to switch from cash to electronic payments. Its Prime Minister, Lee Hsien Loong, even devoted a portion of his 2017 National Day Speech toward encouraging citizens and businesses to embrace electronic payments. His government has also launched initiatives to develop a common QR code to facilitate cashless transactions, something one might find in mainland China.

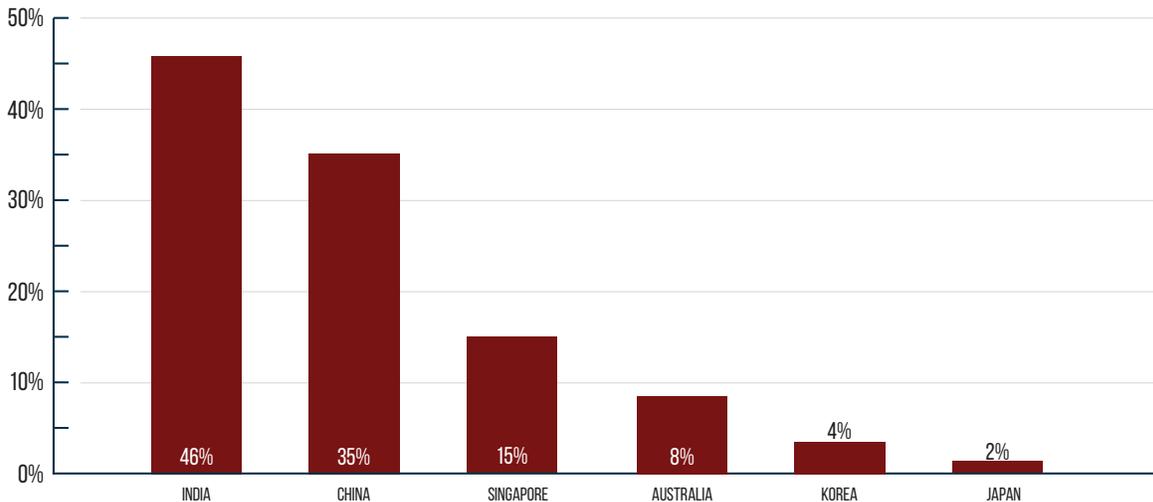
In Singapore's case, it seems proliferation of electronic payment systems has actually led its citizens to shun them. The options are so abundant that no one system has achieved ubiquity. Local businesses and consumers are wary of committing to any electronic payment system, fearing they could become technologically obsolete after a short time, and consider it a burden to spend time familiarizing themselves with so many new technologies.¹⁶ Despite the availability of electronic payment technology, Singaporeans'

commitment to cash persists with an overall cash share of 15.1 percent. Once again, culture's role in local economic development cannot be overlooked.

Figure 2 displays PYMNTS' projections for each country's cash shares until 2021, and Table 2 depicts their cash shares for 2006, 2011, 2016 and 2021. We anticipate that regional cash share will decrease by 1.8 percent by 2021.

We also expect the average cash share weighted by each nation's GDP to grow at a rate of 1.1 percent between 2016 and 2021. This apparent contradiction lies in China's relatively large regional GDP share, and in the fact that its slice of the regional economic pie is expected to grow in the coming years. Several of the Asia Pacific's largest economies' cash shares are expected to grow by 2021, but China's is expected to decrease slightly. That means the overall regional cash share of GDP will likely decrease as well.

FIGURE 2. CASH SHARE PROJECTION IN THE ASIA PACIFIC BY 2021



¹⁶ Cheok, Melissa. For all its tech savvy, Singapore still prefers cash over digital payments. Bloomberg. 2017. <https://www.bloomberg.com/news/articles/2017-09-04/for-all-its-tech-savvy-singapore-still-prefers-cash-over-digital-payments>. Accessed May 2018.

We also predict that the region's median cash share will decline from 14 percent to 12 percent between 2016 and 2021. This seemingly contradictory decline in median, and simultaneous increase in weighted average regional cash share, will result from China's large portion of the region's GDP. We predict that the Middle Kingdom's cash share will reduce in coming years, thereby skewing that of the region, as seen in Table 2.

The same figure shows that other Asia Pacific nations will likely follow suit, with some seeing declines in physical cash use by 2021. India is expected to reduce its cash share from 49 percent to 46 percent in this time,¹⁷ and Japan, South Korea and Australia will see theirs decrease from 3.4 to 1.9 percent, 4.1 to 3.5 percent and 11.2 to 8.4 percent, respectively.

There is no evidence to suggest that cash will lose its appeal anytime soon, however, and we will probably never see a truly cashless society in our lifetime. As digital technology



continues to proliferate, alternative payment options will slowly take on a larger role in national, regional and global economies.

TABLE 2. CASH SHARE PER COUNTRY IN THE ASIA PACIFIC

| COUNTRY | 2001 | 2006 | 2011 | 2016 | 2021 |
|--------------------------|-------|-------|-------|-------|-------|
| AUSTRALIA | -- | 18.9% | 15.0% | 11.2% | 8.4% |
| CHINA | -- | 26.0% | 35.8% | 35.9% | 35.0% |
| INDIA | -- | 29.3% | 52.8% | 49.3% | 46.2% |
| JAPAN | 17.1% | 10.4% | 5.5% | 3.4% | 1.9% |
| KOREA | -- | 7.1% | 4.6% | 4.1% | 3.5% |
| SINGAPORE | -- | 38.9% | 17.2% | 16.7% | 15.1% |
| WEIGHTED AVG. CASH SHARE | | | 24.6% | 26.2% | 27.3% |
| VARIATION 2011-2016 | | | 1.6% | | |
| VARIATION 2016-2021 | | | 1.1% | | |



¹⁷ This estimate does not consider the aggressive demonetization policy India adopted in 2016.

TOTAL CASH USAGE

Each Asia Pacific nation's proportional dependence on cash will likely vary in the coming years, depending on domestic, cultural and economic factors. The relationship between each country's total cash use and its GDP appears to be more straightforward; however, the nominal value of cash exchanged within each country's borders is expected to increase alongside its GDP.

We anticipate that the region's overall annual GDP will increase at a CAGR of 7 percent until 2021, with India growing the fastest at an annual rate of 10.5 percent. This prediction is based on the Asia Pacific's 2011 to 2016 growth rate of 6.3 percent, with its total use of cash increasing at an average rate of 7.9 percent. These numbers suggest a correlation between nominal cash use and GDP growth.

If we assume this correlation will persist, then total cash use is forecast to increase at a CAGR of 8.8 percent until 2021. This is shown in Table 3, which lists historic and predicted nominal amounts of cash spent every five years between 2011 and 2021 and the accompanying growth rates.

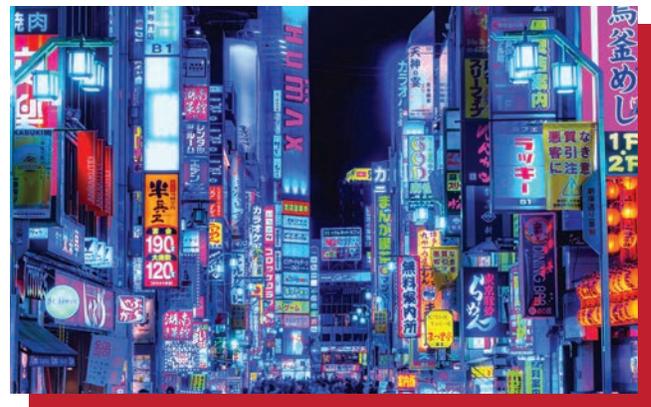
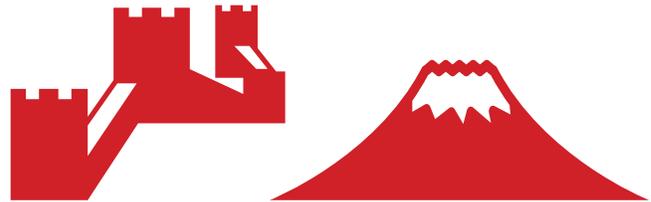


TABLE 3. HISTORICAL AND FORECAST TOTAL CASH USE, BY COUNTRY IN THE ASIA PACIFIC (IN BILLIONS OF DOLLARS)

| COUNTRY | 2001 | 2006 | | 2011 | | 2016 | | 2021 | |
|--------------|----------|----------|---------------|----------|---------------|----------|---------------|----------|---------------|
| | CASH USE | CASH USE | CGR 2006-2001 | CASH USE | CGR 2011-2006 | CASH USE | CGR 2016-2011 | CASH USE | CGR 2021-2016 |
| AUSTRALIA | 0.0 | 147.5 | -- | 164.7 | 2.2% | 142.8 | -2.8% | 137.5 | -0.7% |
| CHINA | 0.0 | 791.6 | -- | 2392.9 | 24.8% | 3677.9 | 9.0% | 5723.8 | 9.2% |
| INDIA | 0.0 | 250.9 | -- | 920.6 | 29.7% | 1494.0 | 10.2% | 2458.2 | 10.5% |
| JAPAN | 846.6 | 517.1 | -9.4% | 253.8 | -13.3% | 174.1 | -7.3% | 111.8 | -8.5% |
| KOREA | 0.0 | 60.8 | -- | 54.6 | -2.1% | 59.4 | 1.7% | 65.8 | 2.1% |
| SINGAPORE | 0.0 | 60.8 | -- | 39.6 | -8.2% | 45.7 | 2.9% | 49.4 | 1.6% |
| TOTAL | | 1828.7 | | 3826.2 | 15.9% | 5594.0 | 7.9% | 8546.5 | 8.8% |

These numbers demonstrate that larger economies tend to have more cash in circulation than smaller ones. The higher the GDP, the more money exchanged on the domestic market, the more revenue generated and the more cash consumers and businesses have to spend. The demand for digital payment systems is very real, but so is the demand for old-fashioned, printed legal tender – and the preference for one over the other depends on consumer circumstance. Even with digital payment systems available, consumers and merchants still desire the option to pay with physical cash.

In other words, digital payment systems are not necessarily competing with physical cash, and economic growth does not appear to be a zero-sum game. Rather, the use of both cash and digital payment methods are simultaneously increasing, both playing a role in each nation's economic growth and development.



DEEP DIVE

INDIA AND THE ISSUANCE OF HIGH DENOMINATION BANKNOTES IN THE ASIA PACIFIC

In our Global Cash Report, Americas Edition, we analyzed how countries in the Americas performed on the issuance of high-denomination bank notes. This topic holds significance in the Asia Pacific, especially in India, where we see a relationship with cash that is swiftly and radically evolving. This Deep Dive presented an opportunity to examine not only the extent of demonetization's impacts on India's economy, but also that of its effects on neighboring Southeast Asian nations.

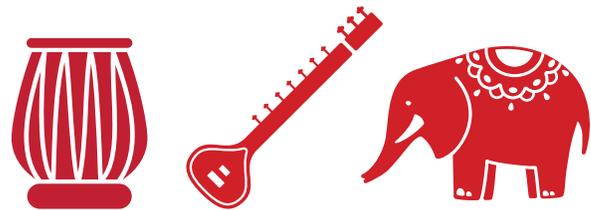
It seems a decrease in the emission of high-denomination bills generally indicates a nation's intent to eliminate cash. There are various reasons for this. One, cash tends to be the preferred payment method for the discretion it offers, and high-value notes are particularly useful for facilitating trade in the underground economy.¹⁸

This is a well-known and intensely studied phenomenon. Harvard economist Kenneth Rogoff's book, *The Curse of Cash*, expands on what he calls a "reverse money laundering process," by which bank notes issued by central banks find their way into the hands of individuals running illegal businesses.¹⁹ It is therefore assumed that decreasing the volume of high-value notes in circulation could help curb illegal market activity.

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Cash can also function as more than a mere medium of economic exchange, serving as a sort of zero-interest bond that potentially competes against other economic assets.

When an economy slumps, central banks can stimulate economic growth by lowering their interest rates to below zero. When this happens, the funds in consumer savings accounts automatically deplete, pitting printed cash against the money in the accounts. Savers are penalized for saving, and borrowers are incentivized to borrow more to avoid losing the funds saved in the bank. This is a strong-arm approach, but an approach, nonetheless



¹⁸ Buter, William H. The case for getting rid of high-denomination bank notes. Asian Review, 2017. <https://asia.nikkei.com/Economy/The-case-for-getting-rid-of-high-denomination-bank-notes>. Accessed May 2018.

¹⁹ Rogoff, Kenneth. *The Curse of Cash*. New Jersey: Princeton University Press, 2016.

In these circumstances, bank patrons who do not wish to borrow money and want to avoid being penalized for saving it can simply withdraw their money from the bank in the form of physical cash. This ensures they are not at risk of losing the money they prefer not to spend. In this way, printed legal tender can compete against a central bank's economic stimulus policies, with some citizens preferring to withdraw cash to avoid volatile interest rates. High-denomination notes make this strategy much easier, rendering a central bank's economic policies less effective.

Decreasing the volume of high-denomination notes in circulation can make the storage of printed legal tender more cumbersome, meaning citizens become less inclined to prefer cash over bank bonds. This provides central banks with more flexibility to stimulate demand, as relying on smaller denomination notes can also improve their control over a struggling economy.²⁰

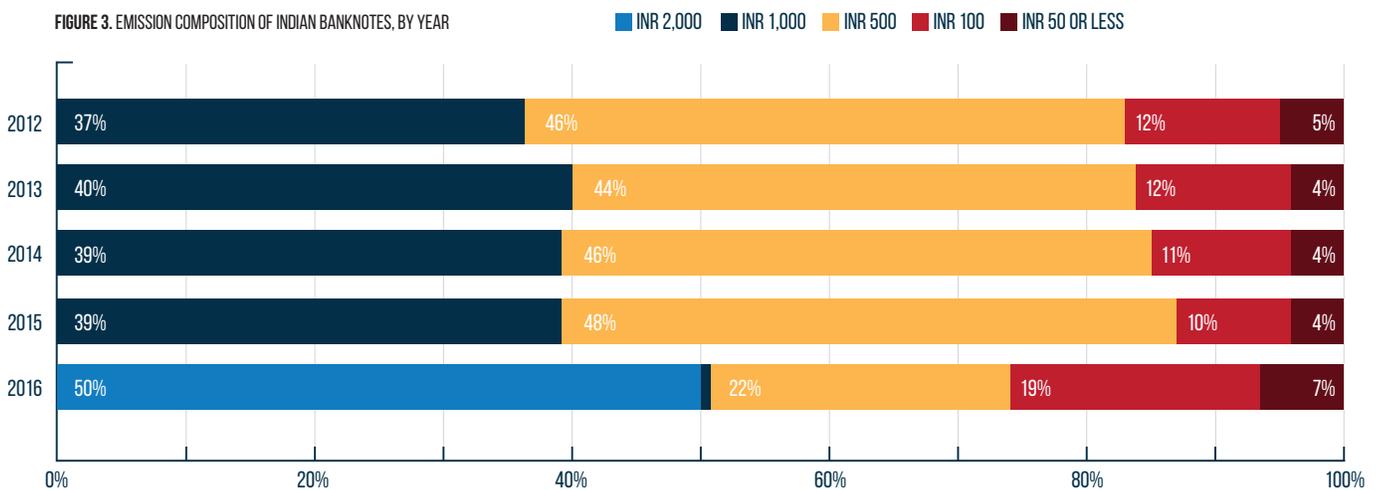
Central banks, therefore, have an incentive to promote electronic payment systems' replacement of traditional cash. Several studies²¹ have confirmed that halting the printing of paper notes would allow governments to obtain more

revenue due to decreased tax evasion and corresponding underground market activities.

In fact, the revenue governments would stand to gain would surpass the opportunity costs they would incur from no longer being able to sell printed cash, also called seigniorage – the difference between a note's production cost and its economic worth.²² "Selling" bank notes is one of the routes by which national governments have historically added to their financial bottom lines. In other words, these governments, including India's, are incentivized to steer their economies towards digitization – at least in theory.

India and like-minded counties in the Asia Pacific provide a unique opportunity to examine how this economic principle works in practice. When Indian Prime Minister Narendra Modi announced on Nov. 8, 2016, that all 1,000- and 500-rupee notes would expire in 50 days, he also decreed that they would be replaced by 2,000- and new 500-rupee notes. This meant switching out as much as 86 percent of all cash in circulation. For reference, 500 Indian rupees is currently valued at approximately \$7.45 USD, and 2,000 Indian rupees translates to roughly \$29.79 USD.

FIGURE 3. EMISSION COMPOSITION OF INDIAN BANKNOTES, BY YEAR



²⁰ Davidson, Jacob. Why killing cash makes sense. Money. 2016. <http://time.com/money/4307717/getting-rid-of-cash/>. Accessed May 2018.

²¹ Ibid.

²² Rogoff, Kenneth. The Curse of Cash. New Jersey: Princeton University Press. 2016.

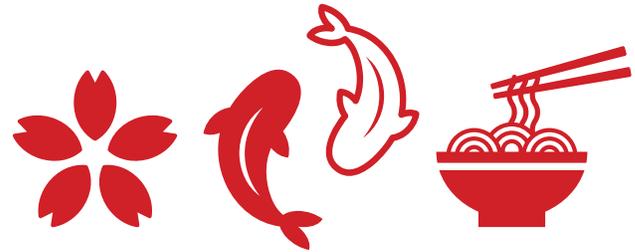
This measure was designed to accomplish several objectives: reduce the amount of money on the black market, increase profits obtained via taxable revenue, fight corruption and counterfeit notes in circulation, and increase personal and institutional accountability in the informal, cash-driven economy.²³

The goal of Prime Minister Modi's initiative was not to reduce the volume of high-denomination bank notes in India's economy. After all, the 1,000-rupee bills scheduled to be removed from circulation were actually replaced by 2,000-rupee bills, as seen in Figure 3.

In 2015, the 1,000-rupee note was the most valuable denomination of printed Indian legal tender, representing 39 percent of all banknotes. They all but disappeared after the demonetization policy took effect in late 2016. In their place, the Indian government issued a high volume of 2,000-rupee notes, which accounted for 50 percent of all notes in circulation. Meanwhile, the portion of available legal cash devoted to 500-rupee notes decreased from 87 percent in 2015 to 73 percent in 2016. In theory, this was not so much a removal of large banknotes as a rearrangement of their circulatory composition.

So, what happened to the banknotes that the Prime Minister's policy suddenly rendered useless? The answer is the most interesting – and amusing – outcome of his best-laid plans.

For the expired notes to be exchanged at banks located throughout India, citizens would have to personally redeem them. Because many of those banknotes were thought to be circulated in the black market, the government reportedly did not expect a high percentage of them to be redeemed



at all, lest their owners expose themselves as black market operators and suffer legal retribution. Officials therefore estimated that only about one-third of the notes would be redeemed, meaning the central bank would not need to reimburse their owners. In theory, this plan would save the Indian government a considerable sum.

In practice, however, Indian banks received as much as 99 percent of the expiring banknotes to be exchanged.²⁴ Needless to say, the practical implications of this policy deviated considerably from their intended effects. The Indian economy still benefited from its Prime Minister's ambitious demonetization policy, though, but in very unexpected ways.

First, the volume of India's electronic and other alternative payment systems surged as demonetization progressed. Second, the number of personal bank accounts and ePayment services increased, as the latter often requires the opening of an accompanying bank account. Companies such as Paytm and Oxigen Wallet reported increases in their consumer bases in the aftermath of Prime Minister Modi's historic declaration.²⁵



²³ Dutt D'Cunha, Suparna. One year later: India's demonetization move proves too costly an experiment. Forbes. 2017. <https://www.forbes.com/sites/suparnadutt/2017/11/07/one-year-later-indias-demonetization-move-proves-too-costly-an-experiment/#39a10a64378a>. Accessed May 2018.

²⁴ Dutt D'Cunha, Suparna. One year later: India's demonetization moves prove too costly an experiment. Forbes. 2017. <https://www.forbes.com/sites/suparnadutt/2017/11/07/one-year-later-indias-demonetization-move-proves-too-costly-an-experiment/#39a10a64378a>. Accessed May 2018.

²⁵ Shepard, Wade. A cashless future is the real goal of India's demonetization move. Forbes. 2016. <https://www.forbes.com/sites/wadeshepard/2016/12/14/inside-indias-cashless-revolution/#702168e44d12>. Accessed May 2018.

There is another, often overlooked element to this story. India's growing use of electronic payment systems, along with the radical reconstruction of its cash economy, indicates a shift in its relationship with cash. It is possible that Indian citizens will increasingly regard cash as less of a means of transaction and more as an economic asset – due, in part, to demonetization.

As nations see an increase in the domestic use of mobile and other electronic payments, they experience a corresponding decrease in the demand for printed bills. This is because growth in electronic payment adoption can come with a decline in use of hard cash. For now, though, India continues to be very much a cash-based economy, and the Indian government has announced plans to increase the number of high-denomination bills in circulation – and it is not alone.



What issuance of high-denomination bills in other Asia Pacific nations means for the regional economy

Australia, South Korea and Japan have all followed India's lead, enacting similar measures to increase the share of high-denomination bills in domestic circulation – though few have been as ambitious. Australia increased the share of 100-note bills in its economy from 42 percent in 2012 to 46 percent in 2016. This was a small change, but it nevertheless represents yet another Asia Pacific economy increasing its percentage of high-denomination notes.

FIGURE 4. EMISSION COMPOSITION OF AUSTRALIAN BANKNOTES, BY YEAR



Japan has a particularly unbalanced banknote emission, with 10,000-yen bills accounting for approximately 92 percent of all printed legal tender. This is an extreme example, and analogous to 92 percent of all cash in the United States being \$100 bills, suggesting that many Japanese citizens are storing their cash under the proverbial mattress. Proportionally, this composition has not changed much since 2012, although there was a slight increase in the relative volume of 10,000-yen notes by 2016.



FIGURE 5. EMISSION COMPOSITION OF JAPANESE BANKNOTES, BY YEAR

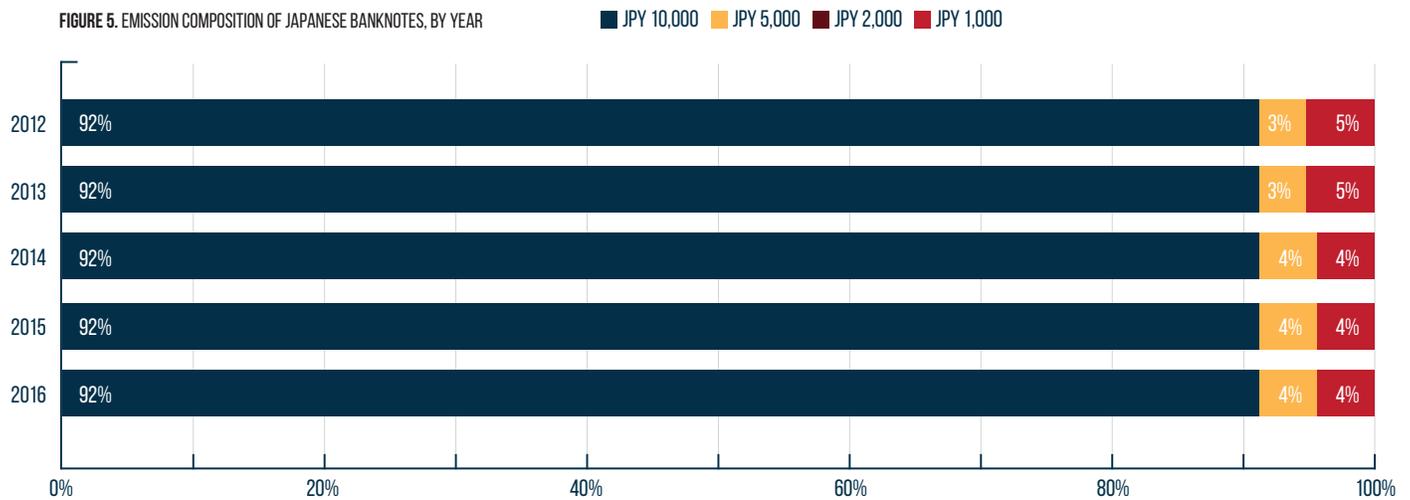
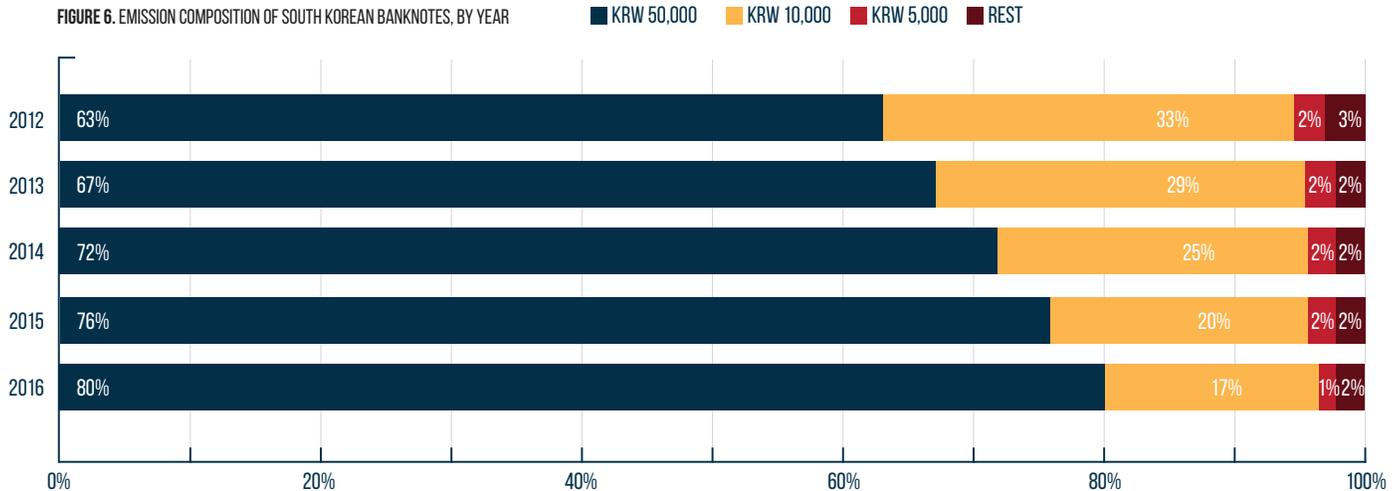


FIGURE 6. EMISSION COMPOSITION OF SOUTH KOREAN BANKNOTES, BY YEAR



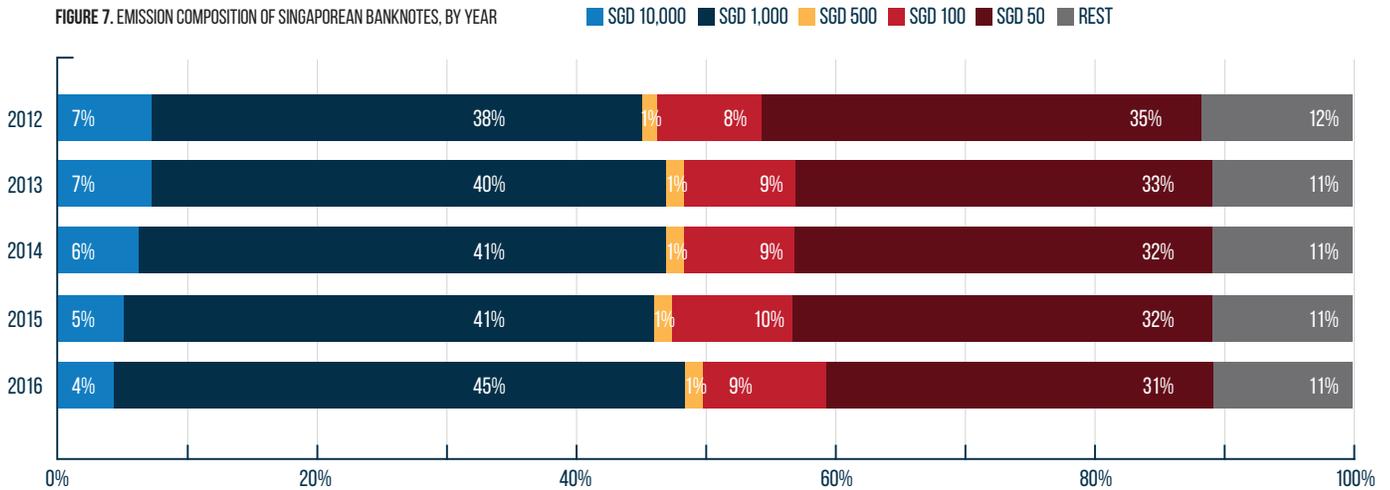
South Korea's situation is similar but less extreme. Issuance of its highest denomination banknotes increased from 63 percent to 80 percent between 2012 and 2016. This data is visualized in Figure 6.

These countries each have very particular economic circumstances dictating their citizens' financial habits. Drawing erroneous comparisons between them would be misleading and impractical, but the similarities in their evolving cash emission rates are undeniable. In each case, electronic payments are making in-roads alongside increases in high-denomination banknotes, suggesting cash is increasingly being seen as a financial asset to be used for long-term storage rather than as a means of payment. In short, these nations appear to be at different points along the same continuum toward economic digitization.

As with most economic trends, however, there is a regional outlier: Singapore. The emission of the country's highest denomination bill, the 10,000-note Singaporean dollar bill (currently valued at approximately \$7,500 USD), decreased from 7 percent to 4 percent between 2012 and 2016, as seen in Figure 7. That said, there has been a simultaneous increase in the relative volume of the country's second-highest denomination banknote, the 1,000-Singaporean dollar bill (worth approximately \$750 USD).



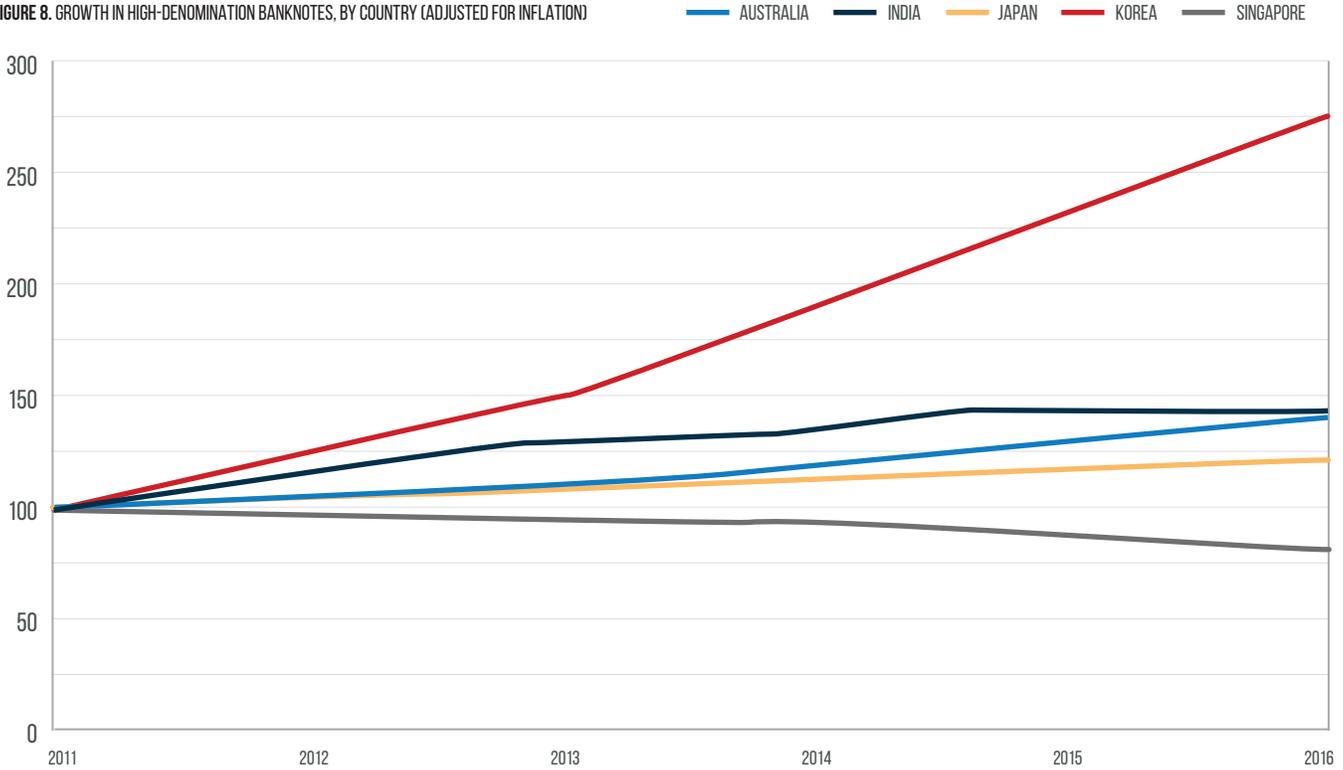
FIGURE 7. EMISSION COMPOSITION OF SINGAPOREAN BANKNOTES, BY YEAR



We have so far only examined the relative growth in the issuance of different Asia Pacific countries' high-denomination banknotes – that is, how it relates to the growth of banknotes of other values. Figure 8 shows the real growth of high-denomination banknotes in selected Asia Pacific countries. In other words, this represents their inflation-adjusted growth rates. We do not have reliable data on China's high-denomination banknote emissions.



FIGURE 8. GROWTH IN HIGH-DENOMINATION BANKNOTES, BY COUNTRY (ADJUSTED FOR INFLATION)



When adjusted for inflation, we still observe an overall increase in high-denomination bank note issuance among all major Asia Pacific economies, with the notable exception of Singapore. This trend likely ties in with the region's overall economic growth. As explored earlier in this report, growth tends to be correlated with an increase in the nominal amount of bills in circulation, even if the proportion of the economy devoted to cash transactions is decreasing.



ATM AND BANK BRANCHES AVAILABILITY INDEX

In this report, we calculated both ATM and bank branch index scores for every country in the Asia Pacific region, as well as for the region as a whole. Each index corresponds to a calculation involving several variables, including population, GDP per capita, participation of ATM, OTC and cash in GDP, and ATM and bank branches per every 100,00 people. This calculation takes the form of a score between 0 and 100. The higher the index score, the more ATMs or bank branches per person.

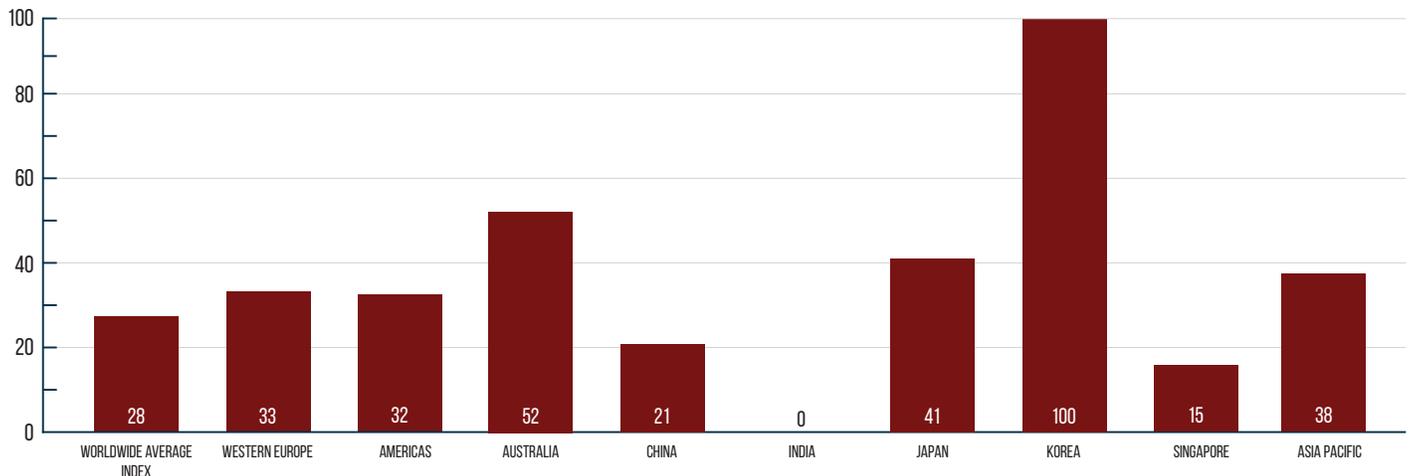
The ATM Availability Index found that the Asia Pacific region, with a score of 38, scored similarly to the Americas (32) and Western Europe (33), and was slightly above the worldwide average of 28.

However, we also found extreme intraregional variation between the scores of each nation. This is meant in the most literal sense: South Korea scored a perfect 100, and India scored 0. The reason for this variation is straightforward: India has a large rural population with little-to-no access to banks and a thriving, informal cash-based economy. South Korea is India's polar opposite: a country with a large urban population and wide access to banks and accompanying financial services.



Between these two extremes, the countries exhibiting high-end scores were Australia and Japan, which scored 52 and 41, respectively. Singapore, meanwhile, scored 15 points.

FIGURE 9. ATM AVERAGE INDEX SCORE ■ ATM AVG. INDEX



The region's scores were considerably lower on the Bank Branch Availability Index, earning only 13 points as a region. Comparatively, Western Europe and the Americas scored 52 and 23, respectively, and the worldwide average came in at 35. The top performing countries in this region were Australia (27) and South Korea (14). Singapore scored a 4.



FIGURE 10. BANK BRANCHES AVERAGE INDEX SCORE ■ BANK BRANCHES AVG. INDEX

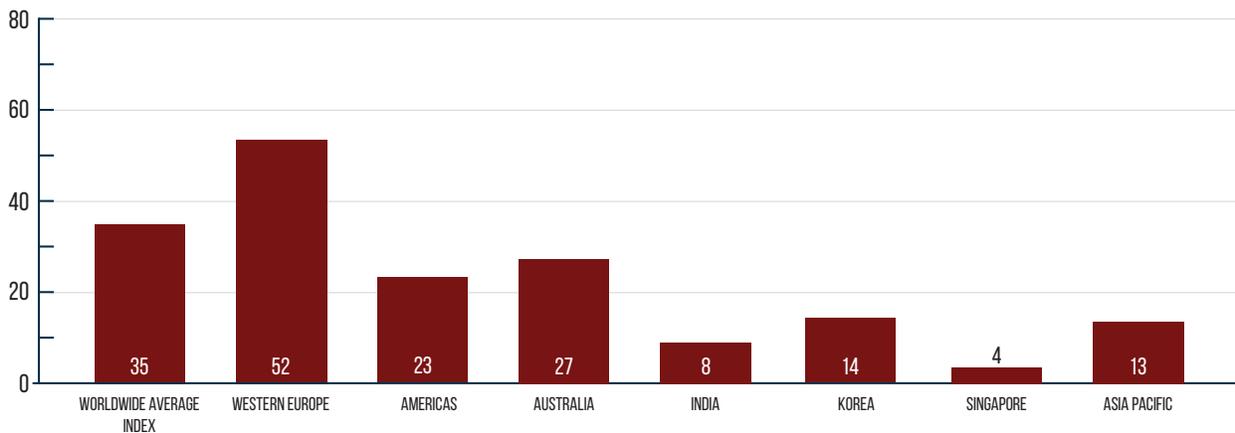


Table 4 depicts an assortment of data points used to calculate these two Indexes, showing that the GDP per capita of the Asia Pacific region was lower than that of Western Europe, the most economically developed region on Earth. The Americas, whose nations are diverse in economic structure and composition, enjoyed a similar regional GDP per capita to that of the Asia Pacific.

Conversely, the Asia Pacific region's cash share was high compared to the Americas and Western Europe, scoring 26.2 percent compared to its Western counterparts' 14 and 18 percent, respectively. Again, the Asia Pacific includes a host of heterogeneous countries, and their individual cash shares of GDP varied widely. Countries like Japan are doing away with traditional cash, and countries like India are clinging to it.

We postulate that the region's relatively high cash share of GDP corresponds with its high ATM share, which is well above those of Western Europe and the Americas. Its OTC share was smaller than that of any other region, however, and also fell well short of the worldwide average of about 10 percent.

Asia Pacific's ATM-to-person ratio was above the world average, with 102 ATMs per 100,000 people – on par with those of Western Europe and the Americas at 90 and 89, respectively. There was a great deal of intraregional variety in this metric, though. South Korea, surprisingly, had as many as 240 ATMs per 100,000 people, while India had only 16.

At first glance, it may appear contradictory to state that the Asia Pacific had both an ATM-per-person ratio comparable to that of Western Europe and the Americas and an ATM share that is much higher. Why would less cash-dependent countries have more ATMs per person?

When we take the region's high cash share into account, this makes perfect sense. People in the Asia Pacific have less access to electronic payment methods, overall, and therefore need to rely more on printed legal tender. This leads them to withdraw more cash from ATMs than their Western counterparts, who also have access to alternative payment systems. ATMs have more uses than just the dispensing of cash, performing other banking functions such as transfers and payment of services.

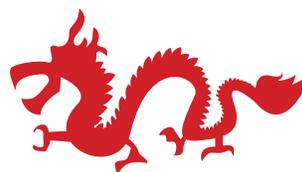
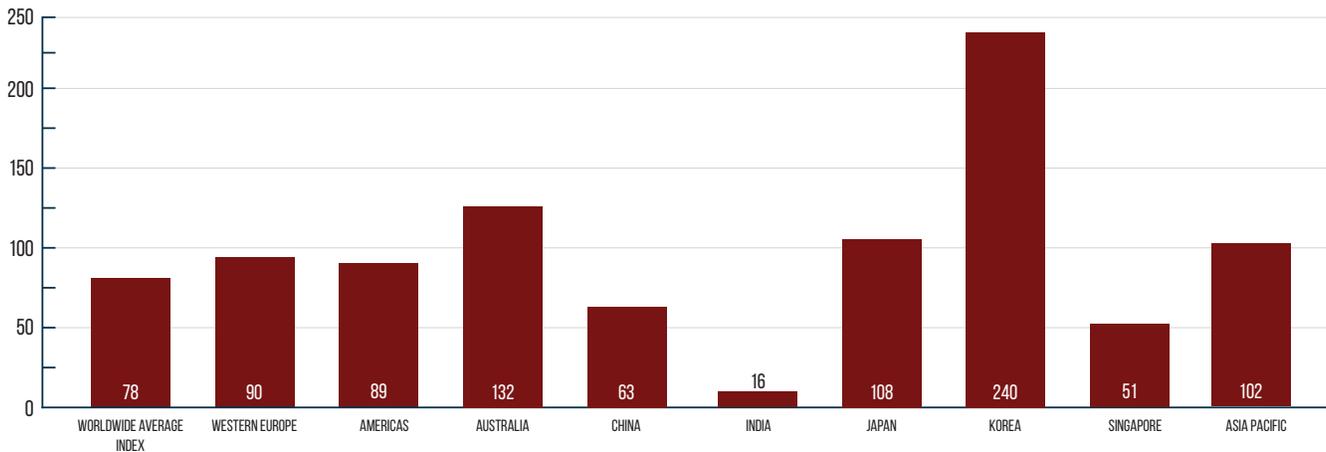


TABLE 4. COMPARISON OF ATM AND BANK BRANCHES AVAILABILITY INDEXES

| | WORLDWIDE AVG. INDEX | WESTERN EUROPE | AMERICAS | AUSTRALIA | CHINA | INDIA | JAPAN | KOREA | SINGAPORE | ASIA PACIFIC |
|---------------------------|----------------------|----------------|----------|-----------|-------|-------|-------|-------|-----------|--------------|
| ATM AVG. INDEX | 28 | 33 | 32 | 52 | 21 | 0 | 41 | 100 | 15 | 38 |
| BANK BRANCHES AVG. INDEX | 35 | 52 | 23 | 27 | | 8 | | 14 | 4 | 13 |
| POPULATION | 108 | 25 | 219 | 24 | 1373 | 1293 | 127 | 51 | 6 | 479 |
| GDP PER CAP (AVG.) | 28 | 43 | 25 | 49 | 7 | 2 | 35 | 25 | 50 | 28 |
| CASH SHARE | 24.6% | 17.9% | 14.1% | 11.2% | 35.9% | 49.3% | 3.4% | 4.1% | 32.8% | 26.2% |
| POS PER 100,000 | 1957 | 2416 | 2484 | 3994 | 1662 | 107 | 1627 | | 3116 | 2101 |
| ATM PER 100,000 | 78 | 90 | 89 | 132 | 63 | 16 | 108 | 240 | 51 | 102 |
| BANK BRANCHES PER 100,000 | 28 | 38 | 20 | 23 | | 11 | | 15 | 9 | 14 |

FIGURE 11. NUMBER OF ATMS PER 100,000 PEOPLE ■ ATM PER 100,000



CONCLUSION



The Asia Pacific region has a dynamic economy, one which is characterized by heterogeneous populations and diverse monetary circumstances. Of the few common features that seem to tie it together are the growth in use of electronic payment methods along with growth in the use of cash.

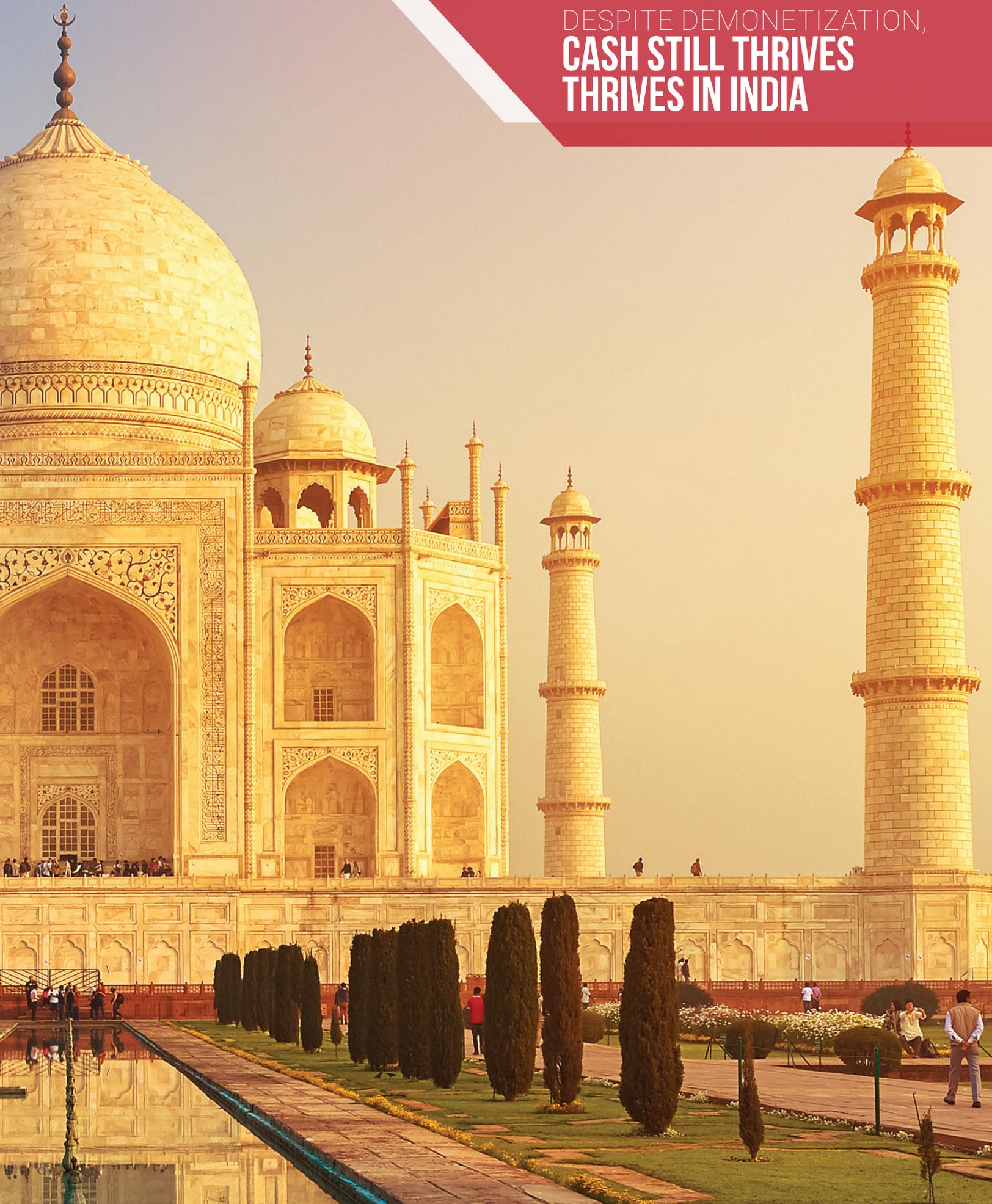
The region's nations vary, however, both in terms of governmental policy and citizen interest in electronic payment methods. Some countries' citizens, like the Chinese, are more open to adopting digital payment methods, while those of others, like Singapore, seem hesitant. Some populations will more readily welcome companies offering alternative payment options, and some won't — regardless of the policies pursued by their governments.

Furthermore, the type of payment being offered to consumers will trigger varying reactions from these dissimilar consumer bases. After all, prepaid services will likely appeal to Japanese consumers, but offering QR-based or mobile services will likely be more familiar to potential customers in China. Meanwhile, India's citizens appear to be warming up open to alternative payment methods, but continue to be heavily dependent on cash.

Any organization intending to engage commercially with Asia Pacific nations would be advised to take these local characteristics into consideration, and to alter their approach accordingly to maximize their consumers' user experiences.

FEATURE STORY

DESPITE DEMONETIZATION,
CASH STILL THRIVES
THRIVES IN INDIA





The Indian government's effort to demonetize has hit some speed bumps — namely, a lack of preparedness and an unwillingness among the country's citizens to fold up their cash. It issued a ban on the nation's higher denomination 500- and 1000-rupee notes in November 2016, essentially deeming 86 percent of its currency invalid.

While the ban was intended to shift India into the digital economy fast lane, improve tax revenues and crackdown on corruption, cash continues to play a strong role in India nearly two years into effect. In fact, the currency in circulation was valued at Rs 17.78 trillion as of February 2018, roughly [99 percent](#) of the value of notes in circulation prior to demonetization, according to the Reserve Bank of India (RBI).

To put it mildly, India's push to go cashless has so far fallen short of its goal. Part of the reason, according to Hugo Erken and Wim Boonstra, senior economists at Netherlands-based financial services firm [Rabobank](#), is that the government did not lay the proper groundwork for the transition to digital currency before implementing the cash ban.

PYMNTS recently caught up with Erken and Boonstra for

insights into India's demonetization experiment, including the lessons the country can learn from European nations that have successfully pursued their own demonetization plans.

Cash lessons from around the globe

The Indian government failed to truly understand how other nations pursued their own demonetization policies, Boonstra noted. [Norway](#) and [Sweden](#), for example, are close to becoming entirely cashless, but their shift didn't happen overnight. This plan has taken roughly 50 years to realize, and that longer transformation was helped by increased access to digital banking solutions.

"If [citizens] don't have a bank account, then, by definition, every transaction will be cash-based," he said.

According to both economists, a key problem with India's demonetization policy was that the government's plan was simply unrealistic. Given that India's currency in circulation is at roughly the same levels it saw before cash ban went into effect, the term "demonetization" does not accurately apply to how the Indian economic policy has played out, Boonstra explained.

Forgetting the demonetization preconditions

One of the reasons cash is still used so often in India is that the government misjudged the complexity involved in transitioning its citizens away from the payment method. Where it went wrong, in Boonstra's estimation, was in neglecting to properly lay the foundation to prepare citizens and businesses for the shift.

For India's demonetization policy to work, several preconditions should have been met before the note ban was implemented. The first is that more of the country's impacted citizens should have had a digital bank account prior to the move. Roughly [40 percent](#) of the nation's population was still underbanked following the demonetization attempt last year.

"Everyone should have a bank account," Boonstra said. "Only then can you reduce the number of cash transactions."

But, promoting digital bank accounts was just the first precondition. Once access to them expands, the government would have needed to urge companies to pay employee salaries using direct deposit, then gradually phase out larger denomination bills.

The Indian government didn't succeed in meeting any of the preconditions, and ultimately couldn't successfully steer the country away from its affinity for cash.

Where cash still thrives

Erken correctly [predicted](#) that India's economy would experience an economic slowdown after its demonetization

“The role of cash is still substantial in the Indian economy.”

policy went into effect, a forecast that was ultimately proven correct when India's GDP growth slipped to 5.7 percent in Q1 2017.

He arrived at the conclusion by reviewing several factors influencing the country's economy, like purchases of two-wheeled vehicles, such as motorbikes. These popular vehicles saw a [decline](#) in sales after demonetization went into effect, a downward trend which spoke to the power of cash in India – and to the enormous challenges involved in truly getting the nation on board with the shift.

"Cash transactions are still very [important] in India," Erken said. "Many vehicles are bought with cash, and the drop [in purchases] was similar to the drop in money supply."

But the nation's automotive market is not the only vertical in which cash is heavily utilized. It is also a crucial financial tool for India's retailers and farmers.

"In the agricultural community, cash is important as well," he added. "All kinds of farmers are still relying on cash to buy products like seeds, fertilizer, that kind of stuff. They also pay their employees in cash, and receive their revenues in cash."



Farmers also tend to live in rural areas, where digital banking infrastructure is not easily available, making it more difficult to get Indian citizens to embrace demonetization.

“In that sense, the role of cash is still substantial in the Indian economy,” Erken said.

Shifting culture of cash

Cash will likely continue to play a significant role in India’s economy for the foreseeable future, according to Erken, but digital financial solutions — including banking tools, business accounts and offerings to enable digital retail — are bound to become more affordable and broadly accepted in the economy.

India’s government faces an additional challenge in its quest to implement an effective demonetization policy, though, and that includes changing cultural attitudes about cash.

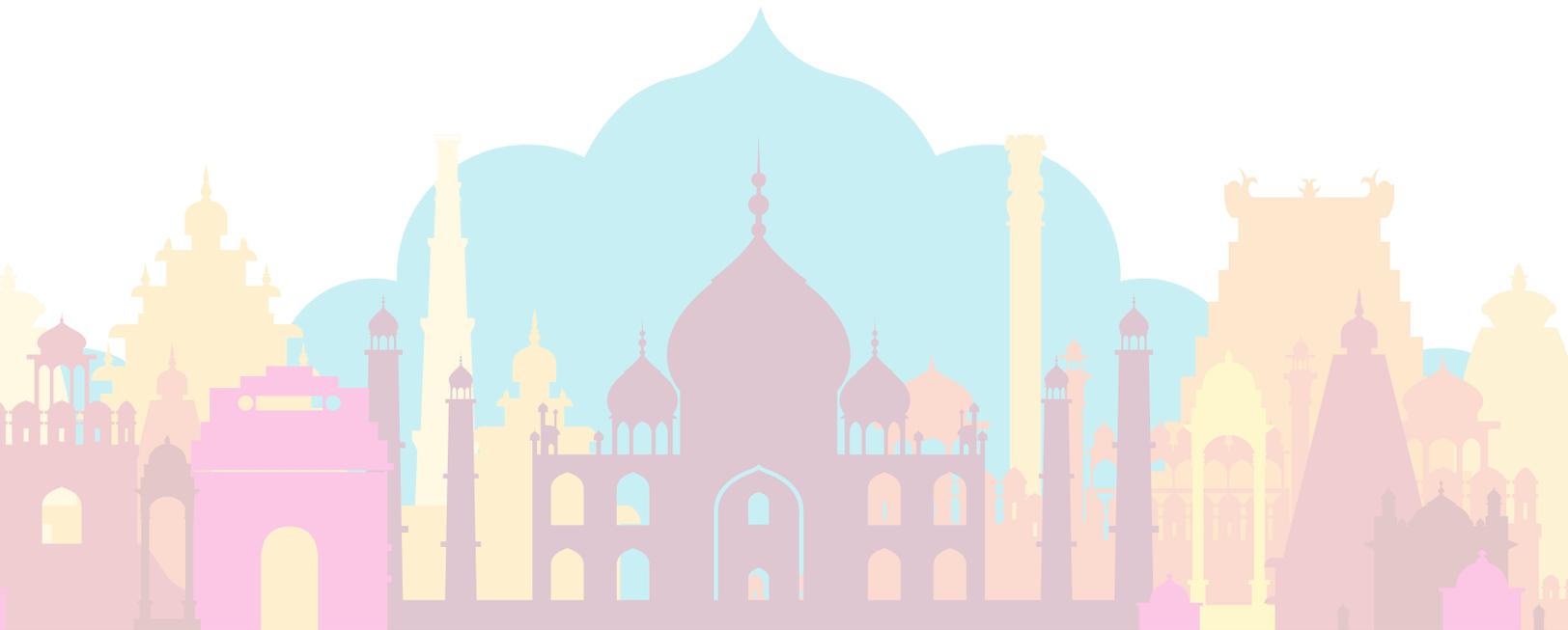
Erken noted that cash still plays a central role in everyday purchases in Germany, far more so than in neighboring nations like the Netherlands, Norway and Sweden. The country wants to hold onto cash to [protect](#) its financial privacy, and to avoid the unknown challenges of a cashless society.

“Germans have something with cash,” Erkan said. “It’s a huge emotional thing.”

Understanding Germany’s cultural and emotional attitudes toward cash offers insight into India’s own attachments. Cultural attitudes take years to adjust, and this means cash is likely going to continue to maintain a heavy influence for the foreseeable future, Boonstra noted.

“An overwhelming part of the Indian economy is cash-based,” he said. “This cannot be changed in a couple years.”

With or without the government’s demonetization policy, it appears India’s grip on cash remains as strong as ever.



METHODOLOGY AND DATA

The PYMNTS.com Global Cash Index, powered by Cardtronics, analyzes overall cash usage and projected trends over the next five years for 40 countries around the world that have provided sufficient data to make estimates

on cash usage. These countries are divided into four regions – Western Europe, Eastern Europe, The Americas and Asia and Other – and we will publish reports reviewing cash share and usage focusing on one region each quarter.

| WESTERN EUROPE | EASTERN EUROPE | THE AMERICAS | ASIA AND OTHER |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  AUSTRIA |  BULGARIA |  UNITED STATES |  AUSTRALIA |
|  BELGIUM |  CROATIA |  MEXICO |  CHINA |
|  FINLAND |  CZECH REPUBLIC |  BRAZIL |  INDIA |
|  FRANCE |  ESTONIA | |  JAPAN |
|  GERMANY |  GREECE | |  SOUTH KOREA |
|  IRELAND |  HUNGARY | |  SINGAPORE |
|  ITALY |  LATVIA | |  SAUDI ARABIA |
|  LUXEMBOURG |  LITHUANIA | |  SOUTH AFRICA |
|  MALTA |  POLAND | | |
|  NETHERLANDS |  ROMANIA | | |
|  PORTUGAL |  RUSSIA | | |
|  SPAIN |  SLOVAKIA | | |
|  SWEDEN |  SLOVENIA | | |
|  SWITZERLAND |  TURKEY | | |
|  UNITED KINGDOM | | | |

- The first factor is cash share, or the total amount of purchases made with cash. We measure cash share as the total amount of cash used by a country divided by the country's annual GDP. The total cash used by citizens of the country is assumed to be equal to the total amount of cash withdrawn at ATM machines plus the total amount of cash withdrawn OTC at bank branches in the country.
- The second factor is how the overall economy is growing. The total cash usage is estimated as the total cash share multiplied by the country's GDP. As a country's economy develops and grows, more overall spending occurs, which means more cash spending is occurring.

We have found that total cash share is decreasing in most countries. Because both population and GDP are growing, however, total cash usage is also still growing (albeit at rates lower than the GDP).

To calculate the results in this report, we performed the following for each country:

- Gathered historic and projected data.
- Estimated OTC cash withdrawals for countries that do not report this data.
- Calculated historic cash share.
- Estimated cash share for 2015 and beyond.
- Estimated total cash usage for 2015 forward and beyond.

Gathered historic and projected data.

We collected historic data for each country from 2000 to 2014, including information regarding total population, GDP, cash withdrawals from ATM and OTC, total card spending and payments infrastructure, such as the number of ATM machines and bank branches.²⁶ We also gathered data to project cash usage, including projected GDP and projected population by age group.²⁷

We gathered data from 2000 through 2014 and used as much as was available. We have data on population and GDP for all years, and data on cash withdrawals and payments infrastructure for many but not all years.

For each country, we collected projections for the GDP and for population by age group. This data comes from the International Monetary Fund (IMF) and World Bank, respectively, and is from the same source as the historic data. Population projections are available every five years, and we used a linear interpolation for the years that are not reported. GDP projections are by year, and if we needed time periods beyond the last projected data point, we assumed that final GDP growth rate will be consistent over time.

Estimated OTC cash withdrawals for countries that do not report this data.

As described, cash share is defined as the total cash withdrawals from ATM machines plus total OTC cash withdrawals. We have selected the 40 countries in our analysis based on the availability of sufficient cash withdrawal data. The 40 included countries produced at least some data on the level of ATM withdrawals each year. If ATM withdrawals are not available, the country is excluded from our analysis.

While all 40 countries provided ATM data, only 12 provided data on OTC cash withdrawals. This means that for the other 28 countries, we had to estimate the level of OTC withdrawals. We did this by looking at each of our 28 target countries (the ones for which we need to estimate OTC withdrawals) and selecting a comparable country from the 12 countries that did provide data (we refer to these as our potential comparable countries).

The estimation procedure is done in the following four steps:

- **ONE:** Calculate the OTC-to-ATM ratio for each of the 12 potential countries that do provide OTC data. These are all potentially comparable countries. This is a simple calculation of dividing the level of OTC withdrawals by the level of ATM withdrawals for each year where data is available.

²⁶ Data on Population is from the World Bank [<http://data.worldbank.org/indicator/SP.POP.TOTL>], Data on GDP is from the IMF [<http://www.imf.org/external/ns/cs.aspx?id=28>], and data on cash with draws, card spending and the payments infrastructure is from the Bank of International Settlements [<http://www.bis.org/cpmi/publ/d142.pdf>] or from the European Central Bank [https://www.ecb.europa.eu/pub/pdf/other/art2_mb201104en_pp79-90en.pdf]

²⁷ Data on projected population is from the World Bank, and projected GDP is from the IMF. If these are the same, combine these footnotes into a single footnote.

- **TWO:** Estimate the logarithmic trend of the OTC to ATM ratio from 2000 through 2014 for each of the potentially

$$\overline{\left(\frac{OTC}{ATM}\right)_{Year}} = \alpha + \beta \times LN(Year) + \epsilon$$

comparable countries.²⁸

We do this to remove any data jumps or movements that are due to factors specific to the country. This trend gives us a complete trend of the OTC to ATM ratio for each year from 2000 through 2014.

- **THREE:** Select the potential comparable country. For each country that does not have OTC data (target

country), we select the most comparable country from the list of countries that do provide OTC data. This country is selected by comparing the trends and levels in five different variables:

- ATM withdrawals as a percentage of GDP
- Card spending as a percentage of GDP
- Bank branches per 1,000 people
- ATM terminals per 1,000 people
- POS terminals per 1,000 people

For each potential comparable country, we calculate a difference in levels and a difference in changes over an eight-year period from 2006 to 2014. These are calculated as follows:

$$Difference\ in\ levels = \sqrt{\sum_{i=2006}^{2014} (Variable_{Comparable/i} - Variable_{Target/i})^2}$$

$$Difference\ in\ changes = \sqrt{\sum_{i=2006}^{2014} \left(\frac{Variable_{Comparable/i}}{Variable_{Comparable/i-1}} - \frac{Variable_{Target/i}}{Variable_{Target/i-1}} \right)^2}$$

In the formula above, i is the year and "Variable" refers to each of the five variables listed above. We perform this calculation for each of the 28 target countries against each of the 12 potential comparable countries. This provides a difference in levels and a difference in changes for each of the five variables for each combination of a target country and comparable comparison country. We then assign a weight of two-thirds to the difference in levels and one-third difference in changes, and for each target and comparable country, we calculate a weighted average difference:

$$\begin{aligned} \text{Weighted Average Difference}_{ij} \\ = 0.667 * Avg\ difference\ in\ levels + 0.333 * Avg\ difference\ in\ changes \end{aligned}$$

In this equation, i is the target country and j is the comparable country.

For each target country, we then have a weighted average difference for each of the 12 potential comparable countries. The comparable country for each target is selected as the potential comparable country with the smallest difference for each target

²⁸ For three countries, the reduction in OTC-to-ATM ratio was so strong that we used a polynomial trend. These three countries were Latvia, Romania and Slovakia.

country. The following table shows the comparable country selected for each of the 28 target countries.

| NUMBER | TARGET | COMPARABLE |
|--------|---------------|----------------|
| 1 | AUSTRALIA | UNITED KINGDOM |
| 2 | AUSTRIA | ITALY |
| 3 | BELGIUM | NETHERLANDS |
| 4 | BRAZIL | MALTA |
| 5 | BULGARIA | HUNGARY |
| 6 | CHINA | SLOVAKIA |
| 7 | CROATIA | MALTA |
| 8 | ESTONIA | NETHERLANDS |
| 9 | FINLAND | NETHERLANDS |
| 10 | FRANCE | ITALY |
| 11 | GREECE | HUNGARY |
| 12 | INDIA | SLOVAKIA |
| 13 | IRELAND | LATVIA |
| 14 | JAPAN | GERMANY |
| 15 | KOREA | UNITED KINGDOM |
| 16 | LUXEMBOURG | ITALY |
| 17 | MEXICO | CZECH REPUBLIC |
| 18 | POLAND | HUNGARY |
| 19 | PORTUGAL | UNITED KINGDOM |
| 20 | RUSSIA | ROMANIA |
| 21 | SAUDI ARABIA | SLOVAKIA |
| 22 | SINGAPORE | NETHERLANDS |
| 23 | SLOVENIA | HUNGARY |
| 24 | SOUTH AFRICA | SLOVAKIA |
| 25 | SWEDEN | NETHERLANDS |
| 26 | SWITZERLAND | NETHERLANDS |
| 27 | TURKEY | MALTA |
| 28 | UNITED STATES | UNITED KINGDOM |

- FOUR:** Calculate the estimated level of OTC withdrawals for the target country. We have 28 target countries for which we are estimating the level of OTC withdrawals. For nine of these countries, we do have data on the OTC-to-ATM ratio for a single year but have no other data that can allow us to understand how it's trending.

For these countries, we adjust the value of $\left(\frac{OTC}{ATM}\right)_{Year}$

such that it matches the known OTC-to-ATM ratio. This has the result of shifting the OTC-to-ATM ratio for every year up or down such that our estimated trend line passes through the known point. For the other 19 countries, we assume that this adjustment is equal to zero or that the OTC-to-ATM ratio for the selected comparable country is the same as the OTC-to-ATM ratio for the target country.

For each target country, we then take this adjusted value of $\left(\frac{OTC}{ATM}\right)_{Year}$ for the selected comparable country and use it to calculate the level of OTC withdrawals for each from 2000 through 2014.

$$OTC\ Withdrawals_{Year} = \left(\frac{OTC}{ATM}\right)_{Year} \times ATM\ Withdrawals_{Year}$$

The following table identifies the 12 countries for which OTC data is reported, the nine countries for which we have to estimate the trend based on a comparable country but for which we do have a single known data point to set the level of OTC withdrawals, and the 19 countries for which the trend and OTC-to-ATM ratio are derived from the comparable country.

ASIA AND OTHER

| NO | COUNTRY | SOURCE OF OTC DATA | | |
|----|--------------|--------------------|------------------|------------------|
| | | OTC DATA AVAILABLE | KNOWN DATA POINT | VALUE IS DERIVED |
| 1 | AUSTRALIA | | ✓ | |
| 2 | CHINA | | | ✓ |
| 3 | INDIA | | | ✓ |
| 4 | JAPAN | | | ✓ |
| 5 | SOUTH KOREA | | | ✓ |
| 6 | SINGAPORE | | | ✓ |
| 7 | SAUDI ARABIA | | | ✓ |
| 8 | SOUTH AFRICA | | | ✓ |

WESTERN EUROPE

| NO | COUNTRY | SOURCE OF OTC DATA | | |
|----|----------------|--------------------|------------------|------------------|
| | | OTC DATA AVAILABLE | KNOWN DATA POINT | VALUE IS DERIVED |
| 1 | AUSTRIA | | | ✓ |
| 2 | BELGIUM | | | ✓ |
| 3 | FINLAND | | ✓ | |
| 4 | FRANCE | | ✓ | |
| 5 | GERMANY | ✓ | | |
| 6 | IRELAND | | ✓ | |
| 7 | ITALY | ✓ | | |
| 8 | LUXEMBOURG | | | ✓ |
| 9 | MALTA | ✓ | | |
| 10 | NETHERLANDS | ✓ | | |
| 11 | PORTUGAL | | ✓ | |
| 12 | SPAIN | ✓ | | |
| 13 | SWEDEN | | ✓ | |
| 14 | SWITZERLAND | | | ✓ |
| 15 | UNITED KINGDOM | ✓ | | |

EASTERN EUROPE

| NO | COUNTRY | SOURCE OF OTC DATA | | |
|----|----------------|--------------------|------------------|------------------|
| | | OTC DATA AVAILABLE | KNOWN DATA POINT | VALUE IS DERIVED |
| 1 | BULGARIA | | | ✓ |
| 2 | CROATIA | | ✓ | |
| 3 | CZECH REPUBLIC | ✓ | | |
| 4 | ESTONIA | | | ✓ |
| 5 | GREECE | | | ✓ |
| 6 | HUNGARY | ✓ | | |
| 7 | LATVIA | ✓ | | |
| 8 | LITHUANIA | ✓ | | |
| 9 | POLAND | | | ✓ |
| 10 | ROMANIA | ✓ | | |
| 11 | RUSSIA | | | ✓ |
| 12 | SLOVAKIA | ✓ | | |
| 13 | SLOVENIA | | ✓ | |
| 14 | TURKEY | | | ✓ |

AMERICAS

| NO | COUNTRY | SOURCE OF OTC DATA | | |
|----|---------------|--------------------|------------------|------------------|
| | | OTC DATA AVAILABLE | KNOWN DATA POINT | VALUE IS DERIVED |
| 1 | UNITED STATES | | ✓ | |
| 2 | MEXICO | | | ✓ |
| 3 | BRAZIL | | | ✓ |

Calculated historic cash share.

The cash share is defined as the total cash spending divided by the GDP. In this sense, cash usage is relative to the overall size of the economy. Total cash spending is defined as ATM withdrawals plus OTC withdrawals. Total cash share is calculated as follows:

$$Cash\ Share_{Year} = \frac{ATM\ Withdrawals_{Year} + OTC\ Withdrawals_{Year}}{GDP_{Year}}$$

Estimated cash share for 2015 forward.

The cash share is estimated as a logarithmic trend of the historic data. We then estimate the log trend and adjust the line such that it lines up with the historic data for 2014. This creates a naïve historic cash share trend starting at the historic cash share for 2014, rolling forward for five or 10 years.

We then adjust this naïve cash share based on the demographic trends in the country and the likelihood that younger demographics will be more prone to shift away from cash to new payment methods such as mobile wallets or other new technologies that are becoming available. This adjustment analyzes the proportion of the population that is younger and accounts for the relative amount of spending (because younger people generally earn and spend less than older people). This analysis suggests that the actual cash share is likely to be lower than the naïve cash share estimated above once we take these factors into account.

This analysis results in a projected cash share that is less than the cash share projected using the naïve analysis described above.

Estimated total cash usage for 2015 forward.

The total cash usage is calculated by multiplying the adjusted cash share by the projected GDP for each year, 2015 through 2020.

ATM AND BANK BRANCH AVAILABILITY INDEXES

We have created two indexes based on the availability of ATMs and bank branches per 100,000 people in the following countries. To do this, we used economy data and population data from 40 nations, delineated below:

| | | |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  AUSTRALIA |  INDIA |  SAUDI ARABIA |
|  AUSTRIA |  IRELAND |  SINGAPORE |
|  BELGIUM |  ITALY |  SLOVAKIA |
|  BRAZIL |  JAPAN |  SLOVENIA |
|  BULGARIA |  LATVIA |  SOUTH AFRICA |
|  CHINA |  LITHUANIA |  SOUTH KOREA |
|  CROATIA |  LUXEMBOURG |  SPAIN |
|  CZECH REPUBLIC |  MALTA |  SWEDEN |
|  ESTONIA |  MEXICO |  SWITZERLAND |
|  FINLAND |  NETHERLANDS |  TURKEY |
|  FRANCE |  POLAND |  UNITED KINGDOM |
|  GERMANY |  PORTUGAL |  UNITED STATES |
|  GREECE |  ROMANIA | |
|  HUNGARY |  RUSSIA | |

The indexes consider the availability of ATM and bank branches per 100,000 inhabitants in each country. The maximum value an index can achieve is 100 points and zero is the minimum. Each country has been assigned its own score.

We show how we calculated both indexes for each country in the following table. We first obtained the number of ATM and bank branches present per 100,000 people, then took the lowest and the highest number for each index and labeled them 0 and 100, respectively. The rest of the numbers were calculated according to the following equation:

$$Index_i = \frac{x_i - x_{Min}}{x_{Max} - x_{Min}}$$

In this formula, x represents the number of ATM and bank branches per 100,000 people and i represents each country that was neither a minimum nor a maximum score.

| COUNTRY | ATM PER 100,000 | BANK BRANCHES PER 100,000 | INDEX | |
|----------------|-----------------|---------------------------|-------|---------------|
| | | | ATM | BANK BRANCHES |
| AUSTRALIA | 132.3 | 22.89 | 51.9 | 27.3 |
| AUSTRIA | 156.1 | 47.49 | 62.6 | 67.8 |
| BELGIUM | 139.7 | 31.33 | 55.2 | 41.2 |
| BRAZIL | 81.4 | — | 29.1 | — |
| BULGARIA | 79.2 | 51.61 | 28.1 | 74.6 |
| CHINA | 63.1 | — | 20.9 | — |
| CROATIA | — | 27.84 | — | 35.4 |
| CZECH REPUBLIC | 43.6 | 19.68 | 12.2 | 22.0 |
| ESTONIA | 61.0 | 8.15 | 20.0 | 3.0 |
| FINLAND | 37.3 | 19.21 | 9.3 | 21.2 |
| FRANCE | 96.1 | 58.45 | 35.7 | 85.9 |
| GERMANY | 104.5 | 41.43 | 39.5 | 57.8 |
| GREECE | 62.8 | 23.42 | 20.8 | 28.2 |
| HUNGARY | 48.9 | 29.38 | 14.5 | 38.0 |
| INDIA | 16.4 | 11.15 | 0.0 | 7.9 |
| IRELAND | 56.9 | 22.20 | 18.1 | 26.1 |
| ITALY | 81.6 | 50.13 | 29.2 | 72.2 |
| JAPAN | 107.7 | — | 40.9 | — |
| LATVIA | 53.3 | 13.90 | 16.5 | 12.5 |
| LITHUANIA | 41.9 | 19.21 | 11.4 | 21.2 |
| LUXEMBOURG | 92.0 | 39.61 | 33.9 | 54.8 |
| MALTA | 49.9 | 25.53 | 15.0 | 31.6 |
| MEXICO | 37.9 | 10.61 | 9.6 | 7.0 |
| NETHERLANDS | 41.4 | 10.42 | 11.2 | 6.7 |
| POLAND | 56.3 | 37.64 | 17.9 | 51.6 |
| PORTUGAL | 149.5 | 53.81 | 59.6 | 78.2 |
| ROMANIA | 57.9 | 24.91 | 18.6 | 30.6 |
| RUSSIA | 89.5 | 26.24 | 32.7 | 32.8 |
| SAUDI ARABIA | 54.9 | 6.34 | 17.2 | 0.0 |
| SINGAPORE | 50.8 | 8.51 | 15.4 | 3.6 |
| SLOVAKIA | 50.4 | 23.80 | 15.2 | 28.8 |
| SLOVENIA | 81.9 | 28.55 | 29.3 | 36.6 |
| SOUTH AFRICA | 52.7 | 7.37 | 16.2 | 1.7 |
| SOUTH KOREA | 239.7 | 14.84 | 100.0 | 14.0 |
| SPAIN | 107.5 | 67.01 | 40.8 | 100.0 |
| SWEDEN | 31.9 | — | 6.9 | — |
| SWITZERLAND | 84.6 | 29.76 | 30.5 | 38.6 |
| TURKEY | 62.1 | 15.79 | 20.5 | 15.6 |
| UNITED KINGDOM | 108.2 | 30.00 | 41.1 | 39.0 |
| UNITED STATES | — | 34.83 | — | 47.0 |

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