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The 2016 Diary of Consumer Payment Choice

Claire Greene and Scott Schuh

Abstract: This paper describes key results from the 2016 Diary of Consumer Payment Choice (DCPC), the third in a series of diary surveys that measure payment behavior through the daily recording of U.S. consumers' spending. In October 2016, consumers paid mostly with cash (31 percent of payments), debit cards (27 percent), and credit cards (18 percent). These instruments accounted for 76 percent of the number of payments, but only 34 percent of the total value of payments, because they tend to be used more for smaller-value payments. Electronic payments accounted for 43 percent of the value of payment but only 14 percent of the number of payments. The average value of a cash transaction was $22, compared to $112 for the average noncash transaction (and $84 for all transactions). The average value of consumers' holdings of cash on their persons (in pocket, purse, or wallet) was $57, and the median was $24. Given uncertainty about the comparability of point estimates from the 2015 DCPC and the 2016 DCPC, this report includes confidence intervals and probability-based estimates of the changes in consumer payment behavior from 2015 to 2016.

Keywords: cash, checks, checking accounts, debit cards, credit cards, prepaid cards, electronic payments, payment preferences, Diary of Consumer Payment Choice

JEL Classifications: D12, D14, E42

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Acknowledgments appear on the first page of this report. The primary authors are responsible for any errors.

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CPRC CONSUMER PAYMENTS Research Center

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1. Introduction

The 2016 Diary of Consumer Payment Choice (DCPC) is the third official study conducted by the Federal Reserve Bank of Boston and co-sponsored by the Federal Reserve Banks of Richmond and San Francisco to gain a comprehensive understanding of the cash- and noncash-payment behavior of U.S. adult consumers (ages 18 and older).[1] This report contains initial results for 2016 and includes estimates of the number, value, and average value of payments that all U.S. adult consumers made using U.S. payment instruments. It also includes estimates of cash held on person (pocket, purse, or wallet) by denomination of currency.

The DCPC collects data on individual payments from daily records kept by consumers, including the dollar values of payments. DCPC estimates should be more precise than those obtained from the Boston Fed's annual Survey of Consumer Payment Choice (SCPC), which is based on consumer recall of payment activity. Therefore, estimates from the two surveys should not be compared directly.[2] For more details about the DCPC, see the 2012 Summary (Greene, Schuh, and Stavins forthcoming); Schuh (2017); Sampranathak, Schuh, and Townsend (2017); and Greene, O'Brien, and Schuh (2017).

This report focuses on estimates of the *level* of consumer payment use in 2016, that is, the number and value of consumer payments. It also discusses changes from 2015 to 2016, but the 2015 DCPC and 2016 DCPC are not fully comparable. Therefore, estimated changes from 2015 to 2016 may not be unbiased estimates of the actual changes in consumer payment behavior. Two main methodological improvements decreased the comparability of the 2016 DCPC estimates to those from prior years: (1) Between 2012 and 2015, the DCPC panel of survey respondents changed, with the introduction of a more representative sampling frame; (2) in 2015 and again in 2016, the DCPC questionnaire was revised to improve the measurement of consumer payment

[1] The first official study was the 2012 Diary of Consumer Payment Choice (DCPC), which is described in detail in Greene, Schuh, and Stavins (Forthcoming).

[2] The Survey of Consumer Payment Choice (SCPC) began in 2008 and is described most recently in Greene, Schuh, and Stavins (2017). A thorough analysis of the 2015 and 2016 DCPC and SCPC results will be included in a future report.

behavior. Greene, O'Brien, and Schuh (2017) compare the 2012 and 2015 DCPC estimates and report the incompatibilities between them.

While the 2015 and 2016 DCPC are more comparable to each other than 2015 is to 2012, two factors inhibit the comparability of the 2015 and 2016 estimates. The number of respondents who completed all DCPC days was considerably smaller in 2015 (807 versus 2,848 in 2016), so the 2015 estimates have less statistical precision, and the sample calendar periods are not aligned exactly (October in 2016 and mid-October to mid-November in 2015). In addition, the questionnaire from one year is modestly different from the other. Therefore, the reader should interpret point estimates of changes in payment use with caution, taking note of the confidence intervals provided in this report.[3]

All DCPC data, along with technical documentation, will be available to the public free of charge.[4] Throughout the paper, small discrepancies in the estimates may exist due to rounding. The estimates in this paper may differ from preliminary estimates in Greene, O'Brien, and Schuh (2017) because of differences in sample periods and data cleaning procedures. The data may be revised in the future should important new information or analysis warrant doing so.

The remainder of this report is organized as follows. Section 2 provides an overview of the number and value of payments for 2016 and describes changes relative to 2015. Section 3 reports estimates of the level of consumer payment use by payment instrument and describes the implied changes in payment instrument use from 2015 to 2016. Section 4 focuses on cash use and Section 5 on cash holdings. Section 6 concludes. Appendices summarize the underlying survey methodology and list members of the CPRC Advisory Board.

[3] The 2016 and 2017 samples sizes and questionnaires are similar, so those estimates are expected to be more comparable than the estimates from prior years.

[4] The data, documentation, and technical appendix for 2015 and 2016 will be released later. For the 2015 SCPC technical appendix, see https://www.bostonfed.org/publications/research-data-report/2017/the-2015-survey-of-consumer-payment-choice-technical-appendix.aspx.

2. Number and Value of Payments

In October 2016, U.S. consumers made on average 45.9 payments for the month, with a 95 percent confidence interval of [44.2, 47.6] (Table 1a).[5] Thus, on average, an adult consumer made 1.5 payments per day. While this estimate may seem low for many consumers, it includes an average of 38.1 percent of consumers each day who reported making zero payments; and it does not include payments made on consumers' behalf by other parties (such as other household members, other family or friends, employers, and the government).

Also in October 2016, U.S. consumers made on average $3,874 worth of payments [$3,505, $4,243] for the month. Consumer *payments* are not the same as consumer (or household) *expenditures*, *consumption*, or *income*, so the estimated value of consumer payments (and its growth rate) should not be compared to data on expenditure or income. Schuh (2017) demonstrates that, when comparably adjusted, the DCPC payments match reasonably well with national income account estimates of personal consumption expenditures (PCE) and disposable personal income (DPI).[6] This initial report of a limited set of 2016 DCPC results does not include comparable adjustments. Dividing the October 2016 DCPC value of payments by that period's number of payments yields an average value for each consumer payment of $84.4 [$77.2, $91.6].

Given that the 2015 and 2016 estimates may not be fully comparable, the number of consumer payments declined about 11 percent for the month in 2016 and the value of payments

[5] Here and elsewhere, a *p* percent confidence interval represents a data-driven interval with the property that *p* percent of all intervals constructed via a similar methodology will contain the true parameter of interest. The most commonly used interval is the 95 percent confidence interval, which is defined by the estimated mean +/- 1.96 times the estimated standard errors. The 95 percent confidence interval corresponds to a rejection at the 5 percent level of any hypothesized value for the true parameter that falls outside of the interval. In this example, rejection would occur for all values less than 44.2 or greater than 47.6 (that is, +/- 1.7 payments from 45.9).

[6] October tends to have very small seasonal effects, so an approximate annual estimate of the value of payments is 12 times the October estimate, or $46,488, per consumer for the year. With an average of 2.06 adult consumers in U.S. households, this estimate implies average household payments of $95,765 for a year. These estimates are averages, not medians, which are more common for these types of statistics; averages tend to be much larger than medians for household spending and income. Compared to those from comparable data sources, such as the Survey of Consumer Finances and the Consumer Expenditure Survey, the DCPC payment estimates are of roughly the same magnitude.

increased about 8 percent, leading to a roughly 20 percent increase in the average value of a payment. The change in the average number of consumer payments for the month in 2016 was -5.5 [-9.4, -1.6] compared to 2015 (45.9 versus 51.4, or -10.7 percent) (Tables 3a and 1a). The change in the average total value of payments for the month per consumer in 2016 was $275 [-341, 890] compared to 2015 ($3,874 versus $3,600). Although the DCPC total value of payments is not comparable to consumer income or expenditures unless you make major adjustments, it should nevertheless be natural for it to grow in nominal terms roughly in line with inflation, population growth, and real economic growth. Growth in the number of payments, however, is much more difficult to evaluate because there are not many economic models of endogenous determination of consumer payments nor even much in the way of empirical estimates.[7]

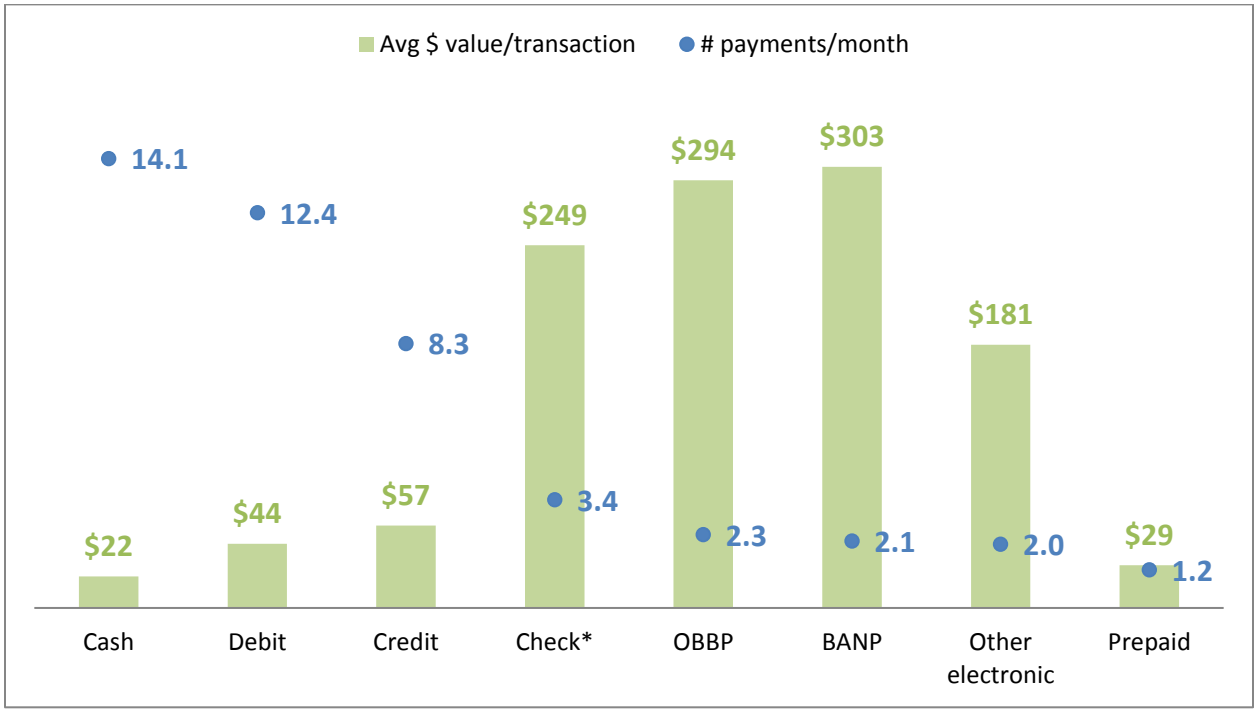
3. Number and Value of Payments by Instrument

In October 2016, U.S. consumers made most of their payments with payment cards (debit, credit, and prepaid) and paper instruments (cash, checks, money orders, and traveler's checks). Consumers on average each made 22.0 [20.9, 23.1] payments for the month with payment cards, 17.6 [16.6, 18.5] with paper instruments (including cash), and 6.4 [5.7, 7.0] with electronic instruments (Table 1a). The volume shares of payments were 47.8 percent [46.3, 49.4] for payment cards, 38.3 percent [36.6, 39.9] for paper instruments, and 13.9 percent [12.7, 15.0] for electronic payments (Table 1b).

The value of U.S. consumer payments in October 2016 was largest for electronic instruments. Consumers on average each made $1,663 [$1,381, $1,946] worth of payments for the month using electronic instruments, followed by $1,159 [$969, $1,348] worth using paper instruments and $1,053 [$975, $1,130] worth using payment cards. The value share of electronic

[7] One empirical example is a recent study by Coibion, et al. (2017) that uses the Consumer Expenditure Survey to show a trend decline since the early 1980s in the number of days per month in which consumers make at least one expenditure (more than $0). This concept is an extensive margin for daily payments and thus not exactly the same as the DCPC number of payments, which is an intensive margin.

payments was 42.9 percent [38.4, 47.5], while the values shares for paper instruments, at 29.9 percent [25.9, 33.9], and payment cards, at 27.2 percent [24.5, 29.8], were similar.



Source: 2016 Diary of Consumer Payment Choice, Table 1a. *Note:* *Check includes money order and traveler's check. OBBP: Online banking bill pay. BANP: Bank account number payment.

Figure 1: Number and Average Value of Payments by Instrument, October 2016

While consumers made about three-quarters of their payments using cash, debit cards, and credit cards, these payments accounted for only about one-third of the value of their payments: 7.9 percent in cash, 14.1 percent in debit cards, and 12.2 percent in credit cards.[8] These estimates reflect the previously established fact that consumers choose individual payment instruments for different purposes.[9] They tend to use cash and payment cards often for relatively low-value payments, while they tend to use checks and electronic payments less often for relatively high-

[8] Cash, debit, and credit are also the three most frequently used payment instruments by consumers in the SCPC, but debit is the most frequent in the SCPC, while cash is the most frequent in the DCPC (see Greene, Schuh, and Stavins 2017 for the latest SCPC estimates). The SCPC does not provide the dollar values of payments.

[9] See Klee (2008), Cohen and Rysman (2013), O'Brien (2014), Briglevics and Schuh (2016), and Stavins (2017).

value payments, as shown in Figure 1. Compared to when they used cash, for example, U.S. consumers made far fewer but higher-value payments using other paper instruments (including checks, money orders, and traveler's checks). The average value when using payment cards was $47.9 [$45.1, $50.7], compared to $261.3 [$221.8, $300.8] when using electronic instruments (bank account number payment [BANP] and online banking bill payment [OBBP]).[10]

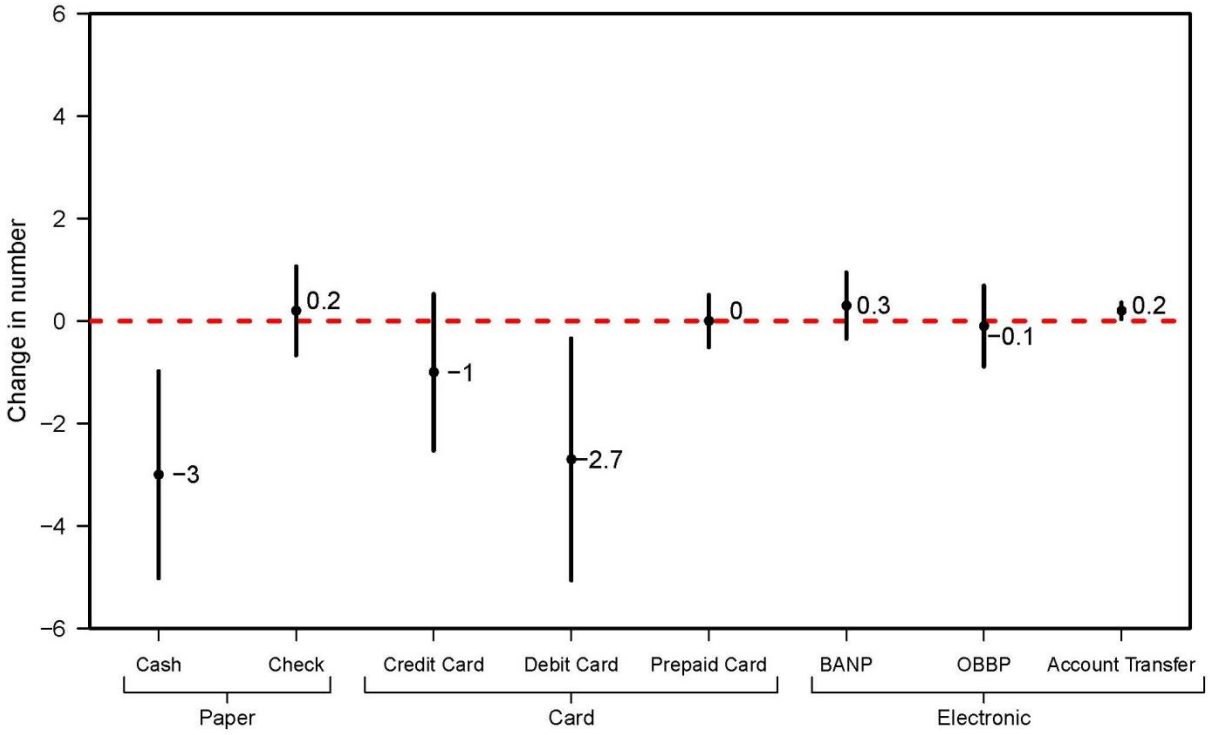
Changes in the Number and Value of Payments by Instrument

In October 2016, U.S. consumers on average made fewer payments using cash and payment cards than they did in the fall of 2015: 3.8 [-6.6, -1.0] fewer payments using payment cards and 3.0 [-5.0, -0.9] fewer cash payments, which likely contributed to similar declines in growth rates (14.6 percent for cards and 17.3 percent for cash) (Table 3a). Figure 2 shows the changes in the number of payments per month from 2015 to 2016 and that the decline in the number of debit card payments accounted for most of the decline in card use overall. In contrast to cash and payment cards use, most aspects of check and electronic payments were slightly higher in 2016 than in 2015. The change in the volume share of cash payments in 2016 was -2.5 [-5.9, +1.0], and the change in the volume share for cards was similar, at -2.2 [-5.7, +1.3]. The declines in the growth rates for the average values per transaction of payment card and cash payments also were similar, but they were not economically large or statistically significant.[11] The change in the value share of cash payments from 2015 to 2016 was -2.7 percentage points [-5.5, +0.2], which is about the same decline seen in the volume share. The similarity of changes in the volume and value shares of cash payments is consistent with the modest implied decline of $0.7 [-$5.4,

[10] The electronic payment instruments are defined as follows. Bank account number payment: A payment made by providing one's bank account number to a third party, such as one's employer or a utility company. The number can be given on websites, paper forms, etc. Online banking bill payment: A payment made from a bank's online banking website or online mobile app that accesses funds from a customer's checking or savings account to pay a bill or to pay other people. This payment does not require the customer or the bank to disclose his or her bank account number to a third party.

[11] Although the value and average value of prepaid cards declined, the volume share of prepaid cards increased slightly, because the number of prepaid card payments was unchanged while the total number of payments declined considerably.

+$4.0] in the average value of cash payments per transaction in 2016; indeed, this estimate is not statistically significant at conventional levels (Table 3b).



Source: Diary of Consumer Payment Choice. *Notes:* The vertical lines depict the 95 percent confidence intervals of the changes in the number of payments between 2015 and 2016, and the numbered dots depict the point estimates, all of which appear in Table 3a. Confidence intervals that lay entirely above or below the horizontal zero line indicate changes that are statistically significantly different from zero. Money orders and traveler's checks are omitted from this figure.

Figure 2: Changes in the Number of Payments per Month by Payment Instrument, 2015 to 2016

Although the number of check and electronic payments together over the course of the month increased by only 1.2 [0.3, 2.2], the increase was large relative to the 2015 level, so the volume share of these payments increased 4.7 percentage points. Check and electronic payments had relatively high average values per transaction ($257, Table A), and their combined value share increased 11.9 percentage points.

	Number	Value	
	per consumer per month		per transaction
Check + electronic	9.8	2516.0	257.0
Confidence Interval	[9.0, 10.6]	[2167.2, 2864.8]	[226.4, 287.5]
Percentage Share	21.3%	64.9%	NA
Confidence Interval	[20.0%, 22.7%]	[61.6%, 68.2%]	NA

Source: 2016 DCPC, authors' calculations. Note: Includes paper checks, OBBP, and BANP.

Table A: Check and Electronic Payments, October 2016

The changes from 2015 to 2016 in the use of individual consumer payment instruments reflect an economically and statistically significant increase in the share of larger-value payments and a corresponding relative decrease in the share of smaller-value payments. This shift occurred during a year of considerable decline in the total number of payments, even as the dollar value of consumer payments increased. It is possible that changes in the survey methodology from 2015 to 2016 account for at least some of the shift from low-value to high-value payments. However, changes in economic conditions—without changes in underlying preferences—also may have influenced consumer payment choices in 2016. A full explanation of these changes requires additional data and more research.

4. Cash Use

A key advantage of consumer payment diaries is their superior ability to track detailed usage and management of cash (notes, bills, and coins) transaction by transaction within a day. Like the prior surveys, the 2016 DCPC reflects two important differences between cash and other payment methods. First, cash payments account for a relatively large proportion of the *number* of payments. Of the total number of payments a consumer made on average in October 2016, 14.1 [13.3, 15.0] were made using cash, compared to 31.7 [30.3, 33.2] made using all other payment instruments (Table B). Thus, the volume share (number) of cash payment in total consumer payments was 30.8 percent [29.3, 32.4]—nearly one-third for a single instrument—while about a dozen other payment instruments accounted for the remaining share of 69.2 percent [67.6, 70.7]. A second difference is that cash payments account for a relatively small proportion of the *value* of payments. Of the average consumer payment value, only $306 [$271, $340] was funded using

cash, compared to $3,569 [$3201, $3936] using all other payment instruments. These results imply that the average value of a cash payment was $21.6 [$19.5, $23.7], compared to $112.4 [$102.3, $122.6] for the average value of all other payments.

	Number	**Value**	
	per consumer per month		per transaction
Cash	14.1	305.6	21.6
	[13.3, 15.0]	[271, 340]	[19.5, 23.7]
Noncash	31.7	3568.7	112.4
	[30.3, 33.2]	[3201, 3936]	[102.3, 122.6]
Percentage share			
Cash	30.8	7.9	
	[29.3, 32.4]	[6.8, 9.0]	
Noncash	69.2	92.1	
	[67.6, 70.7]	[91.0, 93.2]	

Source: Authors' calculations.

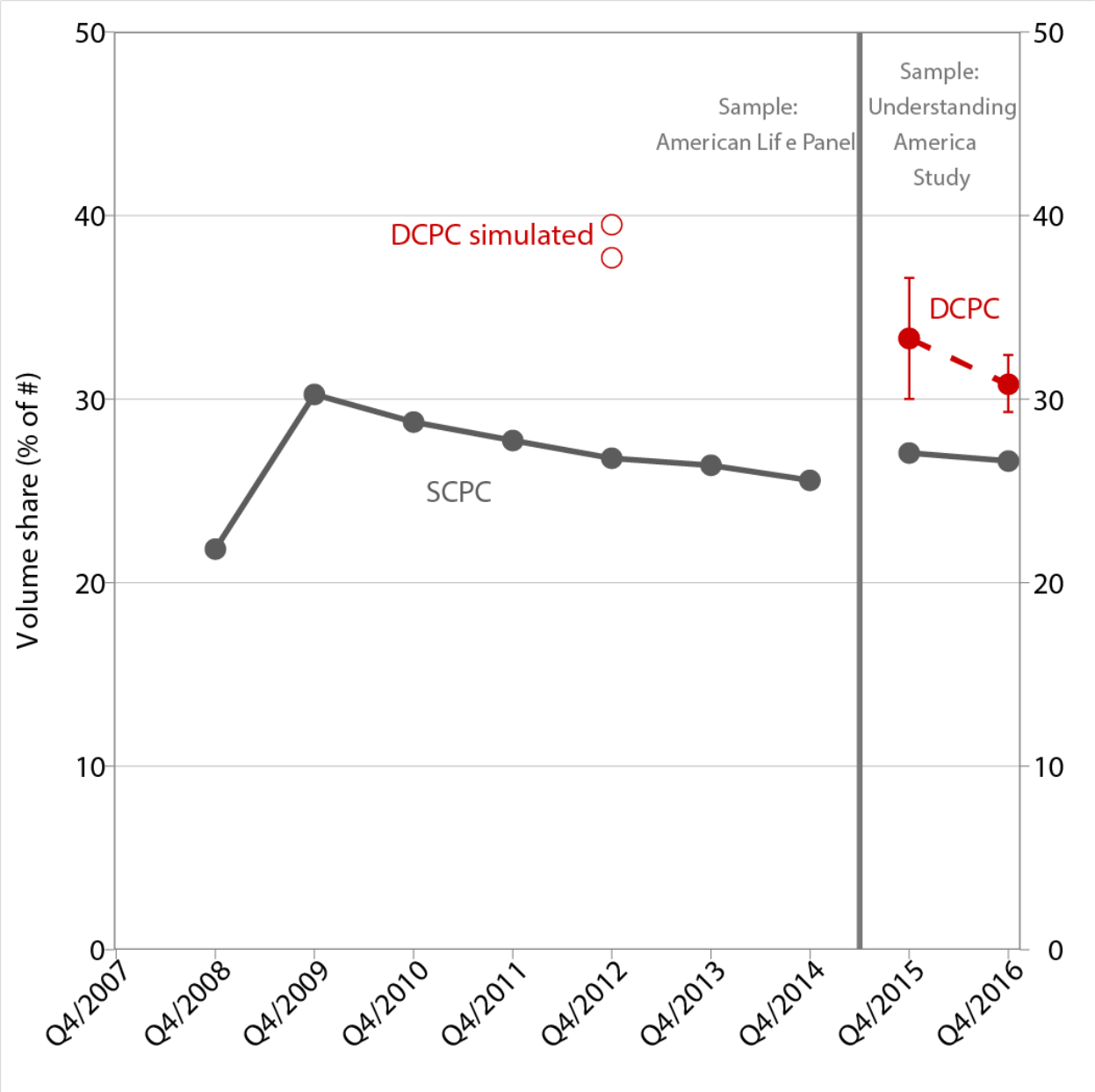
Table B: Cash and Noncash Payments: Number, Value, and Percentage Shares, October 2016

Our best but still imperfect characterization of the trend in U.S. consumer cash use from the DCPC is depicted in Figure 3, an extension of the graph in Greene, O'Brien, and Schuh (2017) that compares the volume shares of cash from the 2012, 2015, and 2016 DCPCs with the volume shares of cash from the 2008–2016 SCPCs. The measurement of cash payments has been relatively the same in all DCPC questionnaires, although it may have been influenced by the sample change from 2012 to 2015.[12] In contrast, questionnaire changes affected the measurement of some payments typically made with noncash payment instruments. Over time, the DCPC has improved its measurements of bill payments, payments for durable goods and other large-value items (more than $200), payments funded by new credit (loans), and payments that involve transfers of assets. The improved measurements affect the value and volume shares of noncash payments (and, thus, the shares of cash payments). Therefore, due to changes in survey methodology, the 2012 DCPC estimate is simulated based on the technique described in Greene, O'Brien, and Schuh (2017). The midpoint of the 2012 DCPC simulated cash share implies an

[12] See Greene, O'Brien, and Schuh (2017) for details.

annual rate of decline of about 1.8 percentage points from 2012 to 2015, somewhat less than the estimated decline of 2.5 from 2015 to 2016.[13] The average SCPC share from 2012 to 2016 was 26.5 percent and consistently lower than the DCPC share, which may reflect the ability of the DCPC to more comprehensively track the relatively large number of small-value cash payments. More data and research are needed to fully understand the differences between the levels and trends of the SCPC and DCPC estimates.

[13] The lower and upper simulated estimates imply annual rates of decline of 1.5 and 2.1 percentage points per year, respectively.



Source: Survey of Consumer Payment Choice, Diary of Consumer Payment Choice. *Notes:* 2012 DCPC estimate of the volume share of cash payments is simulated to take into account differences in survey methodology, as described in Greene, O'Brien, and Schuh (2017). The vertical line demarcates periods in which respondents were drawn from different samples, so the estimates may not be comparable over time (hence the break in the time-series lines). The dashed lines between 2015 and 2016 DCPC estimates reflect potentially substantial changes in the questionnaire.

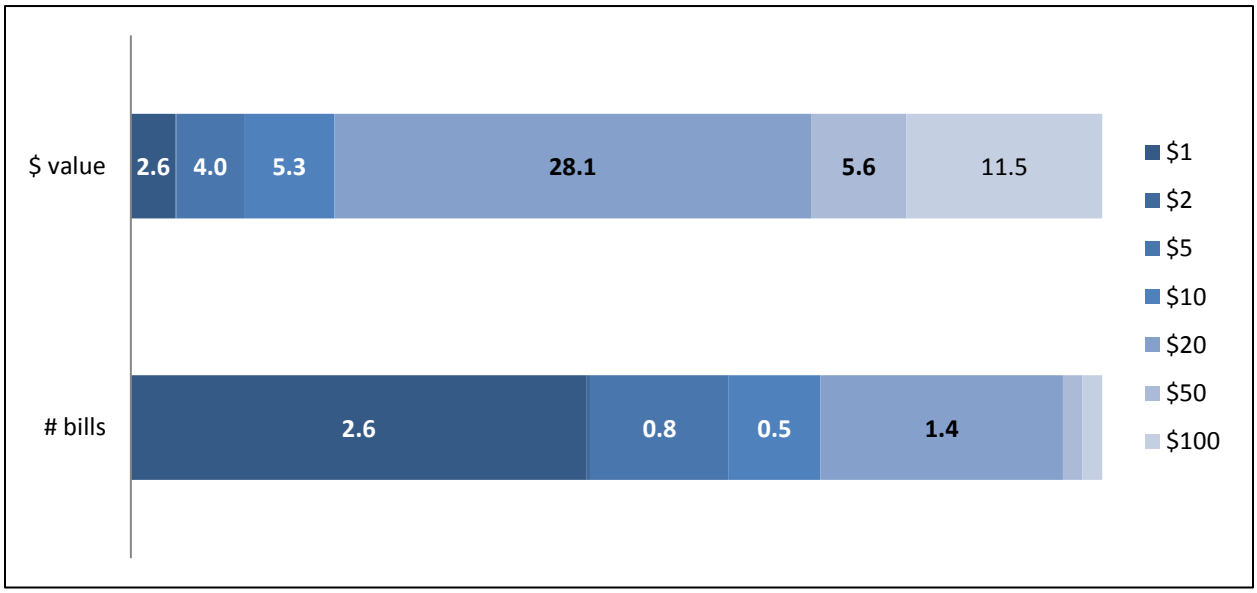
Figure 3: Volume Shares of Cash Payments, 2008–2016

5. Cash Holdings

The 2015 DCPC and 2016 DCPC obtain data on consumers' holdings of cash on their person (pocket, purse, or wallet) and stored elsewhere (home, car, office, and such). The data on

cash holdings on person were collected every night; the data on stored cash were collected on the first and final nights of the survey. For both measures, respondents were asked to count the exact number of notes and bills held by denomination, and the online questionnaire helped ensure accurate summation of the dollar values of cash holdings by denomination and in total for each location. Holdings of coins were not reported. This initial report discusses only the value of cash holdings on person.[14]

In October 2016, a U.S. consumer held on average $57.2 of cash [$52.5, $61.9] on his or her person each day, and the median amount held was $24 (Table 4). These holdings represent an average of 5.62 bills and notes [5.34, 5.90] of all denominations per consumer, and a median of 4.0 bills and notes. By value, more than two-thirds of cash on person (69.3 percent) was in the form of $20 bills (49.1 percent) and $100 bills (20.2 percent). By number, however, $1 bills were the most commonly held denomination (46.9 percent), while $20 bills (25.0 percent) and $5 bills (14.1 percent) also accounted for a relatively large share of cash on person (Figure 4).



Source: 2016 DCPC, Table 4. *Note:* $2 shares are too small to be visible.

Figure 4: Cash Holdings by Denomination, 2016

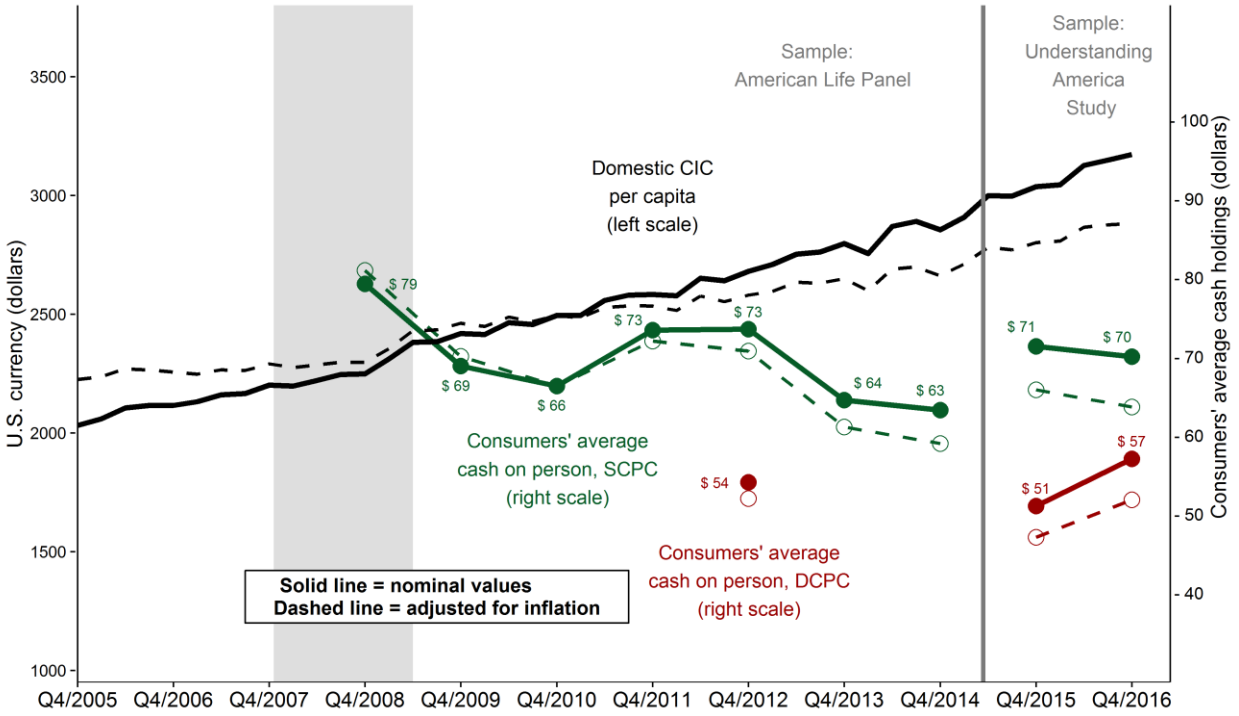
[14] Estimating the value of cash holdings elsewhere, which may at least partly represent savings in cash, requires greater statistical analysis and cleaning, so it will be reported later.

Changes in Cash Holdings

By value, total cash holdings on person for 2016 ($57.2) were $6.26 higher than in 2015, which is not a statistically different change at the 95 percent level. To see how this change in consumer cash holdings relates to other estimates of cash holdings over a longer period of time, we can compare the estimates of SCPC and DCPC cash on person with total U.S. currency in circulation (CIC), as shown in Figure 5.[15] It has been documented elsewhere that total U.S. CIC has been growing steadily, even as a percentage of GDP (not shown in Figure 5).[16] Likewise, real per-capita domestic CIC, which excludes an estimate of foreign demand for U.S. currency, has increased steadily since 2005. Figure 5 shows that consumer holdings of cash on person have been roughly flat since 2012, even after adjusting for inflation, although the SCPC estimates suggest they were somewhat higher in 2008. In contrast, the SCPC estimates of consumer holdings of cash on property (or elsewhere) increased during this time (see Greene, Schuh, and Stavins 2017), and the preliminary DCPC estimates of cash elsewhere (to be released at a later date) also show an increase. Therefore, the trend in total consumer cash holdings (on person plus elsewhere) is positive and qualitatively consistent with total CIC.

[15] The SCPC and DCPC cash holding questions are sufficiently similar and stable over time for the estimates to be comparable and reflect similar trends. Unlike the DCPC, the SCPC asks respondents to report "about how much" cash they hold, so the DCPC estimates are likely to be more precise.

[16] See Judson (2017).



Source: Bureau of Economic Analysis/Haver Analytics, Federal Reserve Board/Haver Analytics, Diary of Consumer Payment Choice, Survey of Consumer Payment Choice, authors' calculations. *Notes:* CIC: currency in circulation. SCPC and DCPC differences could be attributed to different samples, different method of asking about cash holdings, and time of year.

Figure 5: Domestic CIC per Capita and Consumers' Average Cash on Person

Given the modest and statistically insignificant change in DCPC estimates of cash holdings from 2015 to 2016, it is not surprising that there is little economically or statistically significant change in the numbers or values of holdings of individual denominations from one year to the other (Table 6). One exception, while not statistically significant, is the on-person holdings of $50 bills. Although the average number and median value of $50 bills did not change much in absolute terms, the average value of $50 bills held increased by $2.79 in 2016. While this change is not a large value relative to the value of all denominations of cash holdings, it does represent an increase of 4.3 percentage points in value share to 9.8 percent of total cash holdings (a near doubling). This change is notable because some bank ATMs began issuing $50 bills around 2015.

6. Conclusion

The 2016 DCPC point estimates are reliable measures of *levels* of U.S. consumer payment choices at a point in time. Because the DCPC questionnaire and sampling frame (and sample) have been improving, the DCPC does not yet offer unbiased estimates of the *changes* in consumer payment choices over time; however, the change in the DCPC estimates from 2015 to 2016 is probably more accurate than the change in DCPC estimates from 2012 to 2015. The DCPC was implemented again in October 2017, and it is more similar to the 2016 DCPC than the 2016 instrument is to the prior years' questionnaires. Therefore, the 2017 DCPC is more likely to provide an unbiased estimate of the actual changes in U.S. consumer payment choices relative to 2016 than the 2016 DCPC did relative to 2015.

Consumers continue to use cash, debit cards, and credit cards for the large majority of their payments but for only about a third of the value of their payments. While the DCPC data raise many interesting questions about the economics of payments, the economics literature provides little guidance about how and why the number, value, and average value of consumer payments vary over time. More research using the DCPC data and more collection of data from the DCPC are needed to enhance understanding of consumer payment choices. In particular, understanding the trend and future of consumer cash holdings and use would benefit greatly from such endeavors.

Appendix A: Overview of Survey Methodology

This section provides a brief overview of the key elements of the DCPC methodology for 2015 and 2016. A complete Technical Appendix will be published later. In the meantime, related information can be obtained from the 2012 DCPC Technical Appendix (Angrisani, Foster, and Hitczenko 2017b) and the 2015 SCPC Technical Appendix (Angrisani, Foster, and Hitczenko 2017a).

Sampling Frame and Samples

The 2015 and 2016 SCPC and DCPC were implemented with representative samples from the Understanding America Study (UAS), managed by the University of Southern California

(USC) Dornsife Center for Economic and Social Research (CESR).[17] In 2016, the UAS panel comprised 5,861 panelists. In 2015, the UAS panel had only 1,947 panelists, which significantly restricted the available sample sizes that year, as shown in Table A.1. The primary advantage of the UAS is that its panel members are recruited and assembled exclusively using address-based sampling as described in Dillman et al. (2014).[18]

	2015	2016
UAS available panel	1947	5861
DCPC total sample	854	3047
Respondents completing all DCPC days	807	2848
Longitudinal DCPC panelists 2015–16		616
Percentage of pooled sample		20.3

Source: Federal Reserve Bank of Boston. *Note:* Longitudinal panelists participate in multiple years.

Table A.1: Overview of Samples, 2015 and 2016

In addition to the UAS panelists, another 504 respondents were recruited from the Knowledge Panel produced in 2015 by the market research firm GfK Knowledge Networks. GfK respondents were not recruited until after November 15, 2015, so no GfK panelists are included in the estimates for this report.

Questionnaires

The DCPC is a mixed-mode survey administered to diary respondents ("diarists") over three consecutive days. It also includes a pre-diary online survey. In the first mode, diarists record their payments, cash management, and related information for each assigned day using some form of memory aid of their choosing. Examples of memory aids include a long-form or short-form paper aid or a receipt bag provided by the survey vendor. In the second mode, diarists enter the data from their memory aid or by recall into a 20-minute online survey each night. Most of the online questionnaire collects information about payments and related data; each day, it

[17] The 2014 SCPC was implemented with the UAS panel and smaller sample sizes, as well as with the RAND American Life Panel, as described in Angrisani, Foster, and Hitczenko (2016). The DCPC was not fielded in 2014.

[18] For more details of the UAS Panel, see https://uasdata.usc.edu/index.php.

also includes questions specific to that day. Together, the two modes are expected to take approximately 30 minutes per day, and respondents receive a $20 per day incentive. The pre-diary online survey takes about 10 minutes, and respondents receive $10, for a total incentive of $70 per diarist.

Prior to completing the DCPC, all diarists are required to take the 30-minute online SCPC, for which they receive an incentive of $20 upon completion. A respondent may complete the SCPC any time from one to about 45 days before beginning the DCPC. In 2016, all DCPC respondents who were living in areas affected by Hurricane Matthew were offered a five-minute online survey about how the hurricane affected their payments behavior and their completion of the DCPC. The results of this survey will be released later.

While the SCPC and DCPC questionnaires vary over time, differences between the 2015 and 2016 questionnaires were minimal.

Diary Implementation

Diarists are randomly chosen to begin participating in the DCPC each day throughout the defined sample period for the year. Thus, each new diary wave contains a small sample of respondents (average of 37 per day in 2015 and 98 per day in 2016) that is, on average, representative of all U.S. consumers. Diary waves are staggered to start two days before the official beginning of the DCPC and end two days afterward. This way, each day contains approximately one-third of respondents who are completing each day of the diary (one, two, or three) and every day-specific group of questions occurs on each day of the month. As a result of this implementation strategy, DCPC data provide aggregate estimates that are representative of all U.S. consumers on average for each day of the sample period (day-of-the-month weights) and for the sum of all days in the sample period (monthly weights), usually the month of October. As noted above, an important difference between 2015 and 2016 is the implementation period: October 1–31 in 2016 and mid-October to mid-November in 2015.

Data Preprocessing

All DCPC survey responses reported here have been analyzed for errors, inconsistencies, and influential outlier effects. Where necessary, the DCPC data have been cleaned and adjusted

using statistical methods similar to prior methods reported in SCPC and DCPC technical appendices. One innovation in data preprocessing is an attempt at seasonal adjustment. Because consumer payments and cash management behavior exhibit significant day-of-the-week effects and calendar months can vary notably across years in their composition of days of the week, the raw data contain seasonal fluctuations. The results for this report use revised sampling weights that attempt to adjust for differences in consumer payment behaviors across days of the week (Mondays, Tuesdays, etc.) within each year.

Appendix B: CPRC Board of Advisors

Barbara Bennett (joined 2009)
Federal Reserve System

Debbie Bianucci (2013)
Bank Administration Institute

Ron Borzekowski (2016)
Consumer Financial Protection Bureau

Andrew Caplin (2009)
New York University

Christopher Carroll (2014)
Johns Hopkins University

Bob Chakravorti (2012)

Karyen Chu (2016)
Federal Deposit Insurance Corporation

Richard Curtin (2009)
University of Michigan

Laura Erhard (2017)
Bureau of Labor Statistics

Janet Estep (2013)
NACHA

Geoffrey Gerdes (2009)
Federal Reserve Board

Ray Graber (2013)
Graber Associates

Chad Harper (2009 and 2015)
Federal Reserve Bank of Richmond

Fumiko Hayashi (2009)
Federal Reserve Bank of Kansas City

Tony Hayes (2013)
Oliver Wyman

Robert Hunt (2013)
Federal Reserve Bank of Philadelphia

Kim P. Huynh (2013)
Bank of Canada

Beth Kiser (2017)
Federal Reserve Board

Dan Latimore (2017)
Celent

Dan Littman (2009)
FRB Cleveland

May Liu (2011)
Federal Reserve Board

Leon Majors (2009)
ESP/Phoenix Consulting

Bill McCracken (2009)
Synergistics Research

Aaron McPherson (2009)
Mercator Advisory Group

Kevin Moore (2015)
Federal Reserve Board

Steve Mott (2010)
BetterBuyDesign

Max Schmeiser (2015)
Amazon Lending

Martha Starr (2009)
American University

Wilbert van der Klaauw (2016)
FRB New York

Joe Waring (2017)
MasterCard Advisors

Martin Weiderstrand (2010)
Ikea

Tom Welander (2009)
Welander Analytics

Jane Yao (2009)
American Bankers Association

Jay Zagorsky (2010)
Ohio State University

Former Advisors

Carlos Arango (2009–2010)
Bank of Canada

Paul Bauer (2009)
FRB Cleveland

Marla Blow (2013–2014)
Consumer Financial Protection Bureau

Peter Burns (2009–2012)
Federal Reserve Bank of Philadelphia (retired)

Jeff Carter (2009)
MIT Media Lab

David Evans (2011–2016)
Market Platform Dynamics

Dave Humphrey (2009–2014)
Florida State University

Peter Ireland (2009)
Boston College

Roger Johnston (2010–2016)
Fiserv

Beth Klee (2009)
Federal Reserve Board

Rich Oliver (2009–2011)
Federal Reserve Bank of Atlanta

William Roberds (2011–2012)
Federal Reserve Bank of Atlanta

Jay Ryan (2013–2014)
Bureau of Labor Statistics

John Sabelhaus (2012–2015)
Federal Reserve Board

Adam Safir (2014–2017)
Bureau of Labor Statistics

Peter Shortall (2013–2017)
MasterCard Advisors

Geoffrey Thomas (2011–2012)
Citizens Bank

Chris Van Steenberg (2013–2015)
Citizens Bank

Adrienne Wells (2009–2010)
Federal Reserve Bank of Atlanta

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2015–16 DCPC Table of Contents

Table 1a

Payments by Type of Payment Instrument

Average number and value per consumer, October 1–31, 2016

	Number (#)	Value ($)	
	per consumer per month		per transaction
All payments	**45.9**	**3874**	**84.4**
	[44.2, 47.6]	**[3505, 4243]**	**[77.2, 91.6]**
Paper instruments	**17.6**	**1159**	**65.9**
	[16.6, 18.5]	**[969, 1348]**	**[55.8, 76.1]**
Cash.....	14.1	306	21.6
	[13.3, 15.0]	[271, 340]	[19.5, 23.7]
Check and other paper instruments*.....	3.4	853	248.9
	[3.0, 3.8]	[667, 1039]	[203.7, 294.1]
Payment cards	**22.0**	**1053**	**47.9**
	[20.9, 23.1]	**[975, 1130]**	**[45.1, 50.7]**
Debit.....	12.4	546	44.0
	[11.5, 13.3]	[491, 602]	[40.6, 47.3]
Credit.....	8.3	471	56.5
	[7.6, 9.1]	[414, 529]	[51.3, 61.7]
Prepaid/Gift/EBT card.....	1.2	35	29.3
	[1.0, 1.4]	[22, 48]	[21.4, 37.3]
Electronic payments	**6.4**	**1663**	**261.3**
	[5.7, 7.0]	**[1381, 1946]**	**[221.8, 300.8]**
Bank account number payment (BANP)	2.1	633	302.8
	[1.7, 2.4]	[483, 782]	[236.6, 369.0]
Online banking bill payment (OBBP)....	2.3	671	293.6
	[1.9, 2.6]	[474, 869]	[218.6, 368.6]
Other electronics†.....	2.0	359	180.6
	[1.7, 2.2]	[246, 472]	[127.8, 233.5]

* "Other paper" includes money orders and traveler's checks.

† The term "other electronics" includes the following payment instruments: mobile payments, PayPal payments, account to account transfers, direct from income deductions, "other", multiple payment methods for one payment, and unreported payment methods.

Table 1b

Payments by Type of Payment Instrument

Percentage shares per consumer, October 1–31, 2016

	Number (#)	Value ($)
All payments	**100**	**100**
	—	**—**
Paper instruments	**38.3**	**29.9**
	[36.6, 39.9]	**[25.9, 33.9]**
Cash	30.8	7.9
	[29.3, 32.4]	[6.8, 9.0]
Check and other paper instruments*	7.5	22.0
	[6.6, 8.3]	[18.0, 26.0]
Payment cards	**47.8**	**27.2**
	[46.3, 49.4]	**[24.5, 29.8]**
Debit	27.1	14.1
	[25.4, 28.8]	[12.4, 15.8]
Credit	18.2	12.2
	[16.7, 19.6]	[10.5, 13.8]
Prepaid/Gift/EBT card	2.6	0.9
	[2.1, 3.1]	[0.6, 1.2]
Electronic payments	**13.9**	**42.9**
	[12.7, 15.0]	**[38.4, 47.5]**
Bank account number payment (BANP)	4.6	16.3
	[3.8, 5.3]	[13.0, 19.7]
Online banking bill payment (OBBP)	5.0	17.3
	[4.3, 5.7]	[13.0, 21.6]
Other electronics†	4.3	9.3
	[3.8, 4.9]	[6.5, 12.0]

* "Other paper" includes money orders and traveler's checks.

† The term "other electronics" includes the following payment instruments: mobile payments, PayPal payments, account to account transfers, direct from income deductions, "other", multiple payment methods for one payment, and unreported payment methods.

Table 2a

Payments by Type of Payment Instrument

Average number and value per consumer, October 16–November 15, 2015

	Number (#)	Value ($)	
	per consumer per month		per transaction
All payments	**51.4**	**3600**	**70.0**
	[48.0, 54.8]	**[3107, 4093]**	**[61.4, 78.7]**
Paper instruments	**20.4**	**1108**	**54.3**
	[18.3, 22.4]	**[803, 1412]**	**[40.0, 68.7]**
Cash.....	17.1	381	22.3
	[15.2, 19.0]	[291, 470]	[18.1, 26.5]
Check and other paper instruments*.....	3.3	727	221.4
	[2.5, 4.1]	[434, 1020]	[142.6, 300.1]
Payment cards	**25.7**	**1308**	**50.9**
	[23.2, 28.3]	**[1118, 1499]**	**[45.5, 56.3]**
Debit.....	15.2	686	45.2
	[12.9, 17.5]	[535, 836]	[38.2, 52.3]
Credit.....	9.4	583	62.1
	[7.9, 10.8]	[460, 705]	[53.5, 70.6]
Prepaid/Gift/EBT card.....	1.2	40	34.0
	[0.7, 1.6]	[16, 64]	[18.8, 49.3]
Electronic payments	**5.3**	**1184**	**223.8**
	[4.3, 6.3]	**[880, 1488]**	**[175.8, 271.7]**
Bank account number payment (BANP)	1.8	406	228.5
	[1.2, 2.3]	[263, 549]	[165.0, 292.0]
Online banking bill payment (OBBP)....	2.4	679	280.9
	[1.7, 3.1]	[424, 935]	[189.9, 371.9]
Other electronics†.....	1.1	99	90.1
	[0.7, 1.4]	[57, 140]	[54.7, 125.4]

* "Other paper" includes money orders and traveler's checks.

† The term "other electronics" includes the following payment instruments: mobile payments, PayPal payments, account to account transfers, direct from income deductions, "other", multiple payment methods for one payment, and unreported payment methods

Table 2b

Payments by Type of Payment Instrument

Percentage shares per consumer, October 16–November 15, 2015

	Number (#)	Value ($)
All payments	**100**	**100**
	—	**—**
Paper instruments	**39.7**	**30.8**
	[36.4, 42.9]	**[24.2, 37.3]**
Cash	33.3	10.6
	[30.0, 36.6]	[7.8, 13.3]
Check and other paper instruments*	6.4	20.2
	[5.0, 7.8]	[13.5, 26.9]
Payment cards	**50.0**	**36.3**
	[46.8, 53.3]	**[31.2, 41.5]**
Debit	29.5	19.0
	[25.8, 33.2]	[14.8, 23.3]
Credit	18.3	16.2
	[15.7, 20.9]	[13.0, 19.4]
Prepaid/Gift/EBT card	2.3	1.1
	[1.4, 3.1]	[0.4, 1.8]
Electronic payments	**10.3**	**32.9**
	[8.4, 12.2]	**[26.4, 39.3]**
Bank account number payment (BANP)	3.5	11.3
	[2.4, 4.5]	[7.6, 15.0]
Online banking bill payment (OBBP)	4.7	18.9
	[3.4, 6.0]	[12.8, 24.9]
Other electronics†	2.1	2.7
	[1.5, 2.8]	[1.6, 3.9]

* "Other paper" includes money orders and traveler's checks.

† The term "other electronics" includes the following payment instruments: mobile payments, PayPal payments, account to account transfers, direct from income deductions, "other", multiple payment methods for one payment, and unreported payment methods.

Table 3a

Changes in Payments by Type of Payment Instrument

Change in number and value per consumer, 2015–2016

	Change in number (#)	Change in value ($)	
	per consumer per month		per transaction
All payments	**-5.5**	**275**	**14.4**
	[-9.4, -1.6]	**[-341, 890]**	**[3.1, 25.7]**
Paper instruments	**-2.8**	**51**	**11.6**
	[-5.1, -0.6]	**[-308, 410]**	**[-6.0, 29.2]**
Cash.....	-3.0	-75	-0.7
	[-5.0, -0.9]	[-171, 21]	[-5.4, 4.0]
Check and other paper instruments*.....	0.1	126	27.5
	[-0.7, 1.0]	[-221, 474]	[-63.2, 118.3]
Payment cards	**-3.8**	**-256**	**-2.9**
	[-6.6, -1.0]	**[-461, -50]**	**[-9.0, 3.2]**
Debit.....	-2.7	-139	-1.3
	[-5.2, -0.3]	[-299, 21]	[-9.1, 6.6]
Credit.....	-1.0	-111	-5.6
	[-2.7, 0.6]	[-247, 24]	[-15.6, 4.5]
Prepaid/Gift/EBT card.....	0.0	-5	-4.7
	[-0.5, 0.5]	[-32, 22]	[-21.9, 12.5]
Electronic payments	**1.1**	**479**	**37.5**
	[-0.1, 2.3]	**[64, 894]**	**[-24.6, 99.6]**
Bank account number payment (BANP)	0.3	227	74.3
	[-0.3, 1.0]	[20, 433]	[-17.5, 166.0]
Online banking bill payment (OBBP)....	-0.1	-8	12.7
	[-0.9, 0.6]	[-331, 315]	[-105.2, 130.7]
Other electronics†.....	0.9	260	90.5
	[0.5, 1.3]	[140, 381]	[26.9, 154.1]

* "Other paper" includes money orders and traveler's checks.

† The term "other electronics" includes the following payment instruments: mobile payments, PayPal payments, account to account transfers, direct from income deductions, "other", multiple payment methods for one payment, and unreported payment methods.

Table 3b

Changes in Payments by Type of Payment Instrument

Percentage point change in shares per consumer, 2015–2016

	Change in number (#)	Change in value ($)
All payments	—	—
	—	—
Paper instruments	**-1.4**	**-0.9**
	[-4.8, 2.1]	**[-8.6, 6.8]**
Cash	-2.5	-2.7
	[-5.9, 1.0]	[-5.5, 0.2]
Check and other paper instruments*	1.1	1.8
	[-0.5, 2.7]	[-6.0, 9.7]
Payment cards	**-2.2**	**-9.2**
	[-5.7, 1.3]	**[-14.8, -3.5]**
Debit	-2.4	-4.9
	[-6.2, 1.4]	[-9.4, -0.5]
Credit	-0.1	-4.0
	[-2.8, 2.6]	[-7.5, -0.6]
Prepaid/Gift/EBT card	0.3	-0.2
	[-0.7, 1.3]	[-1.0, 0.5]
Electronic payments	**3.6**	**10.0**
	[1.4, 5.8]	**[2.1, 18.0]**
Bank account number payment (BANP)	1.1	5.0
	[-0.1, 2.3]	[0.0, 10.1]
Online banking bill payment (OBBP)	0.3	-1.5
	[-1.2, 1.8]	[-8.9, 5.8]
Other electronics†	2.2	6.5
	[1.4, 3.0]	[3.5, 9.5]

* "Other paper" includes money orders and traveler's checks.

† The term "other electronics" includes the following payment instruments: mobile payments, PayPal payments, account to account transfers, direct from income deductions, "other", multiple payment methods for one payment, and unreported payment methods.

Table 4

Cash Holdings on Person

Average number of bills and value per consumer, October 1–31, 2016

Average	Number of bills (#)		Value ($)	
	Mean	Median	Mean	Median
All bills	**5.6**	**4.1**	**57.2**	**24.0**
	[5.3, 5.9]		**[52.5, 61.9]**	
$1	2.6	2.0	2.6	2.0
	[2.5, 2.8]		[2.5, 2.8]	
$2	0.0	0.0	0.0	0.0
	[0.0, 0.0]		[0.0, 0.1]	
$5	0.8	0.3	4.0	1.6
	[0.7, 0.9]		[3.7, 4.3]	
$10	0.5	0.0	5.3	0.0
	[0.5, 0.6]		[4.8, 5.9]	
$20	1.4	0.3	28.1	6.6
	[1.3, 1.5]		[25.7, 30.5]	
$50	0.1	0.0	5.6	0.0
	[0.1, 0.2]		[3.1, 8.1]	
$100	0.1	0.0	11.5	0.0
	[0.1, 0.1]		[9.2, 13.9]	
Percentage shares by denomination				
All bills	**100.0**	**—**	**100.0**	**—**
	—		**—**	
$1	46.9	—	4.6	—
	[45.3, 48.5]		[4.2, 5.0]	
$2	0.4	—	0.1	—
	[0.3, 0.6]		[0.1, 0.1]	
$5	14.1	—	6.9	—
	[13.4, 14.9]		[6.3, 7.6]	
$10	9.5	—	9.3	—
	[8.6, 10.3]		[8.3, 10.3]	
$20	25.0	—	49.1	—
	[23.4, 26.5]		[45.5, 52.7]	
$50	2.0	—	9.8	—
	[1.1, 2.9]		[5.9, 13.8]	
$100	2.1	—	20.2	—
	[1.7, 2.5]		[16.8, 23.5]	

Table 5

Cash Holdings on Person

Average number of bills and value per consumer, October 16–November 15, 2015

Average	Number of bills (#)		Value ($)	
	Mean	Median	Mean	Median
All bills	**5.2**	**4.0**	**50.9**	**23.0**
	[4.8, 5.7]		**[43.8, 58.1]**	
$1	2.6	2.0	2.6	2.0
	[2.3, 2.8]		[2.3, 2.8]	
$2	0.0	0.0	0.1	0.0
	[0.0, 0.1]		[0.0, 0.1]	
$5	0.7	0.2	3.3	1.2
	[0.6, 0.8]		[2.9, 3.8]	
$10	0.5	0.0	4.6	0.0
	[0.4, 0.5]		[3.8, 5.3]	
$20	1.4	0.5	27.2	9.4
	[1.2, 1.6]		[23.1, 31.3]	
$50	0.1	0.0	2.8	0.0
	[0.0, 0.1]		[1.6, 4.0]	
$100	0.1	0.0	10.4	0.0
	[0.1, 0.1]		[5.9, 14.8]	
Percentage shares by denomination				
All bills	**100.0**	**—**	**100.0**	**—**
	—		**—**	
$1	49.0	—	5.0	—
	[46.0, 51.9]		[4.3, 5.8]	
$2	0.6	—	0.1	—
	[0.1, 1.1]		[0.0, 0.2]	
$5	12.6	—	6.5	—
	[11.3, 13.9]		[5.5, 7.5]	
$10	8.7	—	9.0	—
	[7.5, 10.0]		[7.3, 10.7]	
$20	26.0	—	53.4	—
	[23.1, 28.9]		[47.4, 59.4]	
$50	1.1	—	5.6	—
	[0.6, 1.5]		[3.4, 7.7]	
$100	2.0	—	20.4	—
	[1.1, 2.8]		[13.5, 27.3]	

Table 6

Change in Cash Holdings on Person

Change in average number of bills and value per consumer, 2015–2016

Average	Change in number (#)	Change in value ($)
All bills	**0.4**	**6.3**
	[-0.2, 0.9]	**[-2.3, 14.8]**
$1	0.1	0.1
	[-0.2, 0.4]	[-0.2, 0.4]
$2	0.0	0.0
	[0.0, 0.0]	[-0.1, 0.0]
$5	0.1	0.7
	[0.0, 0.2]	[0.1, 1.2]
$10	0.1	0.7
	[0.0, 0.2]	[-0.2, 1.7]
$20	0.0	0.8
	[-0.2, 0.3]	[-3.9, 5.6]
$50	0.1	2.8
	[0.0, 0.1]	[0.0, 5.6]
$100	0.0	1.1
	[0.0, 0.1]	[-3.9, 6.2]
Percentage point change		
All bills	—	—
$1	-2.0	-0.4
	[-5.3, 1.3]	[-1.2, 0.4]
$2	-0.1	0.0
	[-0.7, 0.4]	[-0.1, 0.1]
$5	1.5	0.5
	[0.0, 3.0]	[-0.7, 1.6]
$10	0.7	0.3
	[-0.8, 2.2]	[-1.6, 2.2]
$20	-1.0	-4.4
	[-4.2, 2.1]	[-11.2, 2.5]
$50	0.9	4.3
	[-0.1, 1.9]	[-0.2, 8.7]
$100	0.1	-0.2
	[-0.8, 1.0]	[-7.6, 7.2]