

Global Cash Index™

a **CARDTRONICS** collaboration

NOVEMBER 2017



UNITED KINGDOM EDITION

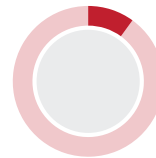


41 Score of the United Kingdom
ATM Availability Index

108 Number of ATMs
per 100,000 people

-0.5% Percentage point
decline in cash share of GDP
between 2011 and 2016

-0.4% Estimated percentage point
decline in cash share of GDP
between 2016 and 2021



11.3%

Percentage of cash share in 2016



£218.3 BILLION

Total use of cash in 2016

CASH USAGE IN THE UNITED KINGDOM: INTRODUCTION

The United Kingdom's £350 billion-plus retail industry is undergoing a massive facelift. From artificial intelligence (AI)-enabled bots on merchant websites to experience-driven stores focusing less on inventory, retail shopping in the U.K. is changing fast — much like it is in the U.S.

While technology is fast transforming the retail industry, consumers in the U.K. still heavily rely on cash when it comes to payments. In fact, as of 2016, 42.6 percent of retail transactions in the U.K. were paid in cash, according to the British Retail Consortium.¹

Even when it comes to paying for day-to-day transactions, cash continues to be the top choice. A 2016 U.K. Association of Convenience Stores report noted nearly four out of five convenience store transactions were paid using cash.²



In recent years, however, cash has been facing growing competition from contactless payments. More than two-thirds of retail payment terminals across the U.K. now accept contactless payments, and there are more than 108 million contactless cards in circulation there.

Contactless payments are vouched for because of their speed and seamlessness, but they come with their own perils. Unlike cash, which is often used as a budgeting tool by consumers, growth in use and availability of contactless cards is making budgeting harder and ballooning U.K. consumer's debt. In the first six months of 2017, credit and charge card purchases rose by 9.3 percent, outstripping the 7.2 percent increase observed in 2016.

In September 2017, the Bank of England (BoE) issued a stern warning saying the rise of consumer debt could cost banks £30 billion in losses on their credit cards, personal loans and car finance offerings if unemployment rates and interest rates were to rise sharply.³ Following the BoE's warning, U.K. banks are now clamping down on offering credit cards — the biggest squeeze on credit offerings since the 2008 recession.⁴

Whether a crackdown on credit offerings will influence use of cash remains to be seen, but the overall volume of cash in circulation is increasing with economic growth. In the words of the BoE's chief cashier, Victoria Cleland, "Cash is still very much alive and kicking."⁵

¹ Author unknown. Debit cards overtake cash to become UK's top payment method. July 12, 2017. <https://www.finextra.com/newsarticle/30825/debit-cards-overtake-cash-to-become-uks-top-payment-method>. Accessed November 2017.

² Author unknown. The UK: more payments and more cash. ATMIA. April 10, 2017. <https://www.atmia.com/news/the-uk-more-payments-more-cash/4729/>. Accessed November 2017.

³ Treanor, Jill. Bank of England warns a consumer debt crisis could cost banks £30bn. The Guardian. September 25, 2017. available at: <https://www.theguardian.com/business/2017/sep/25/bank-of-england-warns-a-consumer-debt-crisis-could-cost-banks-30bn>. Accessed November 2017.

⁴ Monaghan, Angela. UK banks plan biggest squeeze on consumer credit since 2008. October 12, 2017. The Guardian. <https://www.theguardian.com/business/2017/oct/12/uk-banks-consumer-credit-credit-card-car-finance-loans-bank-of-england>. Accessed November 2017.

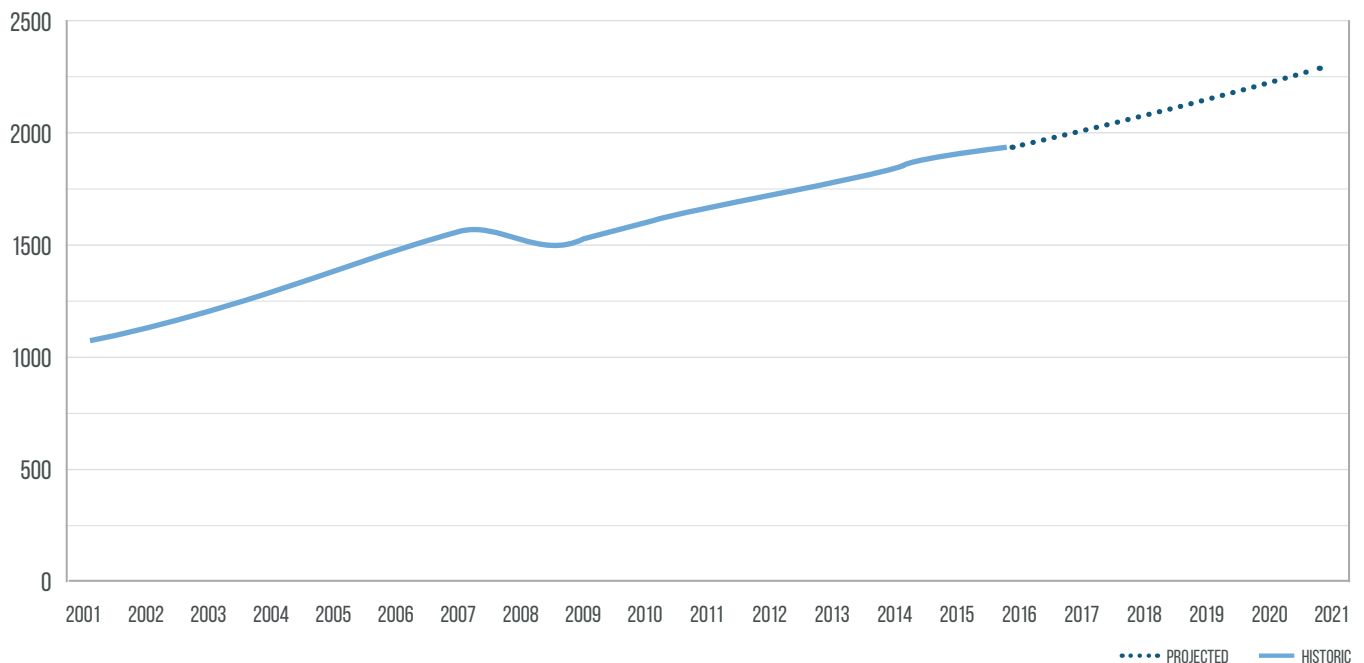
⁵ Jones, Rupert. Cash no longer king as contactless payments soar in UK stores. The Guardian. July 12, 2017. <https://www.theguardian.com/money/2017/jul/12/cash-contactless-payments-uk-stores-cards-british-retail-consortium>. Accessed November 2017.



GDP AND IT'S EFFECT ON CASH USAGE

With a gross domestic product (GDP) of more than \$2.5 trillion, the U.K. boasts the fifth largest economy in the world, ranking behind the U.S., China, Japan and Germany. As shown in Figure 1, the U.K.'s GDP grew at an average rate of 3.6 percent per year between 2011 and 2016 and is expected to continue growing at a similar rate.⁶

FIGURE 1. HISTORIC AND PROJECTED GDP FOR THE UNITED KINGDOM, 2001-2021 (NOMINAL IN BILLION POUNDS)⁷

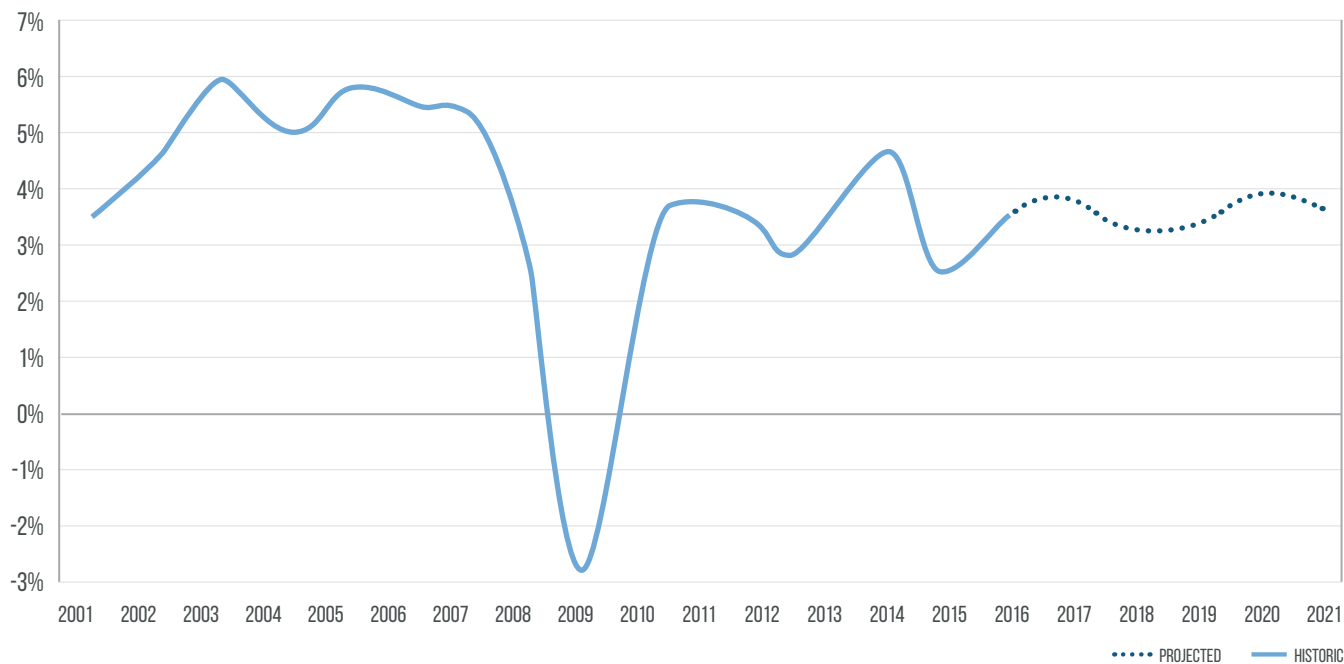


⁶ In the previous edition of this report, the GDP in 2015 was shown in euros. GDP in euros for the U.K. in 2015 was 2,559 billion euros. Since Brexit, we believe it makes sense to express all current and future values for the U.K. in pounds.

⁷ Author unknown. WEO update: World Economic Outlook Database. International Monetary Fund. April 2017. <http://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx>. Accessed November 2017.



FIGURE 2. HISTORIC AND PROJECTED GDP GROWTH FOR THE UNITED KINGDOM, 2001-2021



Between 2001 and 2016, U.K. share of cash decreased at an average of 1.54 percent per year. But, with growth in the U.K.'s economy, we expect total use of cash to increase at a compound annual growth rate (CAGR) of 1.46 percent per year from 2016 to 2021.



CASH SHARE IN THE UNITED KINGDOM

While cash remains one of the most important payment instruments in the U.K., it is seeing a reduction in its overall share, including a decline in over-the-counter (OTC) withdrawals.

OTC withdrawals in the U.K. decreased from representing 4.9 percent of the GDP in 2001 to 1.4 percent of GDP in

2016. Though ATM withdrawals saw a slight reduction, they have remained stable overall. In 2001, ATM withdrawals represented 11.4 percent of the GDP and in 2016 they represented 9.9 percent.

As shown in Table 1, 2016 cash usage in the U.K. stood at 11.3 percent, which is equivalent to £218.3 billion.

GLOBAL CASH INDEX: UNITED KINGDOM EDITION

TABLE 1. GDP AND CASH USAGE DATA FOR THE UNITED KINGDOM, IN BILLIONS OF POUNDS

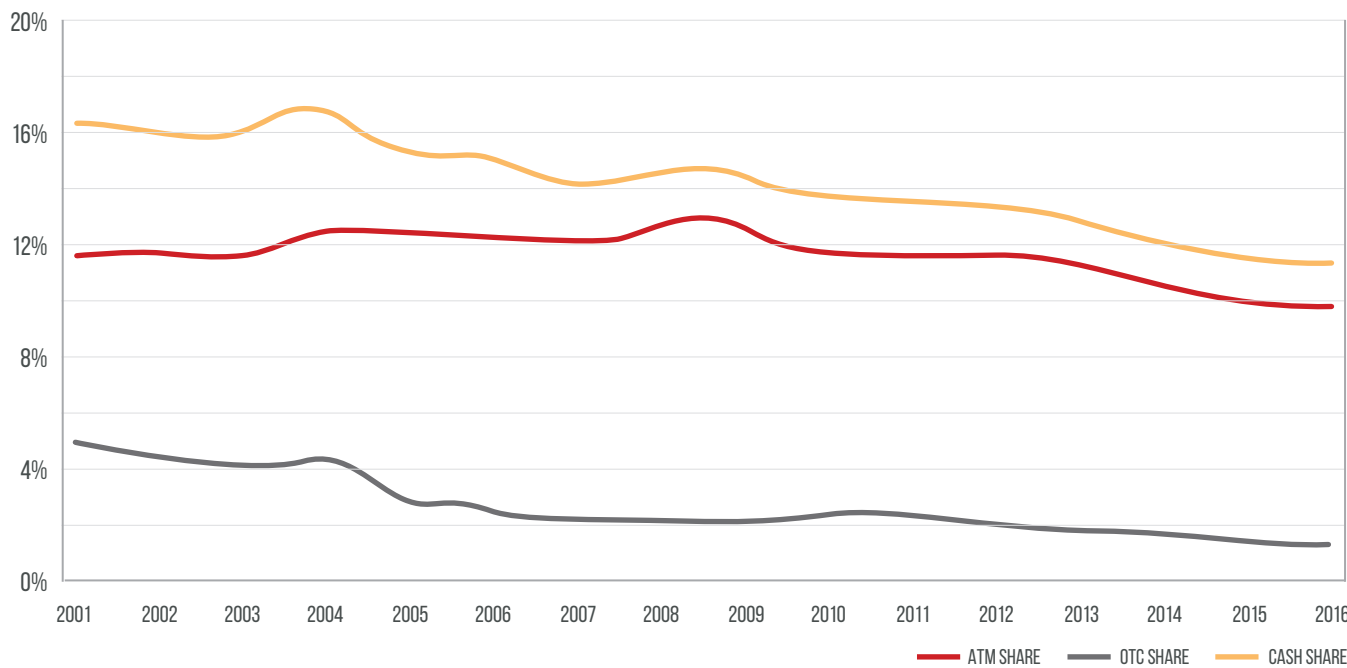
YEAR	NOMINAL GDP IN POUNDS	CASH USAGE — BILLION POUNDS			ATM SHARE	OTC SHARE	CASH SHARE
		ATM	OTC	TOTAL			
2001	1120.6	127.4	55.0	182.4	11.4%	4.9%	16.3%
2002	1172.7	136.4	53.0	189.4	11.6%	4.5%	16.1%
2003	1242.4	144.1	54.0	198.1	11.6%	4.3%	15.9%
2004	1304.9	161.3	56.0	217.3	12.4%	4.3%	16.7%
2005	1379.5	172.0	40.0	212.0	12.5%	2.9%	15.4%
2006	1455.6	179.8	39.0	218.8	12.4%	2.7%	15.0%
2007	1530.9	186.2	33.0	219.2	12.2%	2.2%	14.3%
2008	1564.3	192.2	32.0	224.2	12.3%	2.0%	14.3%
2009	1519.5	192.8	31.0	223.8	12.7%	2.0%	14.7%
2010	1572.4	185.8	35.0	220.8	11.8%	2.2%	14.0%
2011	1628.3	191.3	32.0	223.3	11.7%	2.0%	13.7%
2012	1675.0	193.6	30.0	223.6	11.6%	1.8%	13.3%
2013	1739.6	191.8	30.0	221.8	11.0%	1.7%	12.8%
2014	1822.5	189.4	27.0	216.4	10.4%	1.5%	11.9%
2015	1872.7	190.0	26.1	216.1	10.1%	1.4%	11.5%
2016	1939.6	192.0	26.3	218.3	9.9%	1.4%	11.3%

As seen in Figure 3, cash's share remained flat between 2001 and 2004. While a decrease in OTC withdrawals drove cash's share decline, ATM withdrawals increased during the same period, resulting in a flat usage trend representing 16 to 17 percent of the GDP. ATM withdrawals mostly remained flat after 2004 whereas OTC withdrawals kept decreasing, resulting in a decline in share of cash.

Since 2010, however, both ATM and OTC shares have seen decreases. ATM withdrawals' downward path peaked in 2009, representing 12.7 percent of GDP in 2009 and 9.9 percent in 2016. OTC withdrawals, on the other hand, decreased from representing 2 percent of GDP in 2009 to 1.4 percent of GDP in 2016.

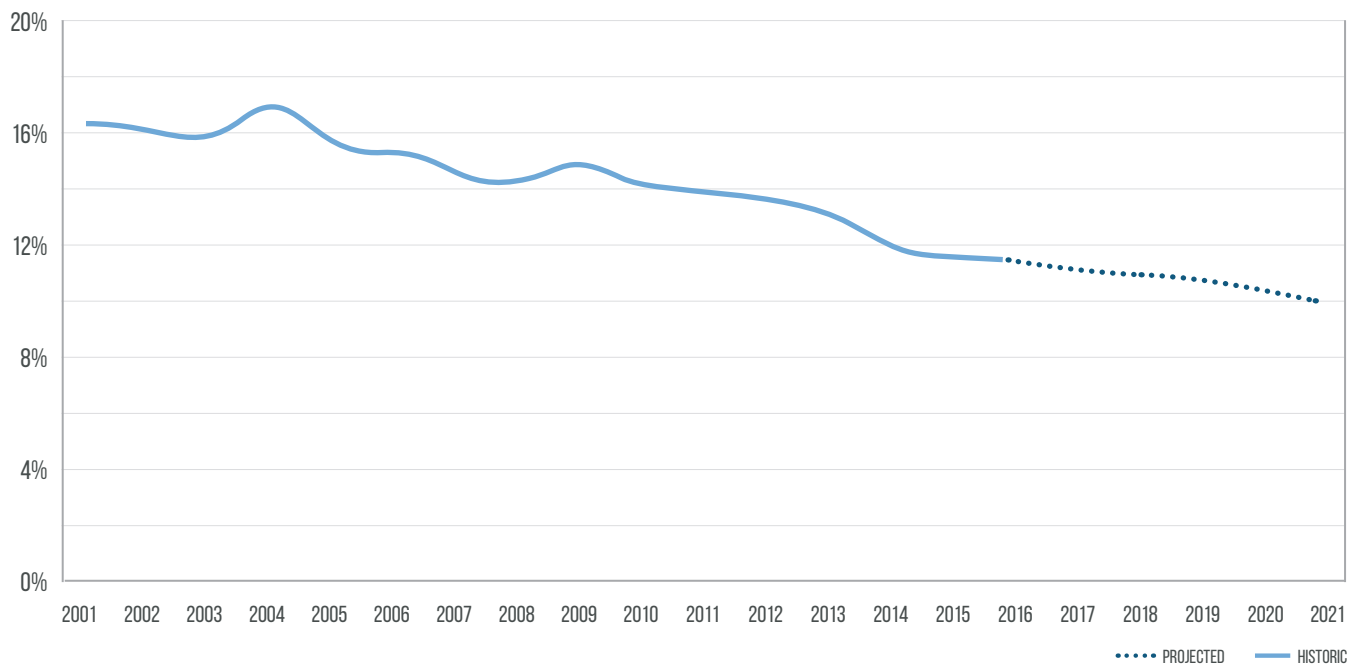


FIGURE 3. CASH SHARES, ATM SHARE AND OTC SHARE IN THE UNITED KINGDOM



Based on our data, we used logarithmic trending to estimate evolution of cash share from 2016 through 2021.

FIGURE 4. HISTORIC AND PROJECTED CASH SHARE WITH LOGARITHMIC TREND





Overall cash usage is growing, but cash's share is declining. From 2010 to 2016, it declined by 0.46 percent per year, and is expected to decline by 0.2 percent per year between 2016 and 2021.

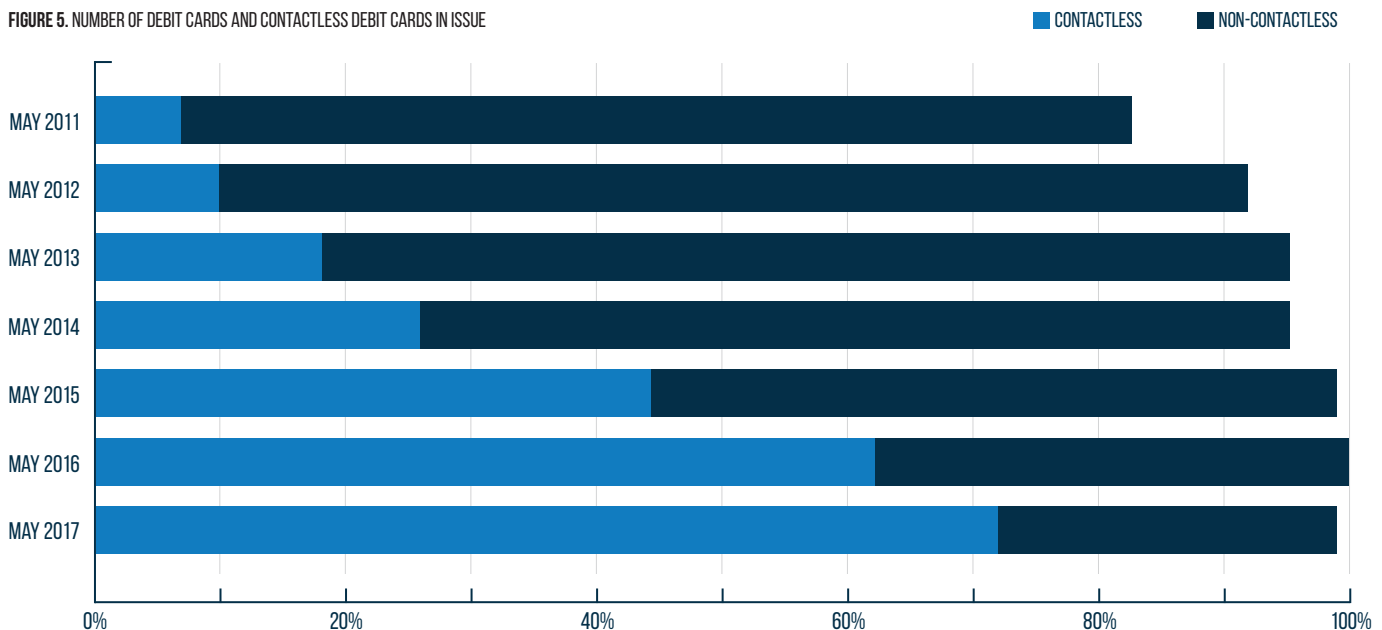
Evolution of cash usage is dependent on a host of macroeconomic indicators, including growth of GDP, inflation and interest rates. Other influencing factors include exchange rates, international tourism, changing demographics and geopolitical developments such as Brexit or governmental changes.

Factors contributing to decline in cash's share in the U.K. include innovations in the mobile payments space, which have a relatively higher adoption rate among younger consumers.

Meanwhile, the U.K. is also seeing a growth in usage of alternative payment methods, including contactless and digital wallets. According to the U.K. Cards Association, the number of contactless debit cards have increased considerably over the last six years, as can be seen in Figure 5.⁸



FIGURE 5. NUMBER OF DEBIT CARDS AND CONTACTLESS DEBIT CARDS IN ISSUE



⁸ Author unknown. The UK Cards Association May 2017 debit card report. The UK Cards Association. May 2017. http://www.theukcardsassociation.org.uk/wm_documents/Debit%20Card%20Report%20-%20May%202017.pdf. Accessed November 2017.



The growth in access and use of contactless debit cards and digital payments has come with growth in FinTech sector investment. The FinTech industry in the U.K. has seen a 50 percent growth in investment every year since 2008. In fact, nearly £433 million were pumped into U.K.-based FinTech startups in the first half of 2017.⁹

Growth in penetration of smartphones has also fueled adoption of alternate payment methods. More than 21.5 million people (44 percent of the population) in the U.K. had access to smartphones in 2011, compared to 43.9 million (86.4 million) in 2016. Ninety-nine percent of adults are expected to have access to smartphones by 2020.¹⁰

Looking back, the growth in contactless payments usage quickly escalated since transportation information platform Transport for London's (TfL) adoption of contactless payments for tube rides. However, contactless payments as they currently stand can only be used to pay for transactions valued at £30 (nearly \$40 USD) or less.

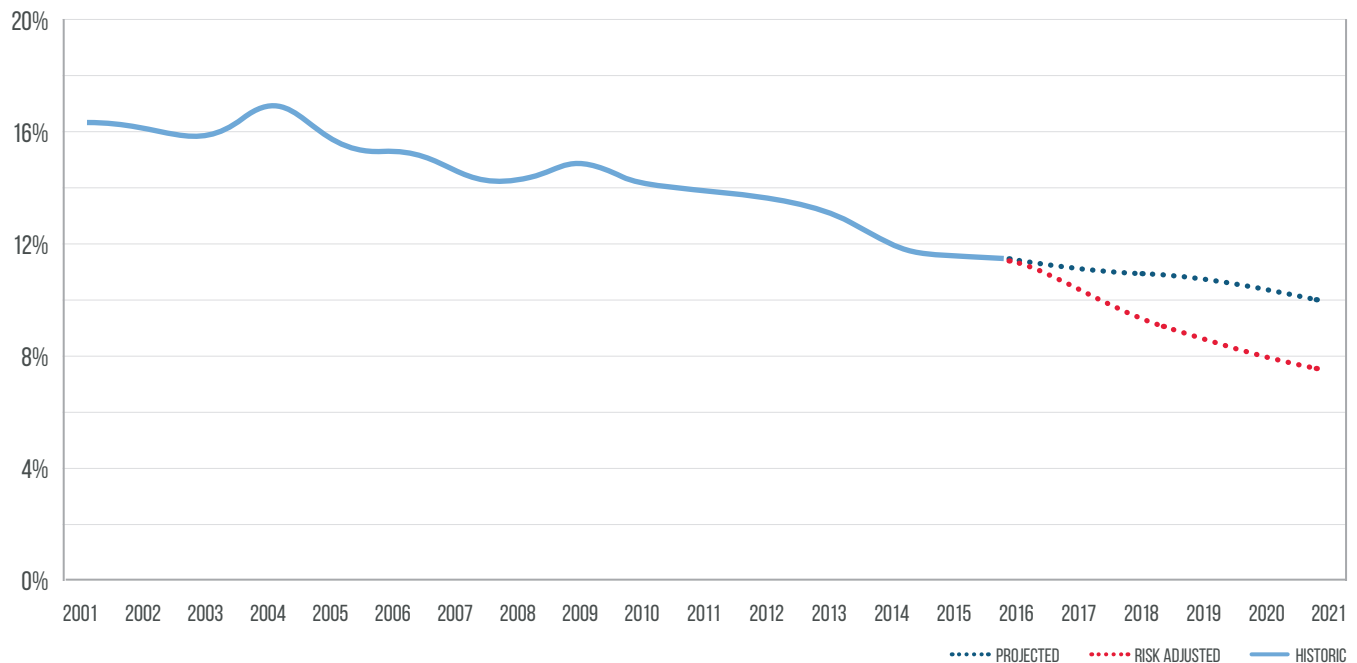
While more than one-third of U.K. retailers have shown interest in raising the £30 limit on contactless payments to £50 (nearly \$66 USD), cash continues to be the overwhelming choice among customers, especially in convenience store settings.

In April 2016, the U.K. Association of Convenience Stores reported 79 percent — nearly four out of five transactions — at 50,000 of their member stores were made using cash.¹¹

Considering the accelerated reductions in cash share realized over a five-year time period, we projected the “risk-adjusted” cash share for the next four years.

As shown in Figure 6, cash usage reduction could be accelerated by 50 percent among 19- to 24-year-olds, 30 percent among 25- to 34-year-olds and 15 percent among 35- to 44-year-olds.

FIGURE 6. RISK ADJUSTED CASH PROJECTION



⁹ Quinn, Michael. Fintech investment thriving in the UK. Money Expert. August 16, 2017. <https://www.moneyexpert.com/1uncategorized/fintech-investment-thriving-uk/>. Accessed November 2017.


¹⁰ Author unknown. Number of smartphones users in the United Kingdom (U.K.) from 2011 to 2018 (in million users). Statista. Date unknown. <http://www.statista.com/statistics/270821/smart-phone-user-in-the-united-kingdom-U.K./>. Accessed November 2017.

¹¹ Author unknown. The UK: more payments and more cash. ATMIA. April 10, 2017. <https://www.atmia.com/news/the-uk-more-payments-more-cash/4729/>. Accessed November 2017.

TOTAL CASH USAGE

When we combine our projected cash share and GDP, we see total cash use in the U.K. is increasing, but at a rate that is less than the growth of the GDP. Table 2 shows the decrease in cash share offsetting the increase in GDP, as well as the resulting net increase in total cash usage.

TABLE 2. CASH SHARE, GDP AND TOTAL CASH USAGE

	CASH USAGE AND PROJECTIONS					COMPOUND ANNUAL GROWTH RATE	
	2001	2006	2011	2016	2021	2011 – 2016	2016 – 2021
CASH SHARE	16%	15%	14%	11%	10%	-0.5%	-0.4%
GDP	1121	1456	1628	1940	2238	3.6%	2.9%
TOTAL CASH USAGE	182	219	223	218	223	-0.5%	0.5%

ATM AND BANK BRANCHES AVAILABILITY INDEX

To gauge accessibility of cash in the U.K. compared to other European countries, we created two separate Indices measuring the footprint of ATMs and bank branches in 40 countries around the world. The Indices rank said countries on a scale of zero to 100.

Each Index corresponds to an average value of variables such as population, GDP per capita, volume of OTC transactions, cash in the GDP and availability of ATMs and bank branches for every 100,000 people.

Other than the U.K., the 14 Western European countries we considered include Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Spain, Sweden and Switzerland.

When we look at the U.K.'s GDP per capita, we see it is slightly lower than that of Western Europe, which includes several countries with higher GDP per capita, like Germany, Switzerland and Luxembourg.

Our calculations in the Bank Branches Availability Index show Western European countries score better than the rest of the world's average, though the U.K. scores much lower than other countries within Europe.

FIGURE 7. BANK BRANCHES AVERAGE INDEX SCORE

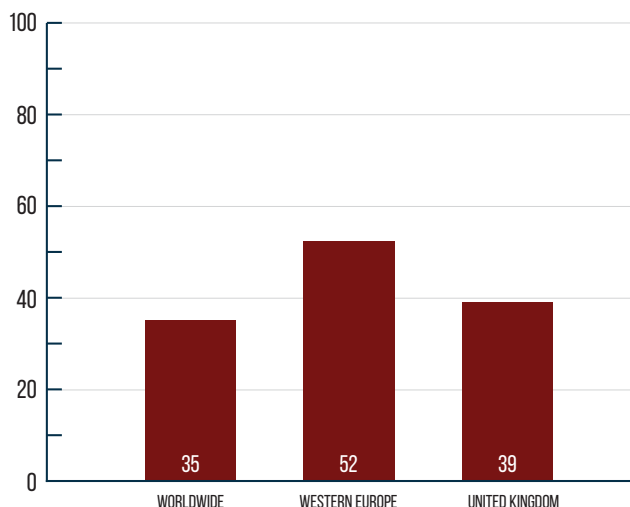




FIGURE 8. SHARE OF ATM TRANSACTIONS

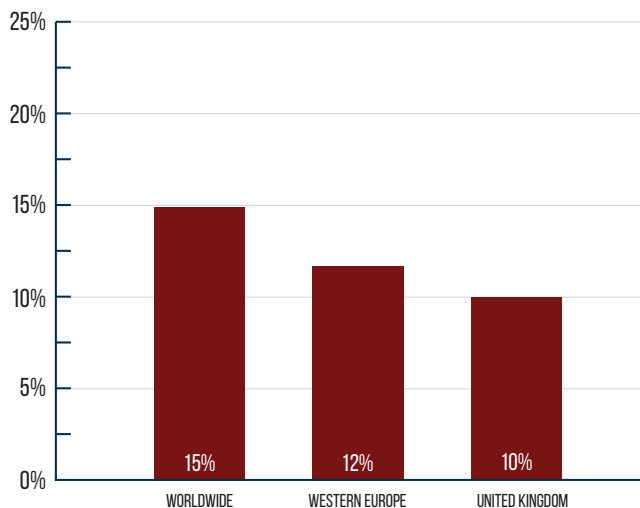
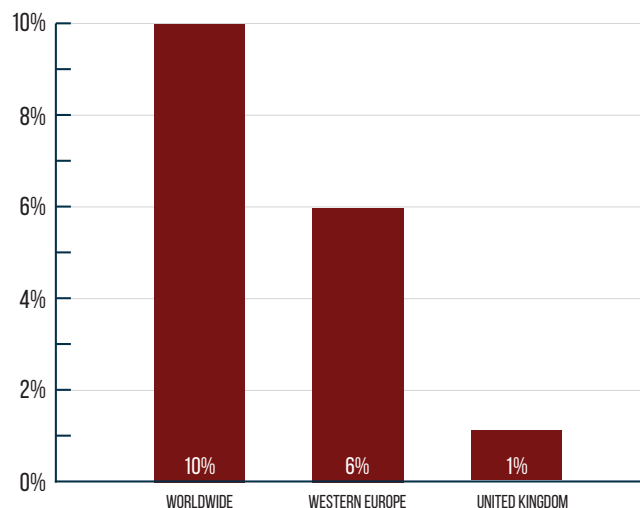


FIGURE 9. SHARE OF OTC TRANSACTIONS



When it comes to availability of ATMs, the U.K. has 108 ATMs per 100,000 people, compared to an average of 90 per 100,000 people in Western Europe. Overall, it scores 41 points on our ATM Availability Index, much higher than Western Europe and the rest of the world.

Although the U.K. has a relatively higher density of ATMs, we see it lags behind the rest of Western Europe when it comes to share of ATM and OTC withdrawals.

TABLE 3. ATM AND BANK BRANCHES AVERAGE INDEX

DESCRIPTION	WORLDWIDE AVG INDEX	WESTERN EUROPE	UNITED KINGDOM
ATM Average Index	28	33	41
Bank Branches Average Index	35	52	39
Population	108	25	65
GDP Per Cap (Average)	28	43	39
ATM Share	15%	12%	9.9%
OTC Share	10%	6%	1.4%
Cash Share	25%	18%	11.3%
POS Per 100,000	1957.4	2415.9	2775.2
ATM Per 100,000	78.0	90	108
Bank Branches Per 100,000	28	38	30

CONCLUSION

Though contactless and other card-based payments have made significant inroads, cash continues to be one of the top payment methods in the U.K. With the rise of consumer credit debt in the U.K., cash promises to not only be an instrument offering store-of-value but also a great budgeting tool.

Cash will continue to face competition from alternate payment forms in the coming years, but it is well-positioned to maintain its high position with year-over-year increases in its overall volume.



FEATURE STORY

IN THE UK,
**CASH AND CONTACTLESS
ARE VYING TO STAY ON TOP**



When the limit on contactless payments in the U.K. was raised in 2016 from £20 to £30, the overall volume of contactless payments tripled.

While, for many industry spectators, the growth in volume of contactless payments equated to a correlating drop in cash use, the actual numbers reveal that despite a growth in competition from alternate payment forms, cash is continuing to hold its ground.

As it turns out, the overall use of cash in the U.K. continues to climb. As of 2016, total banknotes in circulation grew by 10 percent to reach £70 billion — the fastest growth in a decade, according to the Bank of England (BoE).

To gauge the factors powering cash's growth, PYMNTS recently caught up with BoE's director of bank notes and chief cashier, Victoria Cleland, who oversees the production, distribution and security features of banknotes. Cleland explained many facets of the current state-of-cash, including its changing accessibility and evolving role in consumer preferences.

With more competition from alternate payment forms these days, cash may not be the only choice consumers have, but it continues to be a payment method to reckon with, she said.

And rightfully so. Cash accounted for 40 percent of all payments and 44 percent of payments made by consumers in the U.K. in 2016, according to BoE's data.

Where cash stands today

While the transactional demand for cash has been slow in the country, it has maintained a stable course. With cash powering 44 percent of consumer payments, it's still a very popular method of payment — but, alternate payment methods are cutting into some of its overall share, Cleland said.

In fact, some of the competition cash faces in the U.K. today has come with the growth of contactless payments.

Initially, when contactless payments were introduced, consumers used them in place of traditional debit or credit cards rather than cash, Cleland said. But, as contactless terminals have become more ubiquitous in the U.K., they are now being used for much smaller-value transactions.



With the average value of cash transactions remaining steady at around £10, the payment method will continue to be widely used for day-to-day small-value transactions, she said. As such, even if the £30 limit on contactless payments were to be raised, it's less likely to impact use of cash.

Changing accessibility of cash

As with other developed economies, a growing adoption of online and mobile banking in the U.K. has led to a reduction of the physical footprint of bank branches.

In August 2017, Barclays announced plans to shutter 54 bank branches as part of its cost-cutting efforts, and it isn't the only bank closing branches in the country. Royal Bank of Scotland announced its plans to close 180 branches in March. Lloyds and HSBC were also among big financial institutions (FIs) planning to collectively shutter more than 200 U.K. branches.

For consumers, this shrinking physical footprint has also meant changing accessibility to cash. But, perhaps surprisingly, there's now increased availability, according to Cleland.

"The number of traditional bank branches has been reducing, but at the same time we are seeing an increase in the number of ATMs," she said.

With the shift, most of the U.K.'s population is now withdrawing cash from ATMs, Cleland added. Meanwhile, consumers continue to have the option to withdraw and deposit money at the 11,500 post office branches spread across the country.

The decline in the footprint of physical branches is also motivating banks to look for alternate solutions to better serve customers living in less populated areas.

"Banks are also looking to introduce mobile branches that actually drive from one place to another, for enabling people to deposit money back," she noted.

Where cash is headed

Alternate payments methods might be gaining popularity among millennials in the U.K., but cash seemingly continues to have a loyal and slightly growing user base.

As of 2016, some 3.7 million people in the U.K. relied almost entirely on cash transactions, a 0.5 percent increase over 2015, Cleland said. Meanwhile, small businesses continue to prefer accepting cash over credit, debit or contactless payment.

Retailers' average cost per cash transaction measured as a percentage of cash turnover was 0.15 percent in the U.K., the same as 2015, whereas other payment methods cost 0.31 percent, according to 2016 study findings by the British Retail Consortium.

"Cash is still the cheapest payment method and small businesses usually don't want to take cards."

"Cash is still the cheapest payment method and small businesses usually don't want to take cards, particularly for small value payments," Cleland said. "They will only accept a card payment over £5 or £10."

Additionally, with factors like cybersecurity concerns around the use of alternate payment methods, the tangibility of cash and its use as a budgeting tool continue to drive its use.

"At the Bank of England, we see that there's strong demand for cash and expect that to go into the future," she added.

In response to the growing demand, the BoE is introducing new polymer versions of its bank notes, which are intended to have more longevity and improved security features and make them more difficult to counterfeit than their predecessors.

"We introduced the new £5 [polymer] note last year featuring Winston Churchill, and we introduced the £10 [polymer] Jane Austen note and then, in 2020, we are going to introduce a £20 polymer note featuring JMW Turner, an acclaimed British painter," Cleland said.

In the end, while she doesn't have a crystal ball, she foresees cash sticking around for a long time.



And, with that, perhaps, consumers will increasingly pair cash and contactless payments in their day-to-day transactional lives.



METHODOLOGY AND DATA

The PYMNTS.com Global Cash Index, powered by Cardtronics, analyzes the level of 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, and we will publish reports that review cash share and total cash usage, covering one region each quarter. The four regions are as follows:

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			



Total cash usage is the combination of two overall factors:

- 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 forward.
- Estimated total cash usage for 2015 forward.

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 ATP and OTC, total card spending and payments infrastructure, such as the number of ATM machines and bank branches.¹² We also gathered data to project cash usage, including projected GDP and projected population by age group.¹³

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 above, 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.

¹² 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]

¹³ 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.¹⁴

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

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:

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

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

¹⁴ 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 Indices based on the availability of ATMs and bank branches. To do this, we used economy data and population data from 40 countries, which are listed 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 Indices measure the availability of ATM and bank branches per 100,000 inhabitants in each of the 40 countries. The maximum value Indices can achieve is 100 points and the minimum is 0. Each country has its own score.

The following table shows how we calculated both Indices for each country. We first obtained the number of ATM and bank branches per 100,000 people, then took the lowest and the highest number for each Index and set them at 0 and 100, respectively. The rest of the numbers were calculated according to the following formula:

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

In the formula, x is the number of ATM and bank branches per 100,000 people and i represents each country with neither a minimum nor a maximum score. In the table to the right, the red highlights the minimum and the green denotes the maximum.

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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