

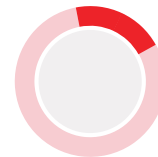
Global Cash Index™

a **CARDTRONICS** collaboration

DECEMBER 2017



GERMANY EDITION



20.7%

Percentage of cash share in 2016



€3,144 BILLION

Total use of cash in 2016

39

ATM Availability Index Score,
on a scale of zero to 100

105

Number of ATMs
per 100,000 people

41

Number of bank branches
per 100,000 people



CASH USAGE IN GERMANY: INTRODUCTION

For the majority of the German population, cash isn't just the obvious choice when it comes to making payments — in many cases, it's the only choice they will consider.

In fact, cash is so prevalent as a payment method in the country that an average citizen is likely to have on hand nearly twice as much as an Australian, Dutch, French or American consumer, according to a European Central Bank study.¹ The same institution found German consumers tend to especially favor cash for the privacy and security it guarantees, in addition to its convenience.²

More than anything else, though, the country's aversion toward alternate payment methods stems from its history of instability and economic crises. Germany found itself on the brink of an economic meltdown for much of the 20th century. The first occurrence was the hyperinflation of 1923, which devalued its currency and resulted from arduous reparations to the allied countries paid in accordance to the Treaty of Versailles. Later, Germany again faced utter economic devastation after its defeat in World War II in 1945.

This economic volatility is widely said to have changed how Germans spend money and use cash. Germany's tumultuous economic history has made its population frugal and debt-averse, which explains its low credit card usage compared to other European countries.³ Even today, after regaining its stature as an economic powerhouse, Germany continues to sing to the tunes of Madonna's song — only those with the "cold hard cash" and who "save their pennies" are "always Mister Right."



THE EFFECT OF GDP ON GERMANY'S USE OF CASH

As of 2016, Germany's gross domestic product (GDP) amounted to more than €3.1 trillion, making it the number one economy in Europe and the fourth most powerful in the world.

Between 2007 and 2016, as shown in Figure 1, Germany's GDP grew at an average of 1 percent per year and is expected to clock 1.5 percent growth per year between 2017 and 2022. While the nation's per capita economic growth has been high, it's expected to see some decline in the coming years due to a stagnating population size.

¹ Bagnall, John; Bounie, David; Huynh, Kim P.; Kosse, Anneke; Schmidt, Tobias; Schuh, Scott and Stix, Helmut. Consumer cash usage: a cross-country comparison with payment diary survey data. European Central Bank. June 2014. <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1685.pdf>. Accessed December 2017.

² Von Kalckreuth, Ulf; Schmidt, Tobias and Stix, Helmut. Using cash to monitor liquidity — implications for payments, currency demand and withdrawal behavior. European Central Bank. October 2011. <http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1385.pdf>. Accessed December 2017.

³ Phillips, Matt. Why Germans pay cash for almost everything. Quartz Media. Sept. 17, 2014. <https://qz.com/262595/why-germans-pay-cash-for-almost-everything/>. Accessed December 2017.



FIGURE 1. HISTORIC AND PROJECTED GDP AT CONSTANT PRICES FOR GERMANY, 2001-2020 (IN BILLION EUROS)⁴

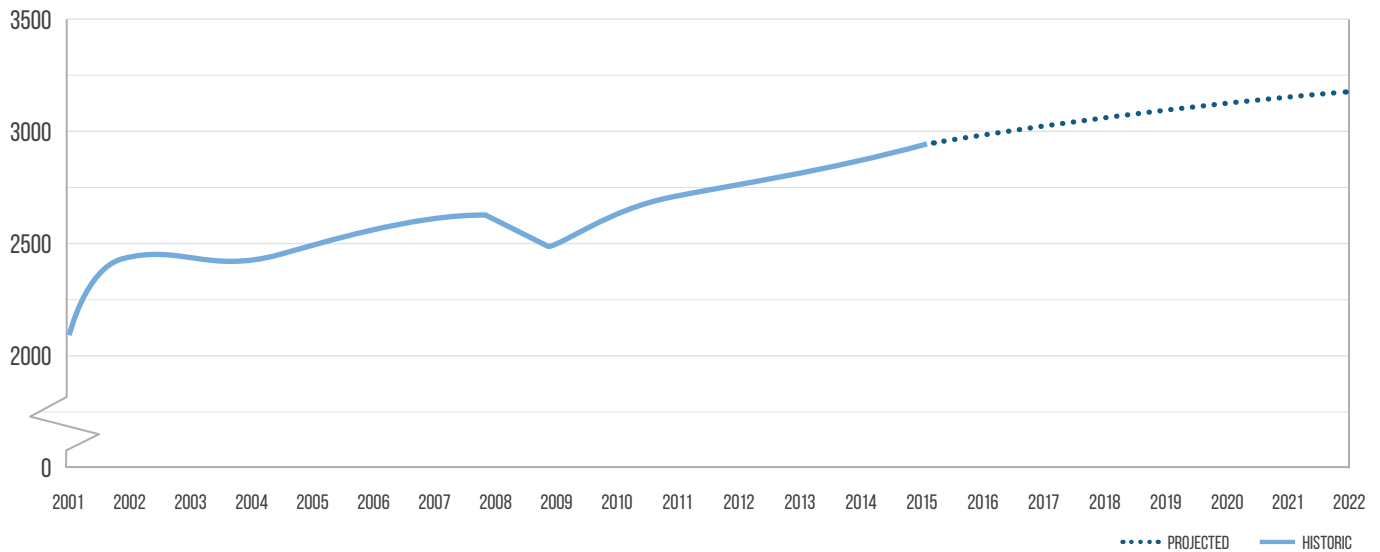
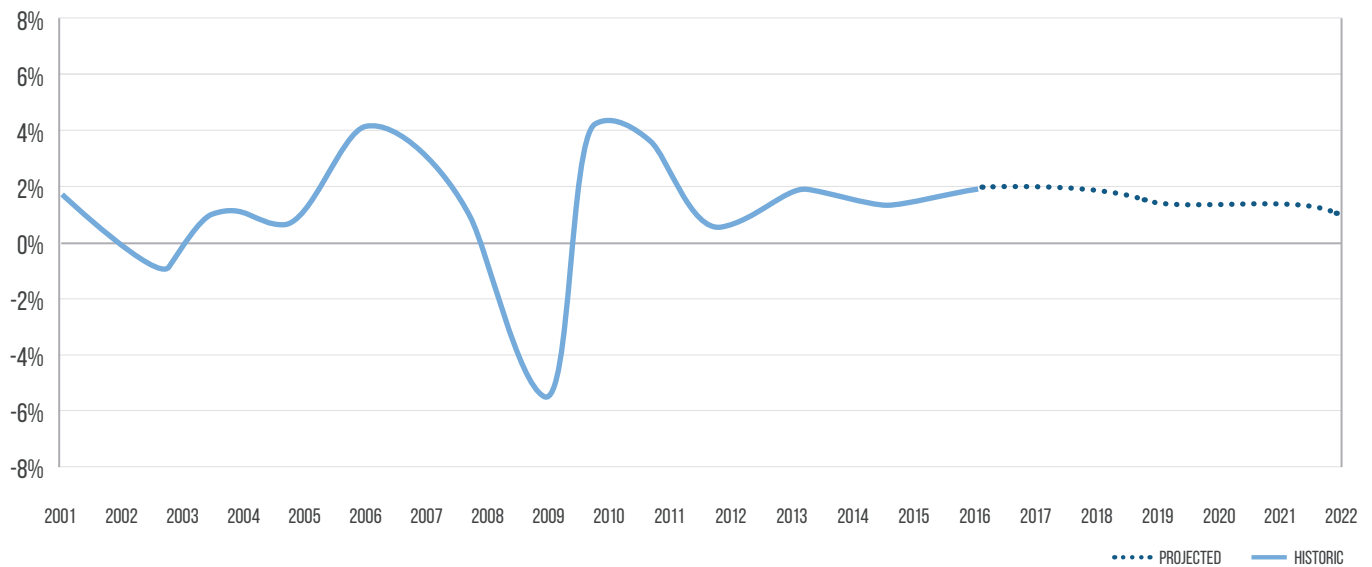


FIGURE 2. HISTORIC AND PROJECTED GDP GROWTH FOR GERMANY, 2001-2022⁵

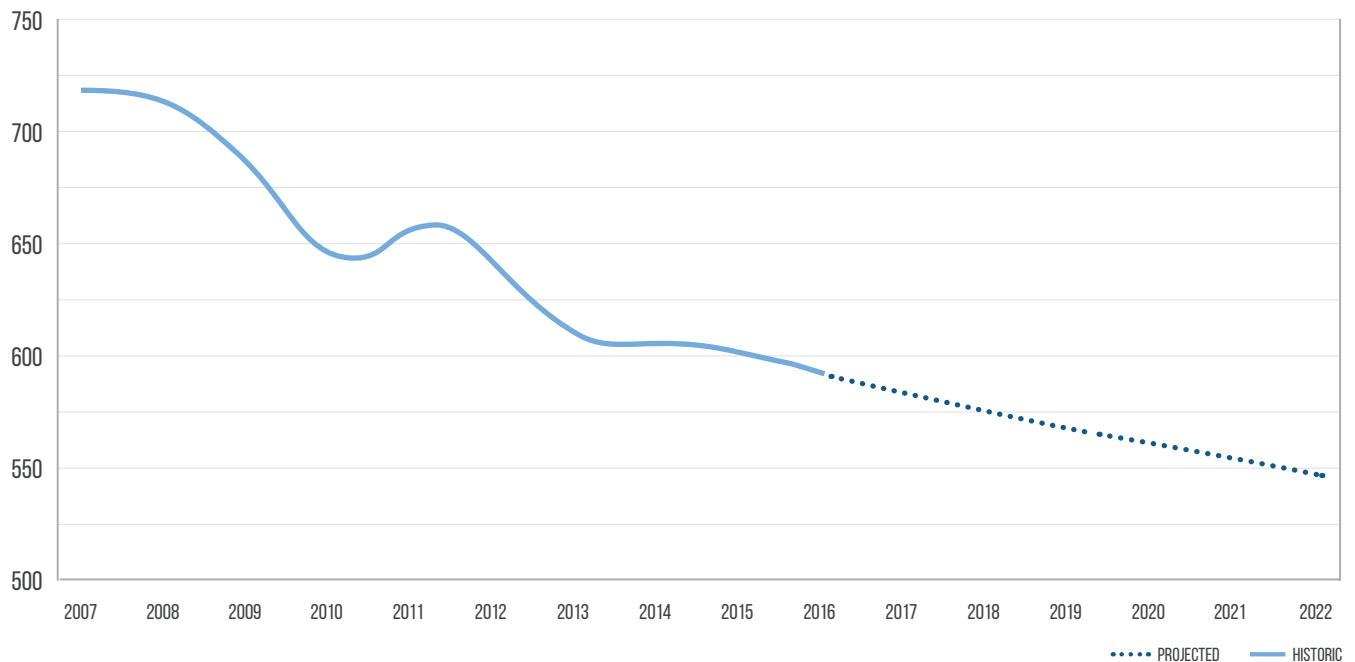


⁴ Author unknown. World Economic Outlook Database. International Monetary Fund. April 2017. <http://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx>. Accessed December 2017.

⁵ Author unknown. World Economic Outlook Database. International Monetary Fund. October 2017. http://www.imf.org/external/datamapper/NGDP_RPCH@WEO/DEU?year=2017. Accessed December 2017.

Despite the economic growth, however, cash usage as a percentage of GDP has seen a decline and is projected to shrink further in the coming years. As seen in Figure 3, total use of cash fell on average 2.1 percent per year between 2007 and 2016. We expect the total use of cash to further drop between 2017 and 2022 at a rate of 1.4 percent per year.

FIGURE 3. HISTORICAL AND PROJECTED TOTAL CASH USAGE (IN BILLION EUROS)



CASH SHARE IN GERMANY

A look at historic trends surrounding cash use and current factors influencing consumers' payment preferences — including government policies and payment innovations, among others — helps us understand how use of cash will evolve in the coming years.

In Germany, the gradual decline in cash's share can be attributed to a change in over the counter (OTC) and ATM withdrawals. OTC withdrawals represented 15.6 percent of the GDP in 2007, but just 8.8 percent in 2016. ATM withdrawals, on the other hand, saw some fluctuation over the last decade but have mostly remained flat. As of 2016, they represented 11.9 percent of the GDP, matching 2007 rates.



GLOBAL CASH INDEX: GERMANY EDITION

TABLE 1. GDP AND CASH USAGE DATA FOR GERMANY (IN BILLION EUROS)

YEAR	NOMINAL GDP IN EUROS	CASH USAGE — BILLION EUROS			ATM SHARE	OTC SHARE	CASH SHARE
		ATM	OTC	TOTAL			
2000	2116.48	253.9	—	—	12.0%	—	—
2001	2179.85	260.5	—	—	12.0%	—	—
2002	2209.29	265.0	—	—	12.0%	—	—
2003	2220.08	303.6	—	—	13.7%	—	—
2004	2270.62	340.2	—	—	15.0%	—	—
2005	2300.86	381.7	—	—	16.6%	—	—
2006	2393.25	381.4	—	—	15.9%	—	—
2007	2513.23	298.8	392.5	691.3	11.9%	15.6%	27.5%
2008	2561.74	311.2	377.3	688.5	12.1%	14.7%	26.9%
2009	2460.28	317.4	365.1	682.5	12.9%	14.8%	27.7%
2010	2580.06	315.5	327.6	643.1	12.2%	12.7%	24.9%
2011	2703.12	333.1	329.5	662.6	12.3%	12.2%	24.5%
2012	2758.26	342.3	310.8	653.1	12.4%	11.3%	23.7%
2013	2826.24	345.4	296.1	641.5	12.2%	10.5%	22.7%
2014	2923.93	356.7	286.5	643.3	12.2%	9.8%	22.0%
2015	3043.65	374.4	277.0	651.3	12.3%	9.1%	21.4%
2016	3144.05	373.4	276.3	649.6	11.9%	8.8%	20.7%



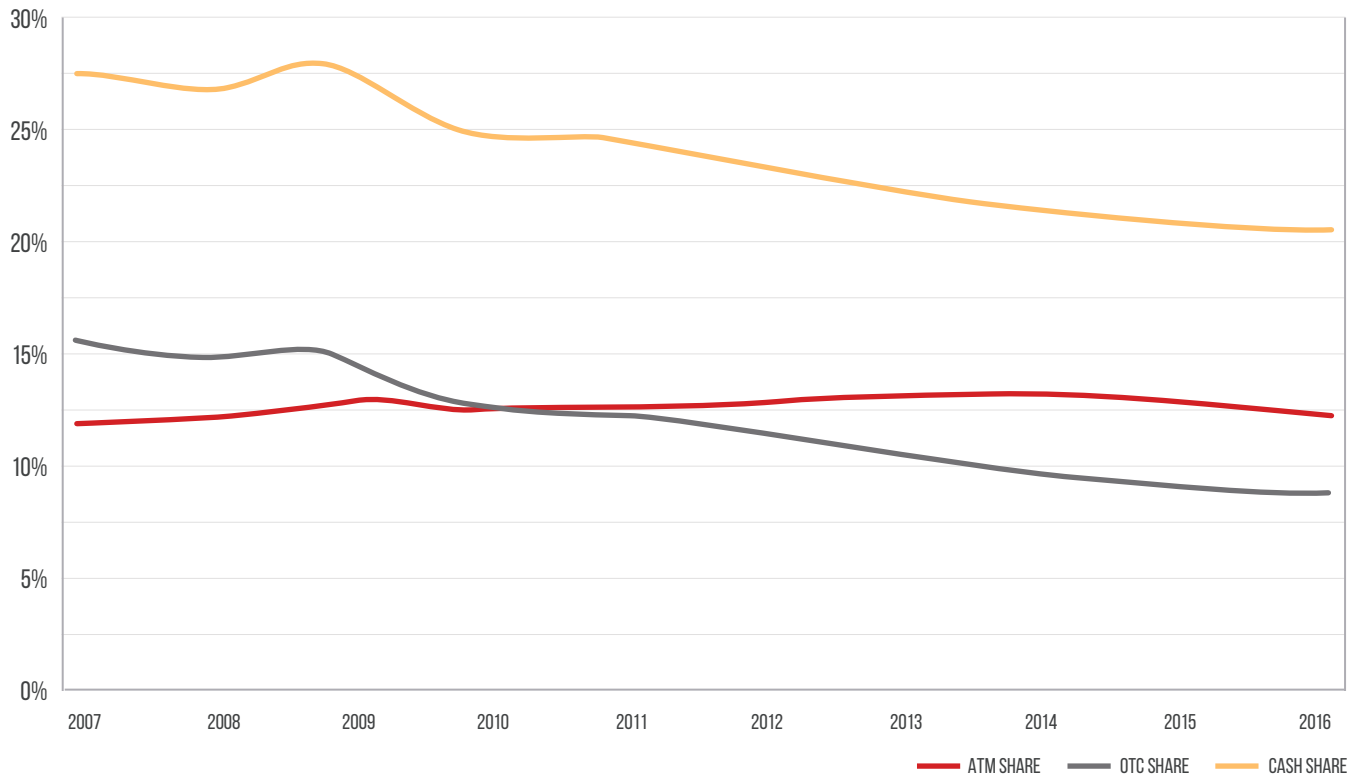
Nonetheless, cash use in Germany remains considerably higher than in other Western European countries — or any country with a comparable per capita GDP, for that matter. As shown in Table 1, overall cash usage stood at €649.6 billion, amounting to 20.7 percent of the GDP.

In comparison, total cash share in the U.K. represented 11.3 percent of the country's GDP, with a 9.9 percent ATM share and a 1.4 percent OTC share.

Based on the data above, we used a logarithmic trend to project cash share as a percentage of GDP between 2016 and 2022. Figure 4 shows the trends that can be expected.

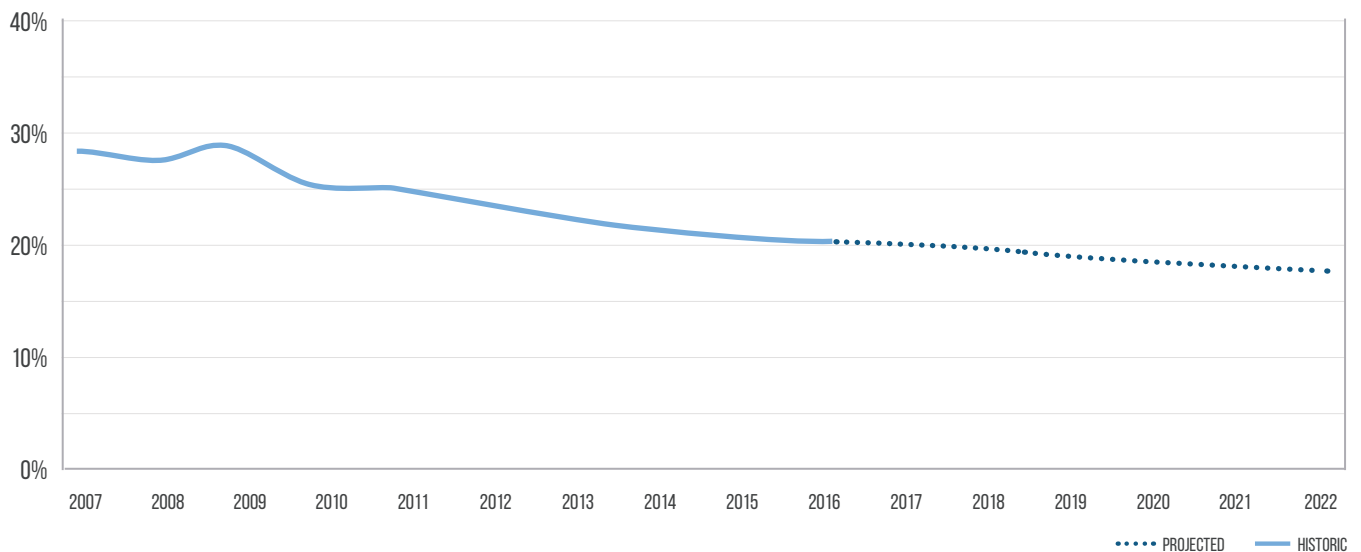


FIGURE 4. CASH, ATM AND OTC SHARES IN GERMANY



As can be seen in Figure 5, cash share declined by 0.7 percent per year between 2007 and 2016. We anticipate a continued decline, but at a slower pace. In fact, we expect cash share to decline by 0.5 percent per year between 2017 and 2022.

FIGURE 5. HISTORIC AND PROJECTED CASH SHARE WITH LOGARITHMIC TREND



There are several factors making other payment forms more competitive and, in turn, contributing to the gradual decline of cash's share in Germany. While not very popular, digital and card-based payment methods are making in-roads in the country — though they are more commonly used by younger consumers.

In the coming years, several macroeconomic indicators will also likely influence cash use, including changes in GDP, interest rates, exchange rate and inflation; demand for international tourism; demographic trends and geopolitical developments such as wars or governmental changes. Meanwhile, cash itself is facing growing competition from emerging digital and mobile payment methods.

In October, a group of 10 German banks — including Forde Sparkasse, Gunzburg-Krumbach, Hannover, Heidelberg and Leipzig, among others — announced the launch of a mobile payments program to exclusively serve their employees. It was backed by financial services firms Bayern Card Services, Finanz Informatik and Pluscard.

The program debuted a little too late to make an impact on a market already dominated by Apple and Samsung, but the introduction of such new players in Germany's mobile payments space shows it is about to get a lot more competitive.⁶

There is still room for growth, however. According to a survey by market research provider Kantar TNS, conducted for German digital economy organization Bundesverband Digitale Wirtschaft (BVDW), two-thirds of 1,049 respondents reported they preferred to use electronic payment methods for transactions worth €50 or more, and nearly half said the same of purchases in the €25 to €50 range.⁷

It's worth pointing out, though, that adoption of digital and card-based payments is slow and alternate payment methods are far from tilting the balance away from cash.

An April 2017 report by EHI Retail Institute noted bank cards still appear to be an afterthought when it comes to eCommerce. Post-delivery invoices were used for 30.5 percent of B2C eCommerce sales in Germany in 2016, making it the most common payment method at the time. A similar



study by Kantar TNS for delivery firm DPDGroup in October of last year found an even greater preference for invoicing, which was used for 51 percent of digital purchases in the country.

The high affinity for cash was also evident in the findings of another report published by German banking and brokerage firm ING-DiBa, which found 84 percent of Germany consumers didn't want to give up their use of hard cash compared to 76 percent of consumers across Europe. When asked the reasons for their responses, many consumers argued that other payment methods like credit cards and checks did not allow the same degree of anonymity and security.⁸

Germany's ever-lasting love of cash comes against a dramatic growth in use of smartphones. In fact, 43.9 million people (64.5 percent of the adult population) in Germany had smartphones in 2016, up from 29.6 million (44.3 percent) in 2013. It is estimated that nearly 61.2 percent of the population (73.4 percent adults) will have access to smartphones by 2020.⁹

Assuming accelerated reductions in cash share are realized over a five-year time period, they 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. Considering the relatively short five-year window, the expected cash share for the year 2020 would drop from 18.4 percent to 15.7 percent, as seen in Figure 6.

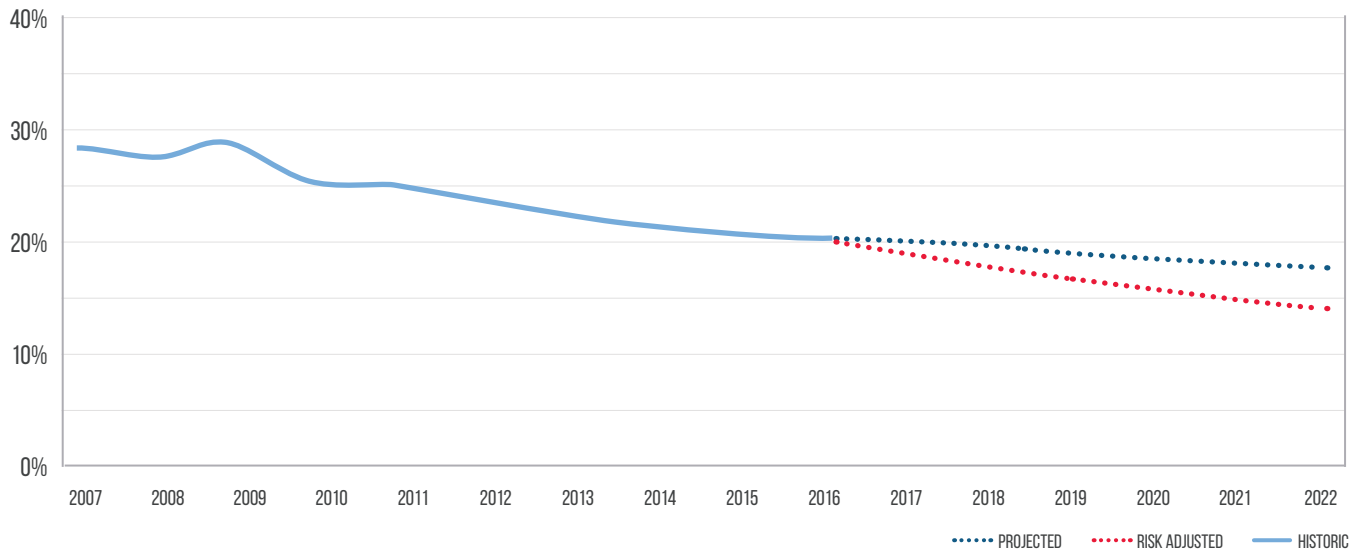
⁶ Anderson, Steven. German banks form conglomerate mobile payments program. PaymentWeek. October 10, 2017. <https://paymentweek.com/2017-10-10-german-banks-conglomerate-mobile-payments-program/>. Accessed December 2017.

⁷ Annicelli, Cliff. Are cracks appearing in Germany's preference for cash?. eMarketer. October 10, 2017. <https://www.emarketer.com/Article/Cracks-Appearing-Germanys-Preference-Cash/1016594>. Accessed December 2017.

⁸ Anderson, Emma. The vast majority of Germans never want to give up cash, poll shows. TheLocal. May 18, 2017. <https://www.thelocal.de/20170518/vast-majority-of-germans-never-want-to-give-up-cash-poll-shows>. Accessed December 2017.

⁹ Author unknown. Forecast of the internet user penetration rate in Germany from 2015 to 2022. Statista. 2017. <https://www.statista.com/statistics/567494/predicted-internet-user-penetration-rate-in-germany/>. Accessed December 2017.

FIGURE 6. RISK ADJUSTED CASH PROJECTION



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	
	2007	2011	2016	2022	2007 – 2016	2017 – 2022
CASH SHARE	27.5%	24.5%	20.7%	17.4%	-0.7%	-0.5%
GDP	2596.2	2664.9	2844.6	3119.7	1.0%	1.5%
TOTAL CASH USAGE	714.1	653.2	587.8	543.7	-2.1%	-1.4%



ATM AND BANK BRANCHES AVAILABILITY INDEX

We determined the accessibility of cash in Germany by creating two Indexes measuring ATM and bank branch footprints in the country and 39 others around the world.

To gain a better sense of its state of cash, we also calculated a comparable Index score by just analyzing Western European countries — Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Spain, Sweden, Switzerland and the U.K. — and the world. The maximum value Indexes can achieve is 100 points, and zero is the minimum.

Each Index corresponds to an average value of different variables: population, GDP per capita, participation of ATMs/OTC/cash in GDP and ATM and bank branches per every 100,000 people.

The findings of our Bank Branches Availability Index show Western Europe scores much higher than the Worldwide Average Index. Germany emerged on top, boasting a score of 58 that was six points higher than the average Index score of all Western Europe. Germany also scored six points higher than the rest of Western Europe on the ATM Availability Index.

Given Germans' high propensity to hold cash, it is understandable that the average penetration of ATMs and bank branches per 100,000 people is higher there than in the rest of Europe and the world. ATMs can be found in almost every nook and cranny in German cities — from subway stations and grocery stores to airports, malls and train stations.¹⁰



TABLE 3. ATM AND BANK BRANCHES AVERAGE INDEX

DESCRIPTION	WORLDWIDE AVG INDEX	WESTERN EUROPE	GERMANY
ATM Average Index	28	33	39
Bank Branches Average Index	35	52	58
Population	108	25	82
GDP Per Cap (Average)	28	43	41
ATM Share	15%	12%	11.9%
OTC Share	10%	6%	8.8%
Cash Share	25%	18%	20.7%
POS Per 100,000	1957.4	2415.9	1127.7
ATM Per 100,000	78.0	90	105
Bank Branches Per 100,000	28	38	41

While one could argue that cash is the undisputed king in Germany, it's worth noting that not all denominations are commonly accepted. Many stores refuse to be paid in bill denominations higher than €50, especially in smaller towns.

¹⁰ Amonson, Birge. Money in Germany. TripSavvy. July 31, 2017. <https://www.tripsavvy.com/money-in-germany-1520151>. Accessed December 2017.

On the flip side, solely using credit cards can make it hard to get by. For example, a bulk of German retailers do not accept credit cards. Germany and its European counterparts have also adopted chip-and-PIN EMV cards that may offer more robust security, but also rule out the option of using the magstripe-based credit cards that are commonly carried by international visitors.¹¹



POS CASH BACK

Point of sale (POS) withdrawals, the option to withdraw cash at a retail checkout awhile making a payment transaction, is less popular among German consumers because of the high availability of ATMs and bank branches in the country.

According to a Deutsche Bundesbank survey, the POS cashback option is only used by Germans when they forget to withdraw cash from an ATM or if circumstances make it difficult to do so. On average, German consumers withdraw no more than 1 percent of their annual cash requirements using this form of cash withdrawal.¹²

CONCLUSION

As younger consumers enter the economic fold, digital and card-based payments are bound to cut into cash's share in Germany.

However, given Germans' strong affinity for using cash in day-to-day payments — and an overall lack of infrastructure for digital payments acceptance — cash is well positioned to maintain its dominance as the leading payment method in the country for years to come.

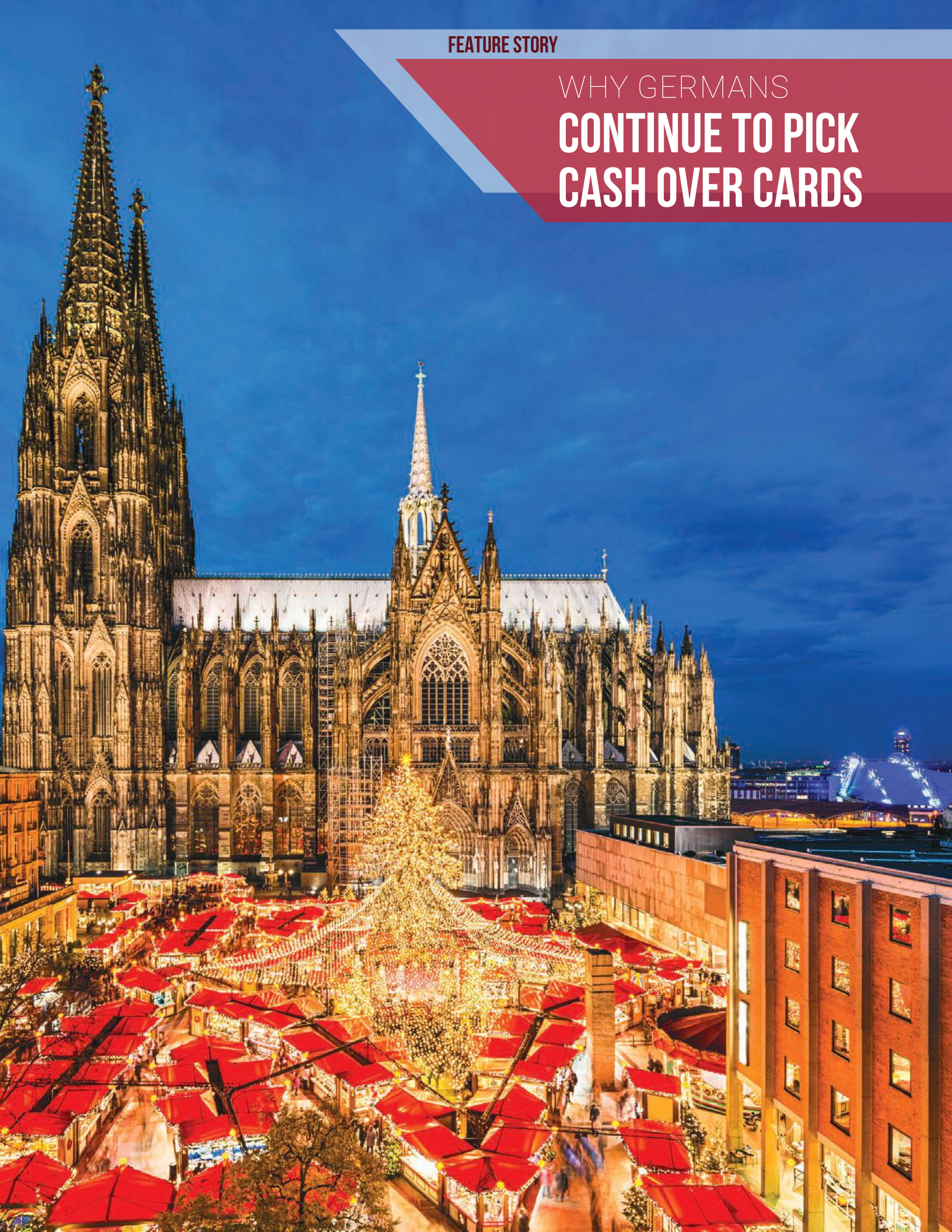


¹¹ HF. Credit card differences. The German Way & More. August 8, 2011. <https://www.german-way.com/credit-card-differences/>. Accessed December 2017.

¹² Author unknown. Cash withdrawals at the point of sale: motives for use and implications for cash holding. Deutsche Bundesbank. June 2014. https://www.bundesbank.de/Redaktion/EN/Downloads/Publications/Monthly_Report_Articles/2014/2014_06_point_of_sale.pdf?__blob=publicationFile. Accessed December 2017.

FEATURE STORY

WHY GERMANS CONTINUE TO PICK CASH OVER CARDS





They say that if you're in Rome, you do as the Romans do. Well, for consumers traveling in Germany, that means making most purchases in cold, hard cash.

This central European country may be known for its economic and tech prowess, but when it comes to making payments, physical currency is still the top choice for consumers around Germany.

The country of 83 million people is one of the most cash-reliant advanced economies in the world. According to data inside the PYMNTS.com Global Cash Index Western and Eastern Europe Edition, Germany had a cash share of just under 20 percent as of 2016 — making it the country with sixth-highest cash share in Western Europe.

The share of cash in Germany is higher than its neighboring countries like Belgium (15.4 percent cash share), France (7 percent cash share) and the Netherlands (7.1 percent cash share.)

But while there's no debating the popularity of physical currency among consumers in Germany, finding out what's fueling its growth— and how it might evolve — is easier said than done, according to Heike Mai, an economist and analyst of banking and financial markets for Deutsche Bank AG.

She noted that a range of factors — including merchant acceptance, convenience and a historical skepticism toward

new financial technology — could be some of the factors leading to the cash craze among German consumers.

“Along with Austria, who are also heavy cash users, we are probably the country that loves cash the most. And we are happy cash users,” Mai said of Germany. “But, why we love cash is the thousand-dollar question right now. And I’m not sure anyone can answer it for sure.”

Big usage in small purchases

Notably, while the country's cash share comes in at just under 20 percent, its usage numbers are much higher. Mai said that roughly 80 percent of purchases in Germany are made using cash, and that an even higher percentage of low-value purchases are made with physical currency.

“If they are going out to a nice dinner at an expensive restaurant, then most consumers will take out their card when it comes time to pay,” Mai explained. “But if they are just

getting a coffee or something else inexpensive, they are going to use cash.”

One of the biggest factors powering physical currency usage for these low-value purchases is its convenience, Mai said. She noted that many merchants, particularly small businesses and many local retail stores, do not accept mobile or contactless payments, and may not even accept payment via debit card.

Consumers’ high reliance on use of cash at small store locations seemingly spills into other purchases as well.

“All merchants here accept cash, but they don’t all accept cards or other methods,” she said. “So in some situations, consumers need cash even if they’d rather use a card. And, once they have cash in their purse or wallet because you need it for those situations, they become much more likely to use it even in situations where they can use a card or other method.”

Old habits die hard

In Germany, cash also benefits German consumers’ inherent resistance to change, according to both PYMNTS research and Mai’s own experience.

The Global Cash Index data reveals that the country’s attitude toward new payment methods can be traced back to its economic problems in the past. In the early 20th century, hyperinflation and war penalties left their mark on the behavior of many German consumers, and studies have shown that consumers in countries struck by economic difficulties and financial crisis rely more on cash than other countries.

[Studies have also shown](#) that the country’s difficult past has made its population frugal and debt-averse, leading them to trust cash over methods like credit cards. What’s more, Mai said that her experience echoes the results found by researchers.

But whatever the reason for reticence, the payments tide is slowly beginning to turn. Mai noted that digital payment

methods are particularly popular among younger consumers, who are increasingly turning to tech-based solutions not just for payments, but for a host of applications.

“The younger you are, the more you use digital payments and the less you use cash,” she said. “Only the very youngest, who don’t yet have bank accounts, are more likely to use cash than digital payment methods.”

“ The younger
you are, the more you
use digital payments
and the less
you use cash. ”

The future of payments

So, despite its high use, will new payment methods dethrone cash from its German throne?

Mai isn’t convinced. While she acknowledged that consumers, particularly younger ones, are slowly beginning to adopt new payment methods, as of now, alternatives like NFC-powered payments or other innovations have not gathered pace in Germany.

And so for a change in consumers’ payment preferences to happen, merchants will have to lead the charge for a switch to modern payment methods – something

that has yet to happen, she noted.

“Mobile payments and NFC payments at the point of sale don’t really exist in Germany. There are some pilot projects, so that is starting to change, but nothing that is really rolled out and widely used,” she said. “So I think we will see a decline in cash payments, but I think it will depend a lot on what merchants are offering. If there’s going to be a change, merchants will need to be very positive about other alternatives.”

And so it seems, if visitors to Berlin want to do as the Germans do, all they need is cash to get by.



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.¹³ We also gathered data to project cash usage, including projected GDP and projected population by age group.¹⁴

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.

¹³ 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]

¹⁴ 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:

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

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

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:

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

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:

$$\text{Cash Share}_{\text{Year}} = \frac{\text{ATM Withdrawals}_{\text{Year}} + \text{OTC Withdrawals}_{\text{Year}}}{\text{GDP}_{\text{Year}}}$$

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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