the PYMNTS.com

Global Cash Index™

a CARDTRONICS collaboration

JANUARY 2018

SPAIN EDITION

€255.4 BILLION

Total use of cash in 2016

22.9%

Percentage of cash share in 2016

41 ATM Availability Index score, on a scale of zero to 100

107 Number of ATMs per 100,000 people

67 Number of bank branches per 100,000 people

CASH USAGE IN SPAIN: INTRODUCTION

Cash's roots and influence in citizens' everyday lives run deep in Spain.

The country boasted one of the highest cash uses in Western Europe in 2016, with overall cash share representing nearly a quarter of its $1.232 trillion economy, according to the PYMNTS Global Cash Index.

There are several factors contributing to Spain's ongoing love affair with cash and its preference for the payment method over newly available ones. First, the country has a higher rural population than many neighboring nations, and that group tends to favor cash for its ease of access and security.

Another factor is its thriving underground economy, a by-product of the global financial crisis of 2009 and the burst of the real estate bubble. Recent estimates peg the value of Spain's underground economy at roughly 16 percent of the nation's overall gross domestic product (GDP).[1]

Some recent policy changes could lead to a slight decrease in cash's influence, however.

The Spanish government is taking measures to reduce parallel economy influence by putting cash in its crosshairs. It recently imposed limits on cash-based transactions for citizens, a move that could undermine the payment method's influence in Spain's financial ecosystem.

Meanwhile, one of the most influential financial institutions (FIs) in Spain recently took steps to make it slightly more difficult to access cash. In March 2015, CaixaBank announced

it would begin charging two euros per ATM withdrawal for users without bank-issued payment cards.[2] The results of Caixa's efforts could be visibly measured last year.

In the Q1 2016, a report published by Analistas Financieros Internacionales[3] (AFI) found the value of point-of-sale (POS) card payments exceeded the value of ATM withdrawals for the first time. It also noted that 25 percent of Spaniards still rely on cash to make smaller, everyday purchases.

Overall, cash in Spain remains strong, thanks, in its part, to larger-than-average ATM accessibility among Spain's rural population. The PYMNTS Spain Cash Report examines the role of cash in the Spanish marketplace, the factors that have allowed it to thrive and the economic influences shifting the way its citizens use it to pay.

[1] Hunter, Simon. Spain losing €26bn in tax revenue due to fraud, says economists' report. El País. Jun 15, 2017. https://elpais.com/elpais/2017/06/15/inenglish/1497545884_038119.html. Accessed January 2018.
[2] De Wit, Richelle. Banks charging for cash withdrawals with card from different bank. Citizens Advice Bureau Spain. Mar. 24, 2015. https://www.citizensadvice.org.es/banks-charging-for-cash-withdrawals-with-card-from-different-bank/. Accessed January 2018.
[3] Delgado, D.V. and Sabater, V.L. Analysing Payment Trends in Spain (March 2017). Analistas Financieros Inernacionales (AFI), S.A.

What Trends Do We See?

In Spain, cash as a payment method has been on the decline for several years and, based on our findings, is likely to continue to do so over the next five, too — although at a slower pace. Reasons for this are largely tied to the 2008 global financial crisis, but the trend can be seen earlier than that economic downturn.

Total cash usage in Spain decreased by about 5.6 percent per year from 2004 to 2016. We expect a continued decline at the relatively low rate of 1.7 percent per year from 2016 to 2022.

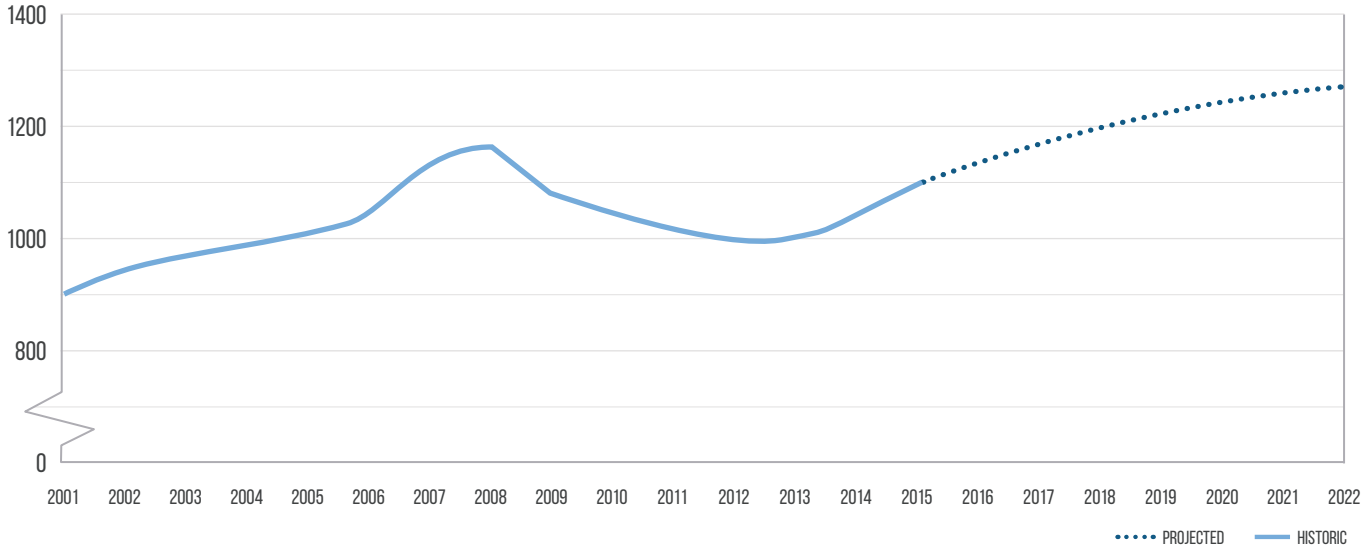
To measure the impact of cash on Spain's economy, PYMNTS first measured the country's overall GDP, which was valued at €1.102 trillion in 2016 (see Figure 1).

According to the most recent PYMNTS Global Cash Index – Western And Eastern Europe Analysis, it's clear cash still plays a strong, driving role in Spain's GDP[4]. When compared with other Western European nations, the analysis found Spain had the third-highest percentage of GDP driven by cash as opposed to non-cash payments. In fact, at 24 percent, Spain finished behind Austria (39 percent) and Italy (25 percent).

For the Spain analysis, PYMNTS' GDP estimate and projections were reached by tracking information from several local and international agencies. That information was used to forecast the country's spend growth between 2001 and 2022, as seen in Figure 1.

As such, PYMNTS determined that economic growth also increases the total value of all payment methods — and cash is no exception.

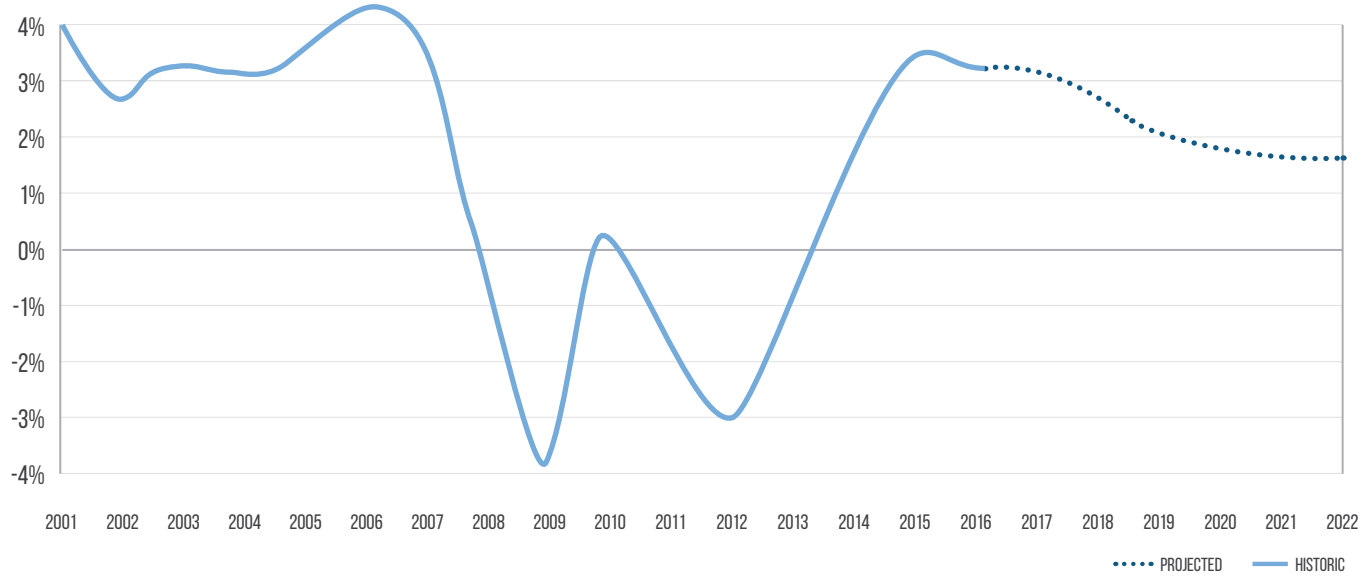
FIGURE 1. HISTORIC AND PROJECTED GDP AT CONSTANT PRICES FOR SPAIN, 2001-2020 (IN BILLION EUROS)[5]



[4] Author unknown. PYMNTS Global Cash Index – Western And Eastern Europe Analysis. PYMNTS. Dec. 2017. https://www.pymnts.com/global-cash-index/. Accessed January 2018.
[5] Author unknown. World Economic Outlook Database. International Monetary Fund. July 2017. http://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx. Accessed January 2018.

Spain's GDP has been growing by an average of 1.5 percent per year from 2012 to 2016, and is expected to grow at a rate of 2.3 percent in the following years (see Figure 2).

FIGURE 2. HISTORIC AND PROJECTED GDP GROWTH FOR SPAIN, 2001-2022 [6]



[6] Author unknown. World Economic Outlook Database. International Monetary Fund. July 2017. http://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx. Accessed January 2018. December 2017.

CASH SHARE PROJECTION
IN SPAIN

We took a two-pronged approach to our analysis to help us better understand the role of cash share in Spain and make cash share projections. We first examined historic trends in the country, then looked at trends — like government policies, payment innovations and other factors — that could cause cash share to decline at a faster rate than indicated by recent history.

We also studied the frequency of ATM withdrawals and over-the-counter (OTC) withdrawals at bank branches.

Our findings indicate that a drop in both ATM and OTC withdrawals is helping to inform a downward trend of cash share in Spain. OTC withdrawals have declined by roughly half in the last decade, from a 29.5 percent share of Spain's GDP in 2004 to 12.9 percent in 2016. ATM withdrawals have also declined, but by a relatively small amount. They made up 11.1 percent of Spain's GDP in 2004 and declined modestly to 10 percent in 2016. As shown in Table 1, overall cash usage in 2016 was €255.4 billion and cash share came in at 22.9 percent.

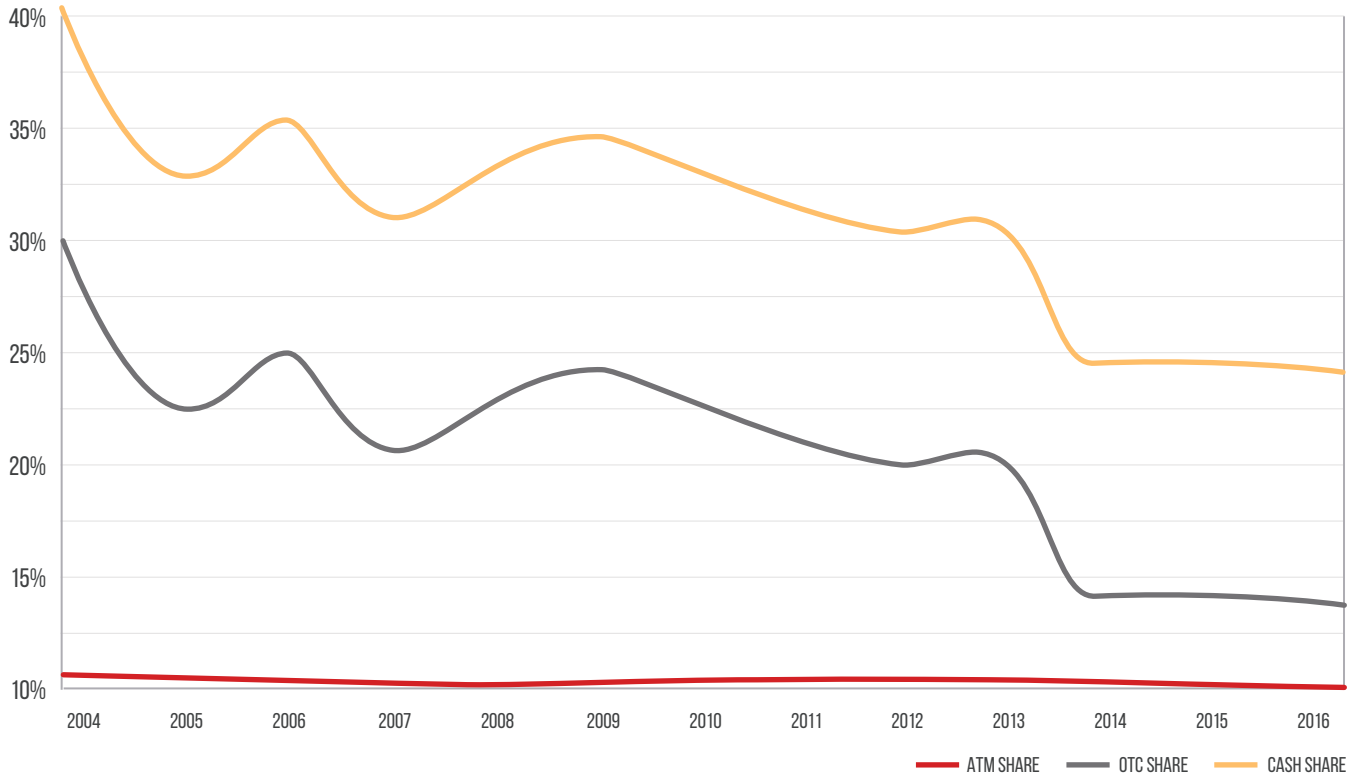
In terms of OTC withdrawals, Spain's activity is in a league of its own compared to its Western European neighbors. For example, OTC share in nearby Germany was reported at 8.8 percent in 2016, and it reached 1.4 percent that same year in the U.K.

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

YEAR	NOMINAL GDP IN EUROS	CASH USAGE — BILLION EUROS			ATM SHARE	OTC SHARE	CASH SHARE
		ATM	OTC	TOTAL			
2000	646.3	—	—	—	—	—	—
2001	699.5	—	—	—	—	—	—
2002	749.3	82.0	—	—	—	—	—
2003	803.5	91.0	—	—	—	—	—
2004	861.4	96.0	254.2	350.2	11.1%	29.5%	40.7%
2005	930.6	101.6	208.5	310.1	10.9%	22.4%	33.3%
2006	1008.0	108.0	250.0	357.9	10.7%	24.8%	35.5%
2007	1080.8	113.9	236.8	350.8	10.5%	21.9%	32.5%
2008	1116.2	116.6	252.3	368.9	10.4%	22.6%	33.0%
2009	1079.0	113.2	249.2	362.4	10.5%	23.1%	33.6%
2010	1080.9	114.2	248.9	363.1	10.6%	23.0%	33.6%
2011	1070.4	113.6	229.3	342.9	10.6%	21.4%	32.0%
2012	1039.8	110.6	208.4	319.0	10.6%	20.0%	30.7%
2013	1025.6	109.2	215.0	324.2	10.6%	21.0%	31.6%
2014	1037.0	111.5	143.1	254.7	10.8%	13.8%	24.6%
2015	1075.6	111.7	143.4	255.1	10.4%	13.3%	23.7%
2016	1113.9	111.9	143.6	255.4	10.0%	12.9%	22.9%

A look at Figure 3 points to the evolution of cash, ATM and OTC share observed in Spain since 2004.

FIGURE 3. CASH, ATM AND OTC SHARE EVOLUTIONS IN SPAIN, 2004 TO 2016



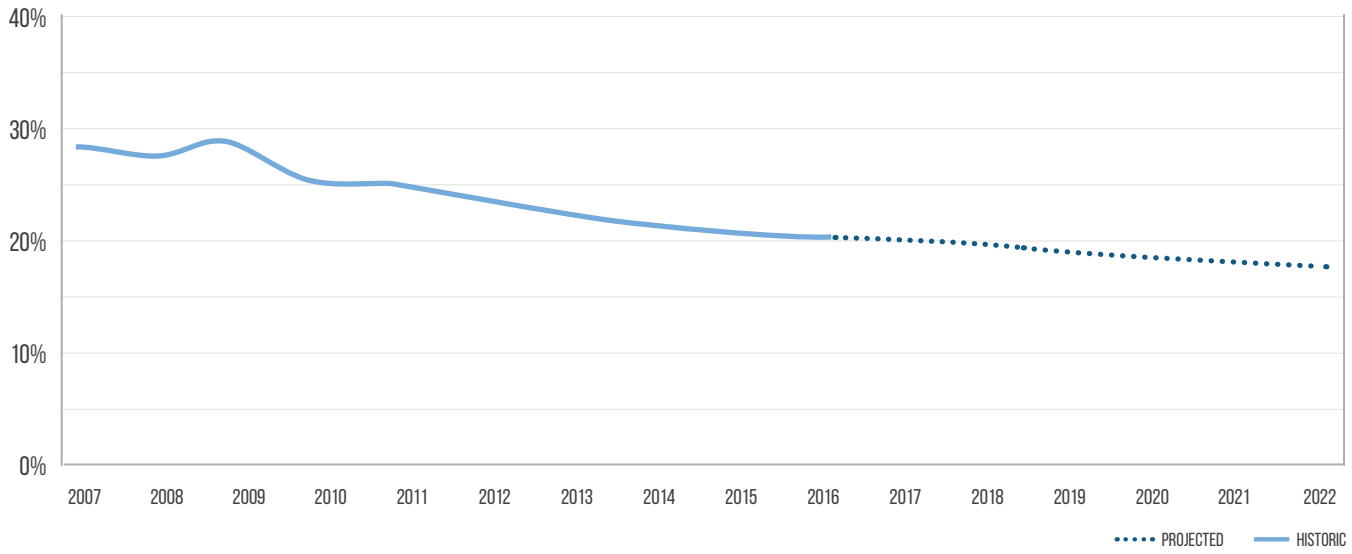
As OTC shares go, so, too, goes overall cash share. As Figure 3 indicates, cash share declined rapidly between 2004 and 2007, falling from 29.5 percent in 2004 to 21.9 percent in 2007. After increasing slightly between 2007 and 2010, OTC continued its downward trend, dropping to 20 percent in 2012. The following year, would see a modest uptick of 1 percent before OTC dropped rapidly again to 13.8 percent in 2014.

The declines in OTC share largely mirror the decline in cash share over the same timespan, which dropped from 31.6 percent in 2013 to 24.6 percent in 2014. It has since declined at a slower rate, dipping from 23.7 percent in 2015 to 22.9 percent in 2016.

Meanwhile, ATM withdrawals remained relatively stable during the same time frame, holding at the 10 to 11 percent range. Because ATM activity has remained stable, shifting cash share trends can largely be traced back to OTC trends.

Based on these data insights, we used a logarithmic trend of the data to project cash share from 2016 through 2021. Figure 4 shows the expected projection of base historic trends.

FIGURE 4. HISTORIC AND PROJECTED CASH SHARE WITH LOGARITHMIC TREND



According to PYMNTS' analysis, Spanish citizens are in no rush to stop using cash. As shown in Figure 4, cash share appears to be declining but at a glacial pace. The rate dipped 1.5 percent per year between 2004 and 2016. Looking ahead, it is still expected to decline, but at one-third the rate previously observed. Based on our projections, cash share is expected to decrease annually by 0.5 percent between 2017 and 2022.

While still a financial force with which to be reckoned in Spain, other signs indicate cash's usage is facing new competition from new payment methods. In an interview with *El País*, Ovidio Egido, managing director of Mastercard's Spanish operations, noted Spaniards could pay for services like parking meters and taxis using newer payment options like credit cards as of 2015[7]. These options, which seemed impossible years before, are now a reality and threatening the role of cash for smaller transactions — an area the payment method currently dominates.

Meanwhile, research indicates Spain has the fourth-highest rate of mobile payment users in Europe after Turkey, Poland and Italy, a sign that mobile payments could further encroach on transactions once dominated by cash.[8] In addition, Samsung Pay was released in Spain in June 2016,[9] and CaixaBank customers learned they could use Apple Pay in October 2017.[10]

[7] De Barrón, Íngigo. Why cash is still king in Spain. El País. Jun 12, 2015. https://elpais.com/elpais/2015/06/09/inenglish/1433859074_583362.html. Accessed January 2018.
[8] Author unknown. 2016 Mobile in Spain and in the World Report. Ditrendia Spain. 2016. http://www.amic.media/media/files/file_352_1050.pdf. Accessed January 2018.
[9] Rolfe, Alex. Spanish banks launch mobile payments initiative Bizum. Payments Cards and Mobile. Oct. 4, 2016. http://www.paymentscardsandmobile.com/spanish-banks-launch-mobile-payments-initiative-bizum/. Accessed January 2018.
[10] Lovejoy, Ben. Apple Pay expands in Spain with CaixaBank, and Italy with Widiba [U]. 9 to 5 Mac. Oct. 18, 2017. https://9to5mac.com/2017/10/18/apple-pay-spain-caixabank/. Accessed January 2018.

It's worth noting, though, that while mobile payments are making inroads in Spain and the rest of Europe, cash continues to power 75 percent of POS payments in the Eurozone.[11]

In Spain, other recent payment innovations are also competing with cash. The country recently became one of the first European nations to offer the SEPA Instant Credit Transfer (SCT Inst) scheme, a new payment network enabling credit transfers within seconds.

Contactless payments are also poised to challenge cash's territory.

According to Pilar Clavería, senior payments advisor at the Spanish Banking Association, approximately 30 percent of all card payments made in December 2016 were contactless — by comparison, just 12.5 percent were registered in December 2015.[12] The recent uptick in Spain's contactless payment activity can be traced to the introduction of Bizum in October 2016.

Bizum is a system that has been integrated into the mobile payment apps of 27 participating Spanish banks, allowing banking customers to send money to or request money from contacts using mobile phone numbers.

The growing role of smartphones could further impact cash's influence in Spain. Recent research indicates smartphone penetration increased dramatically from 26.2 million people — roughly 71.6 percent of Spain's adult population — in 2014 to 31.2 million in 2016 (85.5 percent). Approximately three-quarters of the total population (74 percent) are expected

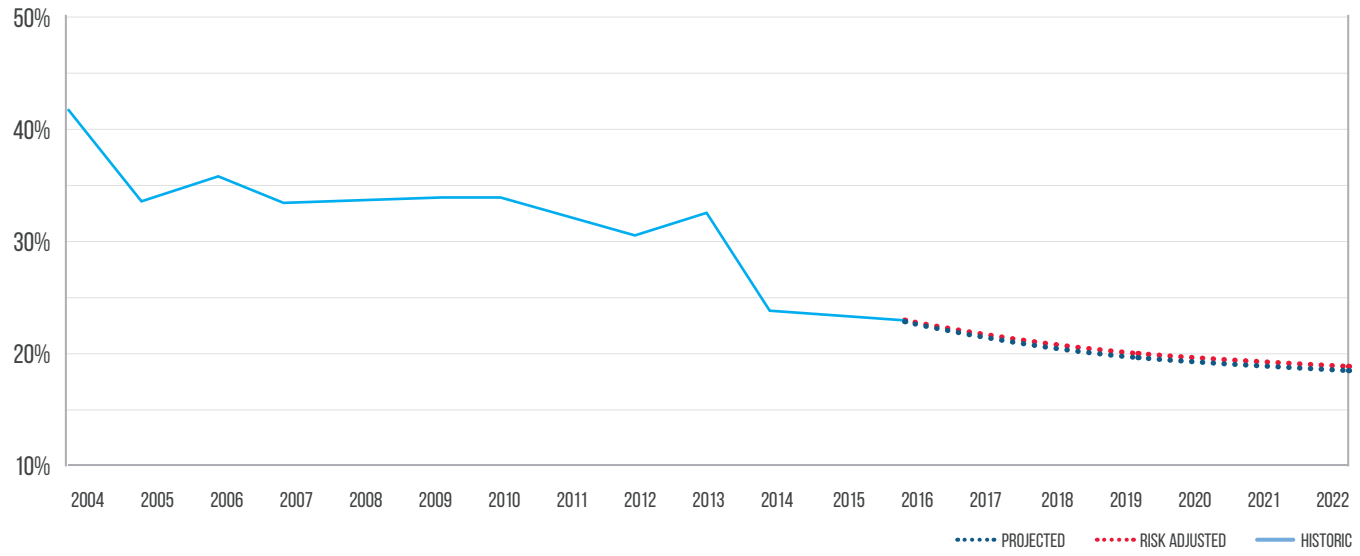
to have smartphones by 2019, representing 94.1 percent of adults.[13]

Changes in the use of cash will also depend on the evolution of macroeconomic indicators such as GDP, interest rates, exchange rates and inflation, the demand for international tourism, demographic trends and geopolitical developments such as wars or changes in government.

Assuming accelerated reductions in cash share over a five-year period, the risk-adjusted cash share could be realized as outlined by the PYMNTS' data shown in Figure 6. Based on our findings, the reduction of cash could be accelerated by approximately 50 percent among those in the 19-to-24 age bracket, by 30 percent among those aged 24 to 34 and by 15 percent among those in the 35-to-44 category.

[11] Author unknown. Cash powers 75 percent of POS payments in Eurozone. PYMNTS. Apr. 4, 2017. https://www.pymnts.com/cash/2017/cash-powers-three-quarter-eurozone-payments/. Accessed January 2018.
[12] Author unknown. The Spanish payment landscape: innovation gains on traction. European Payments Council. Jun. 22, 2017. https://www.europeanpaymentscouncil.eu/news-insights/insight/spanish-payment-landscape-innovation-gains-tradition. Accessed January 2018.
[13] Author unknown. Share of mobile phone users that use a smartphone in Spain from 2014 to 2019. Statista. 2017. https://www.statista.com/statistics/257055/smartphone-user-penetration-in-spain/. Accessed January 2018.

FIGURE 6. RISKADJUSTED CASH PROJECTION



TOTAL CASH USAGE

Spain used approximately €253 billion in cash in 2016, and its overall cash use is projected to reach nearly €238 billion by 2022. Based on this analysis, it is clear that total cash use in the country is declining, a change that can be attributed to slow GDP growth since the 2009 financial crisis. However, the decline is proceeding at a very slow pace.

Table 2 shows the decrease in cash share, the fall and recovery of the GDP and the projected evolution of total cash usage in Spain.

TABLE 2. CASH SHARE, GDP AND TOTAL CASH USAGE (CONSTANT PRICES 2010)

	CASH USAGE AND PROJECTIONS					COMPOUND ANNUAL GROWTH RATE	
	2004	2008	2012	2016	2022	2012 – 2016	2017 – 2022
CASH SHARE	40.7%	33.0%	30.7%	22.9%	19.0%	-7.02%	-0.50%
GDP	988.6	1120.8	1038.7	1102.8	1251.7	1.51%	2.30%
TOTAL CASH USAGE	401.9	370.4	318.7	252.9	237.9	-5.62%	-1.70%

ATM AND BANK BRANCHES AVAILABILITY INDEX

PYMNTS created two indexes based on the availability of ATMs and bank branches in 40 countries around the world (see the Annex for details).

For this particular report, we calculated the same indexes again selecting only Western European countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Malta, The Netherlands, Portugal, Spain, Sweden, Switzerland and the U.K. The maximum value indexes can achieve is 100 points, and the minimum is zero.

Each index corresponds to the average value of a variable, including population, GDP per capita, ATM and bank branches per every 100,000 people, and participation of ATM, OTC and cash in GDP.

We found the average for Western Europe is much higher than the Worldwide Average Index, and Spain scored relatively higher than the rest of the countries in Europe. As Table 3 indicates, Spain has an average of 107 ATMs per 100,000 population compared to 90 for Western Europe and 78 for the Worldwide Average. The number of bank branches per 100,000 population is even more dramatic, with Spain averaging 67 bank branches compared to 38 in Western Europe and 28 Worldwide.

The high penetration of bank branches and ATMs in Spain comes with a higher use of cash and OTC share compared to the rest of the group.

TABLE 3. ATM AND BANK BRANCHES AVERAGE INDEX

DESCRIPTION	WORLDWIDE AVG INDEX	WESTERN EUROPE	SPAIN
ATM Average Index	28	33	41
Bank Branches Average Index	35	52	100
Population	108	25	46
GDP Per Capita (Average)	28	43	26
ATM Share	15%	12%	10.0%
OTC Share	10%	6%	12.9%
Cash Share	25%	18%	22.9%
POS Per 100,000	1957.4	2415.9	2986.3
ATM Per 100,000	78.0	90	107
Bank Branches Per 100,000	28	38	67

CONCLUSION

Given the high propensity for cash use among Spanish citizens, it no surprise that there are so many ATMs and bank branches per 100,000 people compared to other Western European nations.

One of the reasons for the ongoing predominance of cash is that a large portion of the population still lives in rural areas in Spain. According to the most recent data available from the World Bank,[14] rural population comprised 20.2 percent of the total population in Spain, much higher than the 17.2 percent registered by the U.K.

The most important factor explaining the importance of cash in Spain is the magnitude of its underground economy, a sector fueled by the effects of the international banking crisis of 2009. According to a 2014 report[15] published by Spain's Ministry of Finance, the underground economy accounted for 24.6 percent of the nation's total GDP at the end of that year. That's up significantly from the 17.8 percent share of total GDP reported when the crisis began in 2008, and nearly double the rates in the U.K., France and Germany. This informal economy surge resulted from the rise of unemployment and burst of the real estate bubble caused by the international crisis.

The emergence of the underground economy is not going unnoticed by Spanish authorities, either, which recently took measures to curb its influence and reduce its overall dependence on cash. In December 2016, the Spanish government introduced a measure to reduce the amount cap on spending per transaction from €2,500 to €1,000.[16]

Ease of access, store-of-value and a sense of security are some of the many factors that make cash one of the leading payment instruments in Spain. While emerging payment methods are bound to continue to make inroads, the country's affinity for cold hard cash will likely remain a reality for decades to come.

[14] World Bank. https://tradingeconomics.com/spain/rural-population-percent-of-total-population-wb-data.html. Accessed January 2018.
[15] Mount, Ian. Spain's underground economy is booming. Fortune. Feb. 14, 2014. http://fortune.com/2014/02/14/spains-underground-economy-is-booming/. Accessed January 2018.
[16] Buntix, JP. Spanish Government Wants To Curb Cash Usage To 1,000 Euros Per Transactions. Dec. 1, 2016. https://themerkle.com/spanish-government-wants-to-curb-cash-usage-to-1000-euros-per-transactions. Accessed January 2018.

FOR PAYMENTS IN SPAIN, CASH STILL REIGNS

As the calendar turns to 2018, billions of people around the world are kicking out the old, and welcoming in the new — whether that means resolutions of dropping old habits and changing outdated behaviors or casting aside obsolete technology for new innovations.

In Spain, however, some old habits die hard, and that includes the country's preference for physical currency. No matter what new payments tech comes along — or how convenient or secure it claims to be — Spain still likes to pay with cash. Other nations may have been won over by technology, and the Spanish government has made efforts to limit cash usage by consumers, but Spain's population has made its preferences known.

As it turns out, Spaniards are reluctant to consider alternatives to cash when making their daily purchases.

According to Helena Tejero, chief cashier at Banco de España, Spanish citizens' cash usage represents a pattern that is unlikely to change in this New Year — or anytime soon, for that matter. Tejero recently spoke with PYMNTS about the factors prompting Spaniards to keep cash circulating.[17]

Keeping cash thriving in Spain

Today, the country's 46.56 million citizens have access to a host of payment methods, including peer-to-peer (P2P) services, debit cards and credit cards in addition to cash. But, as Tejero noted, one particular method of payment clearly stands out from the pack.

The reasons for cash's ongoing stay as the top payment choice for Spanish citizens may vary, but it's the comfort in using the traditional method that many value most.

"Payments in Spain are made by habit," Tejero said. "In surveys we produce each year, citizens tell us they prefer cash for the convenience and control they have over their spending."

Cash is often used for everyday purchases and items under €10 — such as coffee, bread or other small meals — and

[17]Disclaimer: Tejero spoke as a cash expert, not as a spokesperson for Banco de España. Banco de España's official position is stated in its publications.

is particularly popular among street-level vendors. As a result, these low-ticket purchases appear to be going a long way toward helping cash maintain its grip as a powerful force in the nation's financial system. In fact, payment options like debit and credit cards are often not accepted for transactions valued under €6 for example at some of Spain's pharmacies, Tejero explained.

"Cash is the preferred instrument of payment, but the value of payments is quite low in Spain because it is mainly used in small transactions," she said.

New payment methods lag, but offer new cash opportunities

Based on Banco de España's observations, Tejero noted Spanish citizens appear to be embracing modern payment options like credit and debit cards. Debit cards are a particularly popular means of payment in Spain, with 94 percent of the population holding them and 28 percent of point-of-sale (POS) transactions paid with them.

Even those options appear to be reinforcing their preference for cash, however.

Spain has a higher rural area than nearby European nations, and merchants in such communities do not always accept card-based payment methods for low-value transactions, she explained.

"More retailers accept other means of payments, but not 100 percent," Tejero said. "If you want to buy a small item [such as a] day-to-day purchase, you might find some retailers do not accept credit cards."

Cash, on the other hand, allows parties to settle any kind of financial transaction. As a result, Spaniards living in rural areas tend to rely on it to make payments instead of alternate payment options. Even when this population does use debit cards, though, it often does so to get more cash.

> *"We have seen a lot of interest in promoting those types of cashback services you use cash."*

Even with growth in infrastructure, Spain's retail and services industries are working to meet citizens' demand for cash. For example, Tejero noted some merchants allow consumers to make cashback withdrawals when they purchase using debit cards, as many do in the U.S.

"These services are in their infancy stage, but we have seen a lot of interest in promoting those types of cashback services," she said.

Spain's shifting financial sands

As 2018 begins, Spain's citizens still appear to be unwilling to abandon cash when it comes to making payments, despite notable developments that have made it more challenging as a payment option.

For example, several bank branches shuttered following the 2008 financial crisis, Tejero recalled. As a result, Spain's network of ATMs shrank from roughly 60,000 in 2008 to

approximately 50,000 in 2016.

That shuttering of bank branches led to a noticeable drop in over the counter (OTC) cash withdrawals. Despite the reduction in ATMs, though, Tejero noted ATM usage and the value of cash withdrawals has remained fairly stable.

In addition, with fewer bank branches at which to conduct transactions, Spanish citizens now appear more likely to turn to local ATMs to withdraw cash. This also appears to be helping to make possible the use of cash in the nation.

Meanwhile, the Spanish government has taken its own steps to reduce the influence of cash on the country's financial ecosystem. It imposed a limit of €2,500 per transaction as part of a crackdown on tax evaders in 2012.[18] Four years later, it considered imposing stricter rules to limit cash per transaction to €1,000.[19] This change has not gone into effect, however, and it's currently unclear if or when the government will move to lower the cash ceiling.

But, because most cash transactions average approximately €10, far below the ceiling of €2,500 cap, Tejero said the cash limit does not appear to be reducing Spain's physical currency usage on daily purchases.

"There is no evidence that the ceiling is affecting the use of cash," she expressed.

While Spain's government might continue to attempt to rein in cash's influence, and new payment methods like payment cards and P2P services may prompt citizens to take up digital and card-based alternatives, Tejero believes it will take a long time to diminish the role cash plays in Spaniards' daily lives.

"Lots has been written about the disappearance of cash, but there will be always a demand for cash in the world," Tejero said. "In Spain, we don't see the use of cash disappearing in the near future."

[18]Author unknown. Spain bans cash. The Daily Bell. Apr 20, 2012. http://www.thedailybell.com/news-analysis/spain-bans-cash/. Accessed January 2018.
[19]Buntinx, JP. Spanish government wants to curb cash usage to 1,000 euros per transactions. The Merkle. Dec. 1, 2016. https://themerkle.com/spanish-government-wants-to-curb-cash-usage-to-1000-euros-per-transactions/. Accessed January 2018.

APPENDIX

METHODOLOGY AND DATA

The PYMNTS.com Global Cash IIndex, powered by Cardtronics, analyzes overall cash usage and projected trends over the next five years for 40 countries around the world, that have provided sufficient data to make estimates on cash usage. These countries are divided into four regions — Western Europe, Eastern Europe, The Americas and Asia and Other — and we will publish reports reviewing cash share and usage focusing on one region each quarter. The four regions are as follows:Total cash usage is the combination of two overall factors:

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

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

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

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

- Gathered historic and projected data.
- Estimateed 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 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.
- **TWO:** Estimate the logarithmic trend of the OTC to ATM

[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.

ratio from 2000 through 2014 for each of the potentially comparable countries.[22]

We do this to remove any data jumps or movements that are

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

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:

In the formula above, i is the year and "Variable" refers to

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

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

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.

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			✓

APPENDIX

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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