the PYMNTS.com

Global Cash Index™

a CARDTRONICS collaboration

MARCH 2018

UNITED STATES EDITION

$22.7 TRILLION
Projected value of U.S. GDP by 2021

12.6%
Percentage of U.S. GDP reflected by cash share in 2016

$2.36 TRILLION Value of cash usage in U.S. economy in 2015

$638 BILLION Projected value of the U.S. eCommerce market by 2022

1.5% Projected CAGR of total U.S. cash usage from 2016 to 2021

CASH USAGE IN THE UNITED STATES: INTRODUCTION

Cash has a lot of competition these days. From Google Pay to the latest cryptocurrencies, the news cycle never seems to tire of covering new cashless ways to pay. Concurrently, though, credit cards, debit cards, gift cards and a variety of mobile payments have long vied to claim bigger pieces of the payments pie.

But rumors of cash's decline in the U.S. economy have been greatly exaggerated. Despite other payment methods competing to give it a run for its money, and a long-running narrative that suggests an imminent demise, PYMNTS research has found cash is maintaining its grip. Indeed, as the world's largest economy, measured by gross domestic product (GDP), the U.S. is still very dependent on cash. It appears, then, that cash is not only sticking around, but is also poised for modest growth in the coming years.

The U.S. does not boast the largest ratio of cash to total GDP — in fact, the most recent PYMNTS Global Cash Report: Americas Edition found Brazil and Mexico have it well beat.[1] U.S. cash usage was the lowest of the three countries analyzed, but it does outperform a few Western European countries. U.S. cash usage made up 12.7 percent of its GDP in 2016, while countries like Switzerland saw nearly one-third of that rate (4.5 percent). Conversely, the U.K., an island nation with a cash ratio similar to that of the U.S., saw higher cash usage at 11.3 percent.

Cash usage in the U.S. has largely held steady since 2003, despite an increasing number of digital payment methods. Usage has typically ranged from 14.2 to 15.1 percent of

GDP, an exception being 2009, when the subprime mortgage crisis contributed to a sudden increase. The economy has since improved and cash share gradually declined, reaching 12.7 percent in 2016.

Despite observed fluctuations over the past decade, recent research shows cash maintains a steady role in the U.S. economy. While Americans' digital transactions are now powered by a variety of payment methods — from debit cards and bank transfers to mobile wallets and cryptocoins — no single digital payment method has managed to match or unseat cash usage levels. According to the Federal Reserve's most recent "Diary of Consumer Payment Choice," which studied U.S. consumers' payment methods from 2015 to 2016, cash was still the most-used in terms of overall volume.[2]

[1] Author unknown. Global Cash Index: Americas Edition. PYMNTS. 2018. https://www.pymnts.com/cash/2018/cash-economies-americas-usa-mexico-brazil/. Accessed March 2018.

[2] Greene, C and Schuh, S. The 2016 Diary of Consumer Payment Choice. Federal Reserve Bank of Boston. 2017. https://www.bostonfed.org/publications/research-data-report/2017/the-2016-diary-of-consumer-payment-choice.aspx. Accessed March 2018.

THE SHIFTING ROLE OF CASH
IN THE US

While cash usage has so far remained strong, data indicates that other payment methods are gaining clout and creating competition. The Federal Reserve's report found U.S. households made 40.6 monthly non-cash payments in 2000, a rate that increased significantly to 78.6 in 2015. Of those 2015 payments, more than 144 billion involved credit or debit cards, automated clearing house (ACH) transfers or checks, with a total approximated value of $178 trillion.[3]

GDP
DATA ANALYSIS

The nation's GDP has enjoyed steady growth since 2000, and rising GDP is expected to lift payment types as well. The 18 years since 2000 have seen continued growth, with one notable exception — 2009, the year of the Great Recession. Conditions have since improved, and the International Monetary Fund (IMF) projects similar growth in the next few years, and at rates like those seen recently.

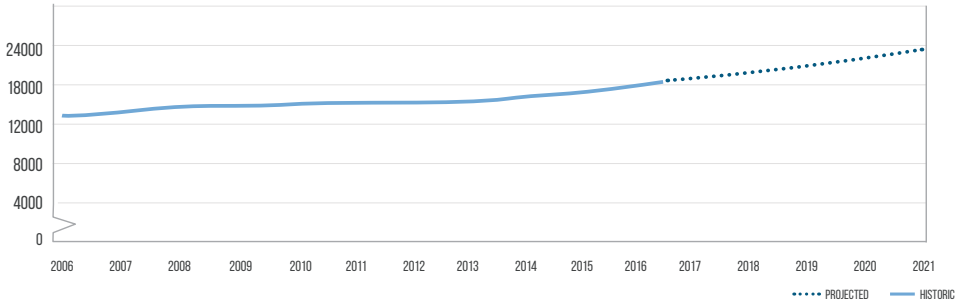
As the number and value of transactions increases, PYMNTS expects a rise in total use of all payment types — and that includes cash. Research shows distinct trends surrounding cash share and usage. Cash share was on a stable path until the Great Recession, and it has since trended lower. Cash usage is still going strong, however, increasing during the same time span. In fact, PYMNTS anticipates the trend of increased cash usage will continue in the near future.[4]

Newer payment options like mobile wallets, contactless payment cards and cryptocurrencies tend to generate a buzz in financial services — and are often heralded as instruments contributing to cash's demise — but research paints a different picture. These alternative payment options' influence may be on the rise, but they're more likely to contribute to keeping cash usage flat or growing at a slower pace rather than eliminating it entirely.

[3] Glasscock, Todd. Studies suggest U.S. trending toward cashless society. Cleburne Times Review. 2017. http://www.cleburnetimesreview.com/news/studies-suggest-u-s-trending-toward-cashless-society/article_0a6b149c-625c-11e7-be22-d7e20c8a2846.html. Accessed March 2018.
[4] Author unknown. Global Cash Index: Americas Edition. PYMNTS. 2018. https://www.pymnts.com/cash/2018/cash-economies-americas-usa-mexico-brazil/. Accessed March 2018.

GDP
PROJECTIONS

FIGURE 1. HISTORIC AND PROJECTED GDP FOR THE U.S., 2006-2021 (NOMINAL, IN BILLION DOLLARS)[5]

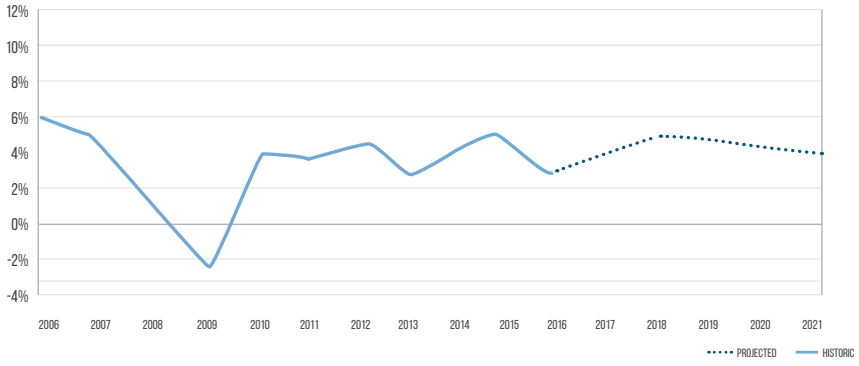


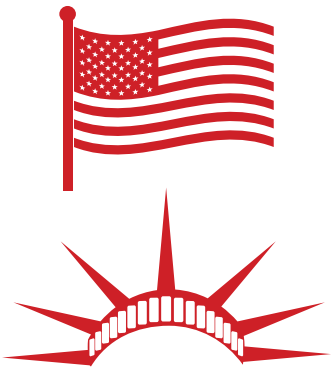
Based on historical and projected data, PYMNTS estimates that U.S. cash share will represent 11.2 percent of the country's GDP by 2021

As depicted in Figure 2, U.S. GDP grew at a compound annual growth rate (CAGR) of 3 percent annually between 2006 and 2016. That CAGR is expected to increase to approximately 4 percent per year between 2016 and 2021. The country's GDP has increased at a very stable rate since 2006, the exception being the 2009 subprime crisis.

Despite incredible economic growth in China, the U.S. will continue to be the largest economy in the world — even in 2021 — with an estimated GDP of $22.7 trillion.

FIGURE 2. HISTORIC AND PROJECTED GDP GROWTH FOR THE U.S., 2006-2021[6]





[5] Author unknown. World Economic Outlook Database. IMF. 2017. https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx. Accessed March 2018.

CASH SHARE PROJECTION
IN THE UNITED STATES

Though the U.S. sees GDP growth contributing to that of cash usage, cash share appears to be declining. This is accompanied by a trend toward decreasing ATM and over-the-counter (OTC) cash withdrawal rates.

The pattern of fewer OTC withdrawals is noteworthy. OTC withdrawals represented 10.2 percent of GDP in 2006, remaining flat or decreasing slightly until 2009 when the figure jumped to 10.7 percent. Withdrawals slid again after that high, dipping to 10.1 percent of GDP in 2012, and then to 8.9 percent in 2016.

In contrast, ATM withdrawals' GDP share remained largely stable until 2012, which saw a slightly downward slide. Cash share ranged between 4.2 percent and 4.5 percent of the GDP from 2006 to 2012, then gradually declined and reached 3.8 percent in 2016.

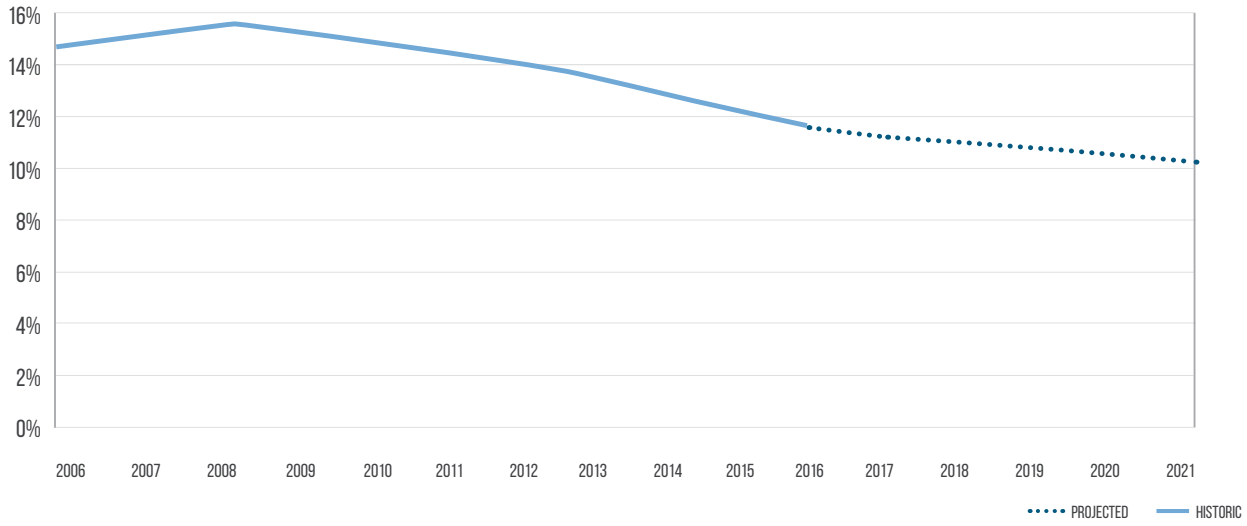
These trends do not seem likely to reverse. Based on PYMNTS' projections, waning OTC and ATM withdrawals will further contribute to a decline in cash share over the next five years. Table 1 shows cash usage from ATM and OTC withdrawals and total cash share in the U.S.

TABLE 1. GDP AND CASH USAGE DATA FOR THE U.S. (IN BILLION DOLLARS)

YEAR	NOMINAL GDP IN DOLLARS	CASH USAGE — BILLION DOLLARS			ATM SHARE	OTC SHARE	CASH SHARE
		ATM	OTC	TOTAL			
2006	13855.9	578.8	1407.6	1986.5	4.2%	10.2%	14.3%
2007	14477.6	600.6	1449.3	2049.9	4.1%	10.0%	14.2%
2008	14718.6	623.2	1492.2	2115.4	4.2%	10.1%	14.4%
2009	14418.7	646.7	1536.4	2183.0	4.5%	10.7%	15.1%
2010	14964.4	659.9	1566.4	2226.2	4.4%	10.5%	14.9%
2011	15517.9	673.3	1597.0	2270.3	4.3%	10.3%	14.6%
2012	16155.3	687.0	1628.2	2315.2	4.3%	10.1%	14.3%
2013	16691.5	691.3	1638.4	2329.7	4.1%	9.8%	14.0%
2014	17427.6	695.6	1648.7	2344.3	4.0%	9.5%	13.5%
2015	18120.7	700.0	1659.0	2359.0	3.9%	9.2%	13.0%
2016	18624.5	700.5	1659.9	2360.4	3.8%	8.9%	12.7%

We plotted a logarithmic trend of the data to project the state of cash share from 2016 through 2021. Figure 3 shows the expectation, based on historic trends.

FIGURE 3. HISTORIC AND CASH SHARE WITH LOGARITHMIC TREND, 2006-2021



An analysis of cash share in the U.S. reveals it saw a 1.2 percent CAGR decline between 2006 and 2016. Looking ahead, cash share is expected to continue to decline at a CAGR of 2.4 percent between 2016 and 2021.

CASH VERSUS
ALTERNATIVE PAYMENT METHODS

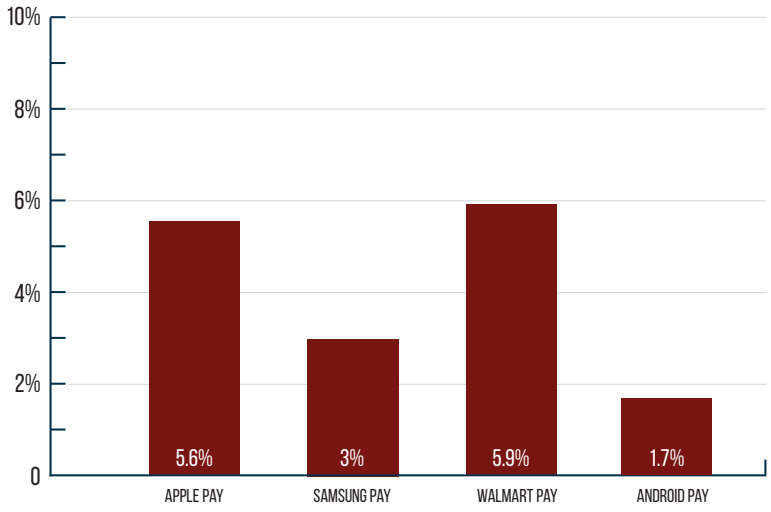
Though overall cash use is seeing declines, recent research from several high profile financial players indicates it is maintaining a strong influence in terms of U.S. consumers' spending.

It appears cash has seen strong usage among U.S. consumers for the past decade, according to a report from the Federal Reserve Bank of Boston. Its "Diary of Consumer Payment Choice" found U.S. consumer cash payments averaged 26 percent of all consumer payments between 2008 and 2015.[6]

In addition, at least one cash alternative is struggling to mount significant competition. Mobile wallets continue to be stuck in neutral, with research indicating solutions like Apple Pay, Samsung Pay, Android Pay and Walmart Pay are not seeing widespread adoption. This further allows cash to thrive as a consumer payment option.

A recent PYMNTS survey, produced in collaboration with consumer insights firm InfoScout, asked several retailers whether smartphone-carrying consumers paid for their purchases using a mobile wallet. The results, outlined in Figure 4, reflect a low percentage of payment transactions completed via mobile wallet. In other words, emerging payment methods do not currently pose an imminent threat.

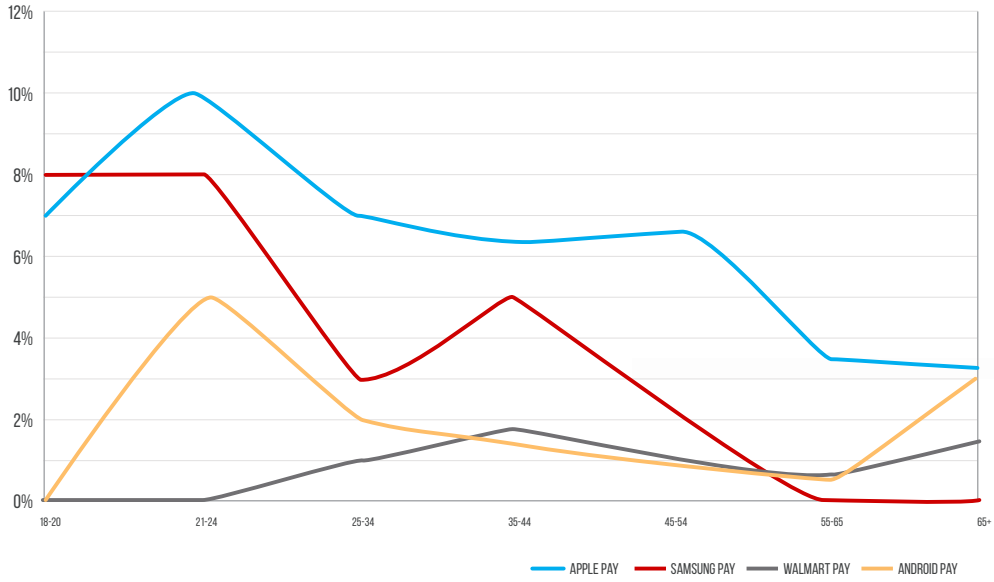
FIGURE 4. PERCENTAGE OF RESPONDENTS WHO USED MOBILE WALLETS FOR A TRANSACTION



The same PYMNTS survey found that only 5.9 percent of shoppers make payments using Walmart Pay, followed by Apple Pay (5.7 percent), Samsung Pay (3 percent) and Android Pay (1.7 percent). With usage levels that fail to cross the 6 percent threshold, mobile wallets do not appear to be an imminent threat.

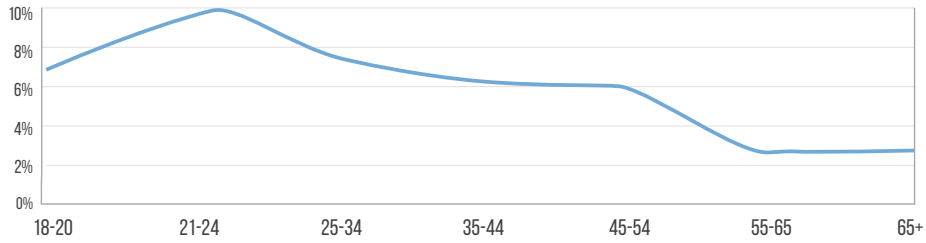
[6] Greene, C, O'Brien S and Schuh, S. U.S. Consumer Cash Use, 2012 and 2015. Federal Reserve Bank of Boston. 2017. https://www.bostonfed.org/publications/research-data-report/2017/us-consumer-cash-use-2012-and-2015.aspx. Accessed March 2018.

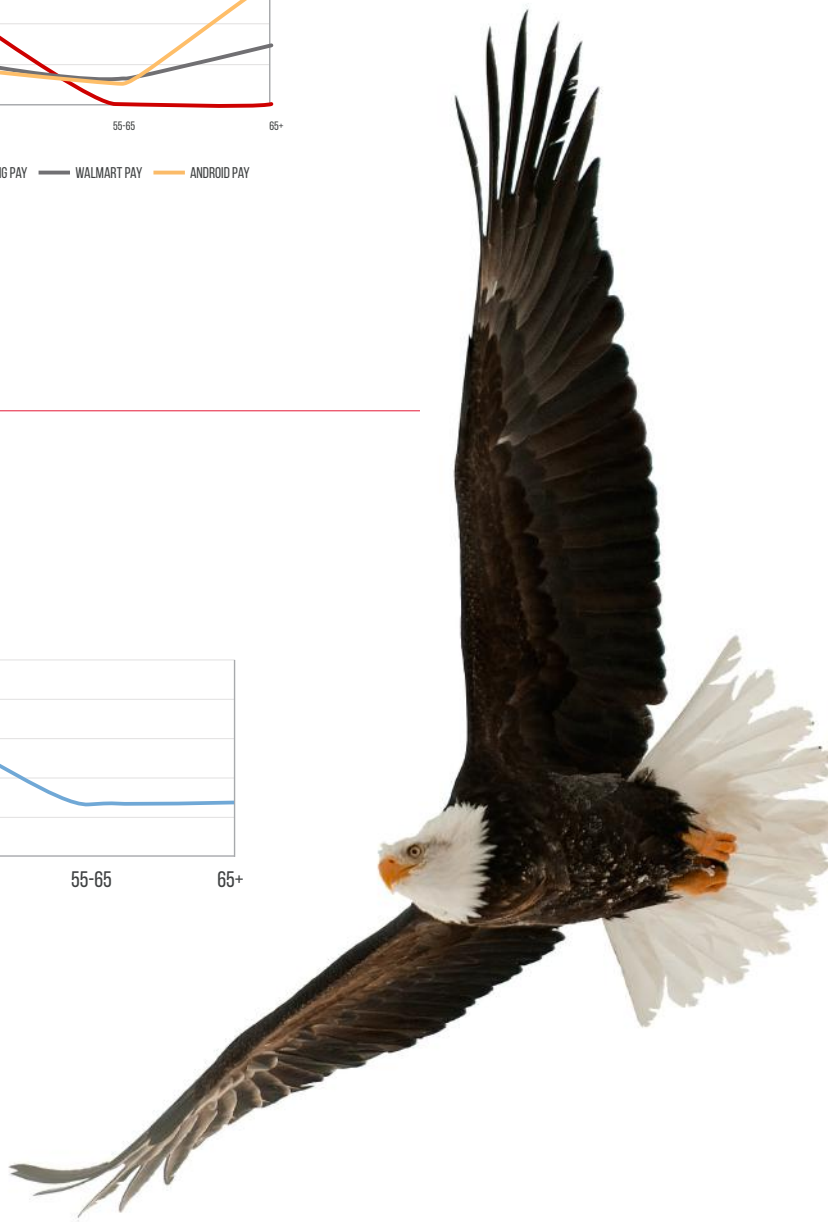
FIGURE 5A. USAGE OF MOBILE WALLETS, BY AGE



Cash could face more challenges in terms of holding onto younger consumers, many of whom show greater readiness to try cash-free options than their older counterparts. When it comes to adoption of mobile wallets, younger generations are more ready to put the option to the test. As seen in Figures 5a and 5b, highest adoption levels come from users aged 21 to 24.

FIGURE 5B. USAGE OF APPLE PAY, BY AGE





PAYMENT CARDS

Though mobile wallets pose little threat to cash so far, cash faces greater competition from debit cards, credit cards and eCommerce, based on recent adoption rates.

A report from global market research and data company YouGov has found 86 percent of Americans say they sometimes use cards to make purchases. Credit cards with EMV chips are the most popular payment card option in the U.S., used by 47 percent, followed by 34 percent who swipe their cards. Just 5 percent reported using contactless cards to make payments.[7]

Credit cards are also rapidly gaining new users. A recent report from TransUnion found the credit card market expanded by 10 million customers in 2016, bringing the number of those in the U.S. with at least one credit card to 133 million. In addition, 52 percent of credit card openings came from young millennials aged 20 to 29.[8]

It isn't all good news and growth for credit cards, however. Major financial firms are also realizing that cards carry risks — especially for issuing banks. Citigroup, JPMorgan Chase, Bank of America and Wells Fargo suffered a combined $12.5 billion in credit card losses in 2017. This reflects a 20 percent spike from 2016, when more than $2 billion in losses were reported.[9] The trend raises concerns about American consumers' ability to make timely credit card payments

To combat credit card risk, many U.S. consumers use cash as a budgeting fallback. Data from the Federal Reserve's "Cash Holdings: A New View on Cash" report found 26 percent of those participating in the most recent "Diary of Consumer Payment Choice" (DCPC) study could be defined as "just in case" cash holders – meaning they held cash every day but never spent it.[10] Those between 18 and 34 years of age made up the largest share of this group, carrying $64 in cash per day on average.

The San Francisco Federal Reserve's 2015 DCPC study indicates the youngest consumers are showing a higher propensity for cash than older consumers.[11] Its study, which examined the preferences of 2,500 Americans, found 38 percent of those aged 18 to 40 — which includes Generation Z and younger millennials — prefer cash.[12]

The data also indicates millennials have a complicated relationship with paper money. Take, for example, the 2015 DCPC findings on so-called "cash-averse" consumers — participants who neither held nor used cash during a three-day monitoring period. While cash-averse consumers made up only 13 percent of the population, DCPC data found 53 percent of them were millennials.

[7] Persson, Roy. While rest of the world moves to mobile payments, US prefers plastic. YouGov. 2018. https://today.yougov.com/news/2018/01/23/while-rest-world-moves-mobile-payments-us-prefers-/. Accessed March 2018.
[8] Author unknown. Credit card popularity soars as 133 million consumers now possess at least one car with a balance. TransUnion. 2016. https://newsroom.transunion.com/credit-card-popularity-soars-as-133-million-consumers-now-possess-at-least-one-card-with-a-balance/. Accessed March 2018.
[9] Gray, Alistair. US banks suffer 20% jump in credit card losses. Financial Times. 2018. https://www.ft.com/content/bafdd504-fd2c-11e7-a492-2c9be7f3120a. Accessed March 2018.
[10] Wang, Claire. Cash Holdings: A New View on Cash: 2015 Diary of Consumer Payment Choice. Cash Product Office, Federal Reserve System. 2017. https://www.frbsf.org/cash/files/fed-notes-cash-holdings-new-view-on-cash-060617.pdf. Accessed March 2018.
[11] Matheny, W; O'Brien, S and Wang, C. The State of Cash: Preliminary Findings. Cash Product Office, Federal Reserve System. 2016. https://www.frbsf.org/cash/files/FedNotes-The-State-of-Cash-Preliminary-Findings-2015-Diary-of-Consumer-Payment-Choice.pdf. Accessed March 2018.
[12] Wang, Claire. Cash Holdings: A New View on Cash: 2015 Diary of Consumer Payment Choice. Cash Product Office, Federal Reserve System. 2017. https://www.frbsf.org/cash/files/fednotes-cash-holdings-new-view-on-cash-060617.pdf. Accessed March 2018.

AN EMERGING ECOMMERCE CHALLENGE

Meanwhile, a growing eCommerce sector also creates new competition for cash. Online sales of physical goods largely require digital transactions, and recent data indicates the market is poised for significant growth. Such online sales generated approximately $360.3 billion USD in 2016, a space expected to reach more than $638 billion by 2022 — a CAGR of 10 percent.

Compared to other countries, the U.S. is behind in terms of online retail activity. In China, for example, approximately 20 percent of retail sales took place online in 2016. The rate of online retail sales in the U.S. was only 8.1 percent during the same period.[13]

It appears eCommerce isn't content to simply stay in its digital lane, however, as at least one eCommerce retailer is already combining online and brick-and-mortar shopping experiences. Amazon opened its cashless and cashierless Amazon Go store in Seattle, Washington, in January,[14] and the facility allows shoppers to use their Amazon Go smartphone apps to track their in-store goods selections. Items pulled off the shelves are automatically added to customers' virtual carts, and patrons are automatically charged when they leave.

If successful, such digital-payment-only, brick-and-mortar retail models could pose additional challenges to retail consumers' cash usage. Such a radical reinvention of the retail process will likely take a decade or longer to come to fruition, though.

DIGITAL DISTRUST

Cash's staying power is helped, in part, by Americans' distrust of both digital technology and their government. According to data from think tank Pew Research, trust in government has dropped annually since the 1960s. This translates to greater cash dependency as U.S. consumers become increasingly concerned about what happens to their digital money. Issues include access, theft and privacy concerns like government tracking of their payment habits.

As cross-cultural sociologist Gummi Oddsson recently noted, Americans prefer not to rely on government and are more anxious than citizens from nations like Sweden. There, government trust is considerably higher when it comes to digitalizing payment options.[15]

In addition to a trust gap, Americans are also worried about online technology. A recent survey of 2,100 respondents found 71 percent were concerned about online privacy as they conducted digital banking activities.[16] This lack of comfort allows cash to maintain a strong role in the U.S. economy.

[13] Author unknown. Retail e-commerce sales in the United States from 2016 to 2022 (in million U.S. dollars). Statista. 2018. https://www.statista.com/statistics/272391/us-retail-e-commerce-sales-forecast/. Accessed March 2018.

[14] Associated Press. Amazon Go, e-commerce giant's cashierless grocery store, opens to the public in Seattle. Chicago Tribune. 2018. http://www.chicagotribune.com/business/ct-amazon-go-cashierless-store-opens-20180122-story.html. Accessed March 2018.

[15] Weller, Chris. America has the technology to go cashless, but nobody trusts it enough to use it. Business Insider. 2016. http://www.businessinsider.com/america-too-paranoid-go-cashless-2016-10. Accessed March 2018.

[16] Smith, Dave. What makes people worry about their privace online? Business Insider. 2014. http://www.businessinsider.com/chart-of-the-day-what-makes-people-worry-about-online-privacy-2014-9. Accessed March 2018.

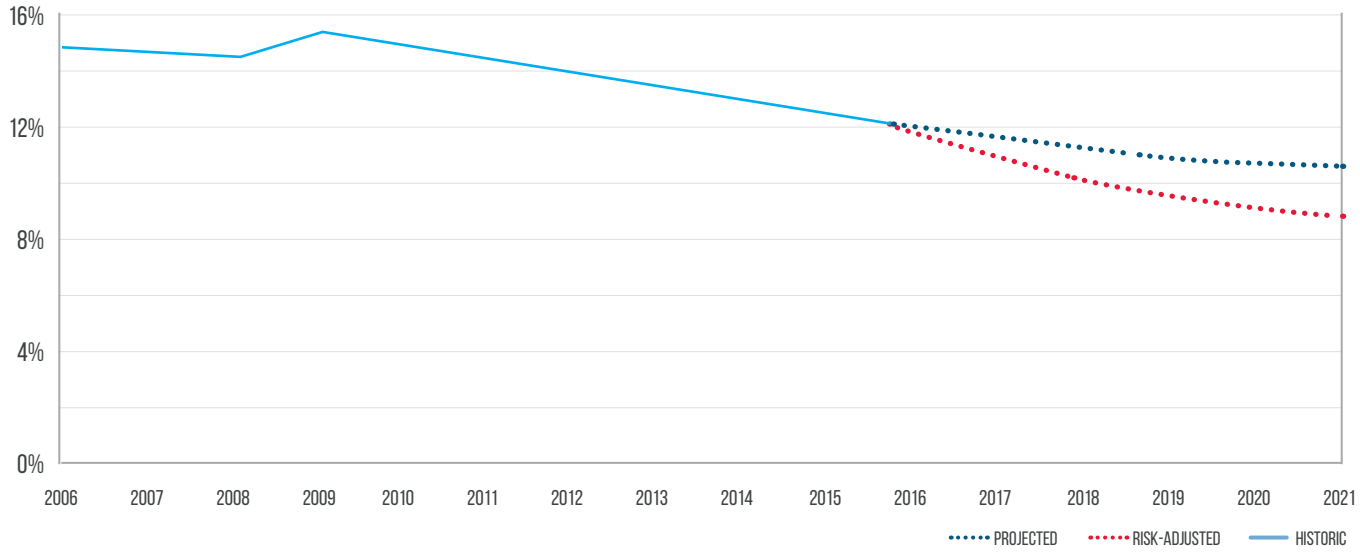
RISK
ADJUSTMENTS

American consumers are caught between fears of technology and a desire for convenience. The eCommerce market is rising, despite distrust working against digital payments, and it could pose a challenge to cash usage. In particular, it could lead to lower cash usage among younger consumers.

PYMNTS anticipates that eCommerce could accelerate cash reduction by 50 percent among those aged 19 to 24 and by 30 percent among 25- to 34-year-olds. Older generations would also likely reduce their cash usage, though probably to a lesser extent. PYMNTS projects a 15 percent cash reduction among those aged 35 to 44 and 5 percent among 45- to 54-year-olds.

Assuming these accelerated reductions are realized over a six-year time period, the risk-adjusted cash share could reach 9.7 percent in 2021. These projections are depicted in Figure 6.

FIGURE 6. HISTORIC AND RISK-ADJUSTED CASH PROJECTION



TOTAL CASH USAGE

Though challenges from new payment methods are mounting, cash usage has grown in the U.S. and is projected to continue to do so over the next few years.

As Table 2 indicates, cash usage in the U.S. increased slightly from 2011 to 2016 at a CAGR of 0.78 percent. Based on these developments, PYMNTS believes U.S. cash usage is on track to further increase between 2016 and 2021, and to do so at a CAGR of 1.5 percent.

TABLE 2. U.S. CASH SHARE, GDP AND TOTAL CASH USAGE

	CASH USAGE AND PROJECTIONS				COMPOUND ANNUAL GROWTH RATE	
	2006	2011	2016	2021	2011 – 2016	2016 – 2021
CASH SHARE	14.3%	14.6%	12.7%	11.2%	-0.46%	-0.43%
GDP	13,856	15,518	18,624	22,681	3.72%	4.02%
TOTAL CASH USAGE	1,986	2,270	2,360	2,542	0.78%	1.50%

Figures 7, 8 and 9 show historic and projected cash share, historic and projected GDP and historic and projected total cash usage.

FIGURE 7. HISTORIC AND PROJECTED TOTAL CASH SHARE

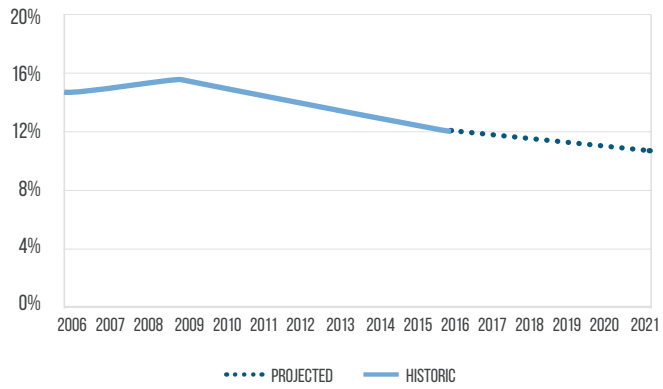


FIGURE 8. HISTORIC AND PROJECTED GDP (IN BILLION DOLLARS)

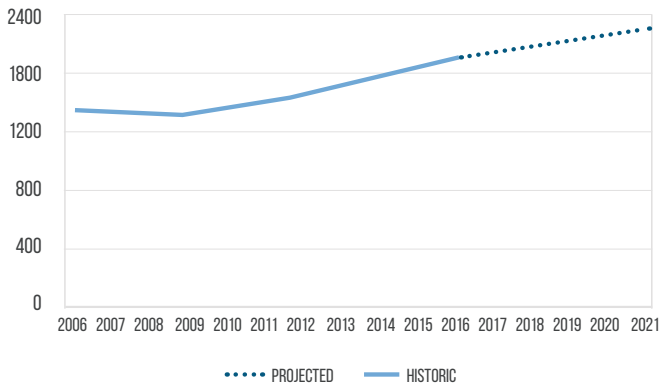
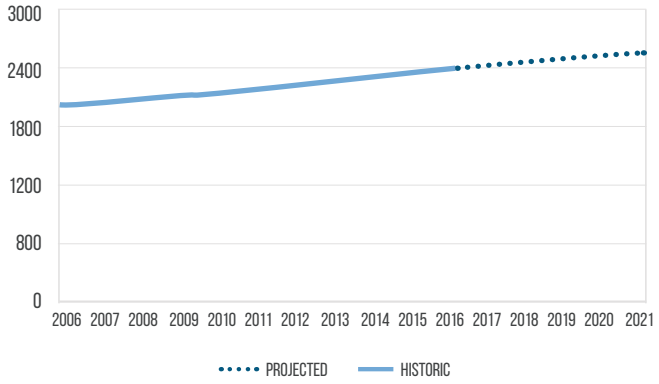


FIGURE 9. HISTORIC AND PROJECTED TOTAL CASH USAGE (IN BILLION DOLLARS)



While cash may be facing additional competition in the U.S., several factors are enabling it to remain an influential payment option. Alternative payment methods like mobile wallets have not shown widespread consumer adoption to date, meaning it will likely be a long time before they are able to erode cash's influence in the U.S. economy.

The picture is not all sunny, though, and cash faces increasing compeitition from the growing eCommerce market. As the Amazon Go experiment demonstrates, eCommerce is expanding and taking new forms — and cash's role in retail will face additional challenges as it does so.

But, based on current attitudes toward government and digital technology, not all U.S. consumers are rushing to convert their physical bills to digital dollars. They appear to want multiple retail payments choices instead of relying soley on digital payment methods. This allows cash to maintain a hold in consumers' hearts.

Until U.S. consumers experience an attitude adjustment in terms of digital payments tech, cash will likely continue to play a significant role in the U.S. economy.

CASH IS STILL ON TOP FOR US CONSUMERS

Despite new payment methods and innovations promising to render physical currency a thing of the past, American consumers still appear keen to keep cash on hand.

The rideshare market's appeal, for example, is based on its promise to enable payments to be seamlessly blended with a digitally facilitated service. Cash is still in demand, though, even in a mobile market where rides are both summoned and paid for with the tap of a smartphone. In fact, newer rideshare services like Curb and DashRabbit are turning to cash to attract customers who would rather not use cards.

According to data from the Federal Reserve Bank of San Francisco, even if more than half of all transportation services in the U.S. converted to ridesharing apps, cash transactions would only decline by 1.4 percent.[17] This suggests that though these services were originally geared toward digital payment, they are failing to make a dent in cash's dominance.

Many other sectors in the broader economy are happy to accept hard currency, too. Recent Federal Reserve Bank of Boston research indicates that among U.S. consumers, cash is the most commonly used payment method for daily expenditures.[18]

To gain a better perspective on how U.S. consumers use cash, PYMNTS recently spoke with Claire Greene, payments risk expert for the Federal Reserve Bank of Atlanta — and former payments analyst for the Federal Reserve Bank of Boston — about what the Fed has learned about U.S. consumers' cash habits.

U.S. consumers (still) love cash

Cash has far outpaced the use of other payment methods in everyday consumer spending, according to data in the Boston Fed's "2016 Diary of Consumer Payment Choice (DCPC)" study.

The survey asked participants about their payment habits during October 2016, finding more than 30 percent of consumers made payments with cash, 27 percent paid with debit cards and only 18 percent paid with credit cards. The results indicated cash is not only going strong, but is also outperforming other payment methods in everyday use.

Though a breakdown of the specific payments consumers made with cash was unavailable, Greene said they clearly preferred cash when making lower value transactions.

[17] Author unknown. Facts and Myths About Cash: Test Your Knowledge. Federal Reserve Bank of San Francisco. Date unknown. https://www.frbsf.org/cash/cash-how-we-use-it/cash-myths-facts-quiz/. Accessed March 2018.
[18] Greene, C and Schuh, S. The 2016 Diary of Consumer Payment Choice. Federal Reserve Bank of Boston. 2017. https://www.bostonfed.org/publications/research-data-report/2017/the-2016-diary-of-consumer-payment-choice.aspx. Accessed March 2018.

"When we asked consumers what they prefer to use for an in-person purchase by dollar value, two-thirds of [them] said they like to use cash for a payment of $10 or less," she said. "About 40 percent of consumers say they prefer cash for payments of about $10 to $25."

The Fed's report does not ask what they are purchasing, but Greene noted consumers might be choosing to pay with cash to protect their privacy. A lack of digital breadcrumbs is a win for some. As an example, she noted a consumer might use cash to purchase a candy bar after lunch, allowing him to enjoy the sugary indulgence without leaving an electronic trail to remind him about it and induce guilt later.

"When you look at security ratings for cash, some [consumers] will rate it as very secure," Greene said. "Think about the anonymity of transactions and the fact that you aren't providing any personal data by making that transaction."

Not everyone is convinced, however.

"Other consumers will rate cash as quite insecure because, of course, you can drop it on the sidewalk and it's gone," she said.

Cash bridges generational divides

Recent data from the Federal Reserve Bank of San Francisco revealed cash is not only a widely popular method of payment among U.S. consumers, but also increasing in popularity.

Cash is the top choice compared to other payment methods for older generations. Early findings from the San Francisco Fed's DCPC report found consumers ages 35 and older consider cash their top payment preference.[19] It also found 31 percent of consumers aged 35 to 44 prefer cash to debit cards, credit cards, checks, electronic payments and other payment options, and that consumers in both the 45 to 54 and 65 and older brackets preferred cash by 33 percent over other options.

> *"Consumers rate cash highly for convenience, cost, set up and acceptance for payment."*

Though younger consumers have a reputation for preferring all things digital, data shows they regularly use cash. The San Francisco Fed report noted cash is the second most popular payment option among consumers aged 18 to 24 and 25 to 34. Debit cards were the most popular, and electronic payments, on the other hand, saw much lower usage rates among these groups.

According to Greene, the Fed has been asking consumers about their financial habits since 2008. Consumers have consistently said they are not ready to retire cash, despite the wide availability of newer payment options.

"Consumers rate cash highly for convenience, cost, set up and acceptance for payment," she said. "Research shows that these ratings are a factor in payment instrument choice [for] both adoption and use. So, that gives you a clue that cash is very much alive."

[19] O'Brien, S. Understanding Consumer Cash Use. Federal Reserve Bank of San Francisco. 2017. https://www.frbsf.org/cash/publications/fed-notes/2017/november/understanding-consumer-cash-use-preliminary-findings-2016-diary-of-consumer-payment-choice/. Accessed March 2018.

APPENDIX

METHODOLOGY AND DATA

The Global Cash Index, powered by Cardtronics, analyzes overall cash usage and projected trends for 40 countries that have provided sufficient data to make such estimates. These countries are divided into five regions — Western Europe, Eastern Europe, the Americas and Asia and Other — and we will publish reports reviewing cash share and usage for 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			

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- 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.
- Estimateed 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.[20] We also gathered data to project cash usage, including projected GDP and projected population by age group.[21]

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.

[20] 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 drawals, 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]

[21] 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 comparable countries.[22]

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

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:

$$Weighted\ Average\ Difference_{ij} = 0.667 * Avg\ difference\ in\ levels + 0.333 * Avg\ difference\ in\ changes$$

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

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

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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 $\overline{\left(\frac{OTC}{ATM}\right)_{Year}}$ 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 $\overline{\left(\frac{OTC}{ATM}\right)_{Year}}$ for the selected comparable country and use it to calculate the level of OTC withdrawals for each from 2000 through 2014.

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

  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			✓

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

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 100,00	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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