

The Use of Checks and Other Noncash Payment Instruments in the United States

Geoffrey R. Gerdes and Jack K. Walton II, of the Board's Division of Reserve Bank Operations and Payment Systems, prepared this article. Thomas Guerin and Amin Rokni provided research assistance.

Over the past several decades, the payments industry has undergone significant change. New electronic payment instruments have been introduced, and the means for making electronic payments have become increasingly available for use in everyday commerce. Further, the adaptation of technology has driven down the costs of processing electronic payments relative to check payments. Partial statistics and anecdotal evidence suggest that consumers and businesses are increasingly using electronic payments. Nevertheless, the paper check continues to be the most commonly used type of noncash payment instrument in the U.S. economy. Checks' share in noncash payments has been declining, however, and recent evidence suggests that the total number of checks paid has been declining as well.

To shed light on the use of checks and other noncash payment instruments in the United States, the Federal Reserve recently sponsored three related surveys collectively referred to as the Retail Payments Research Project. The survey data were used to estimate the number and value of payments made in 2000 using checks and several types of electronic payment instruments as well as to study the characteristics of individual checks paid in 2000. The magnitude and diversity of the samples also enabled a comparison of check use across type and size of depository institution and across geographic regions. In addition, the data provided a basis for looking at changes in noncash payments since 1979, when the Federal Reserve collected data on checks for an analysis of the check-clearing system, and since 1995, when the Federal Reserve collected data on checks for a report to the Congress on funds availability and check fraud. The surveys are described in detail in the appendix.

NOTE. Darrel Parke and Samuel Slowinski, of the Board's Division of Research and Statistics, provided valuable assistance with the production and interpretation of the statistical estimates.

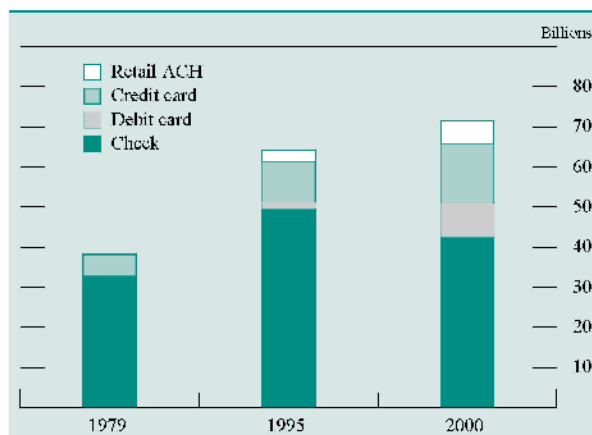
Taken together, the data show that an estimated 32.8 billion checks were paid in the United States in 1979, 49.5 billion in 1995, and 42.5 billion in 2000 (chart 1). The exact year in which check use peaked is unknown, but it appears that the number paid began to decline sometime in the mid-1990s. By 2000, retail electronic payments had gained considerable ground. Nonetheless, checks remained the predominant type of retail noncash payment. Checks also continued to account for a large proportion of the total value of retail noncash payments in 2000, though the real value of total checks paid had declined since 1979.

OVERALL TRENDS IN THE USE OF CHECKS

In the United States, most noncash payments are made using checks, credit cards, debit cards, and the electronic payment system called the automated clearinghouse (ACH)—collectively referred to as retail noncash payments.¹ Consumers, businesses,

1. The term *check* refers to a demand draft drawn on or payable through or at a depository institution or a federal, state, or local government entity, including cashiers and certified checks, travelers checks, money orders, and rebate checks. The ACH is an electronic payments network that enables the processing of credit and debit payments, such as payroll and prearranged bill payments, between depository institutions.

1. Number of check and retail electronic payment transactions, selected years



1. Number and value of retail noncash payments, 2000

Type of payment	Number		Value	
	Billions of payments	Percent of total	Trillions of dollars	Percent of total
Check ¹	42.5	59.5	39.3	84.4
Retail electronic payments	28.9	40.5	7.3	15.6
Debit card	8.3	11.6	.3	.7
<i>Credit card</i>				
General-purpose ²	12.3	17.2	1.1	2.3
Private-label ³	2.7	3.8	.2	.3
Retail ACH ⁴	5.6	7.9	5.7	12.2
Total	71.5	100.0	46.6	100.0

NOTE. In this and subsequent tables, components may not sum to totals, and calculations may not yield averages and percentages shown, because of rounding.

1. Includes checks paid by depository institutions, U.S. Treasury checks, and postal money orders.

2. Includes co-branded credit cards, charge cards, co-branded charge cards, secured credit cards, travel and entertainment cards, commercial cards, and new payment technologies that route transactions through the card associations' networks.

3. Includes retailer cards, oil company cards, third-party fleet cards, and cards issued by third-party receivable owners.

4. Excludes ACH transactions classified as cash concentration and disbursement, which, for purposes of this study, are not considered payments.

and government entities made about 71.5 billion retail noncash payments in 2000 (table 1). The total value of these payments was about \$46.6 trillion, approximately four and three-fourths times U.S. gross domestic product (GDP) for that year. Checks were the predominant type of retail noncash payment, accounting for 59.5 percent of these payments by number. By comparison, checks constituted 85.7 percent of retail noncash payments in 1979 (table 2). Although the number of check payments increased from 1979 to 2000, the number of checks as a share of retail noncash payments declined about 26 percentage points.

Growth in overall economic activity and population led to a general growth in payments, including cash payments, between 1979 and 2000. Such factors as technological change and increased availability

and acceptability of alternatives to cash influenced the proportion of payments made with retail noncash instruments. From 1979 to 2000, the number of retail noncash payments grew approximately 3 percent a year, about the same as the rate of growth of real GDP. Hence, both the number of retail noncash payments and the amount of economic output roughly doubled over the period. Over the same period, the number of households increased from 78.8 million to 105.5 million, for an annual rate of growth of almost 1.5 percent.

The growth in retail noncash payments leading up to the mid-1990s may have resulted from a general increase in payments, an increase in the number of households with checking accounts, and the replacement of some cash payments by noncash payment alternatives.² About 9.2 billion more retail electronic payments were made in 1995 than in 1979. The number of checks also rose considerably over the period. In fact, about 16.7 billion more checks were paid in 1995. However, the number of checks paid as a share of all retail noncash payments declined, from 85.7 percent to 77.1 percent.

The decline in the number of checks as a share of retail noncash payments continued over the period 1995 to 2000, and the number of checks paid declined as well, from an estimated 49.5 billion in 1995 to 42.5 billion in 2000. (In comparison, the annual number of electronic payments increased 14.2 billion over the period.) Whether the number of checks paid in nearby years was higher or lower than in 1995 is unknown. However, these estimates suggest that the number of checks paid peaked during the mid-1990s.

2. The proportion of households without a checking account fell from 18.7 percent in 1989 to 13.2 percent in 1998. See Arthur B. Kennickell, Martha Starr-McCluer, and Brian J. Surette, "Recent Changes in U.S. Family Finances: Results from the 1998 Survey of Consumer Finances," *Federal Reserve Bulletin*, vol. 86 (January 2000), pp. 1-29.

2. Number and rate of growth of retail noncash payments, selected years

Type of payment	Number (billions) ¹			Growth (percent, annual rate)		
	1979	1995	2000	1979-95	1995-2000	1979-2000
Check	32.8	49.5	42.5	2.6	-3.0	1.2
Retail electronic payments	5.5	14.7	28.9	6.3	14.6	8.2
Debit card .....	.0	1.4	8.3	...	41.8	...
<i>Credit card</i>						
General-purpose	1.5	7.8	12.3	10.9	9.5	10.5
Private-label	3.8	2.6	2.7	-2.3	.9	-1.6
Retail ACH .....	.2	2.8	5.6	19.0	15.1	18.0
Total	38.3	64.2	71.5	3.3	2.2	3.0

NOTE. See table 1, notes 1-4.

... Not applicable.

SOURCES. Federal Reserve; National Automated Clearing House Association; *Nilson Report*, selected issues; and ATM & Debit News, *EFT Data Book*, 2002 edition.

The apparent decline in the number of checks paid between 1995 and 2000 was likely not driven by a change in the general level of economic activity. Both years were part of an economic expansion that began in the early 1990s and peaked in March 2001 (according to the National Bureau of Economic Research), and spending by consumers and businesses, which make the predominant number of payments in the economy, increased during the period. Instead, the decline in check use appears to have been related to increased use of electronic payments by consumers and businesses.

Although the number of checks paid appears to have declined during the latter part of the period, the number increased on net from 1979 to 2000. The value of checks paid, however, decreased—from an estimated \$50.7 trillion in 1979 to \$39.3 trillion in 2000 (both in 2000 dollars; table 3).³ The declines in overall check value and related measures (the estimated average value of a check, for example, declined from \$1,544 in 1979 to \$925 in 2000) provide supporting evidence that electronic payments have replaced checks for at least some types of transactions. In addition, most large-value payments for settlement of financial market transactions that were once made by check are now made electronically, many using the large-value funds transfer systems (such as Fedwire and CHIPS). Such payments are discussed separately because they are not considered retail noncash payments.

VARIATIONS IN CHECK PAYMENTS ACROSS DEPOSITORY INSTITUTIONS

Almost 15,000 depository institutions in the United States—commercial banks, credit unions, and savings institutions—provide checking or share draft accounts. However, the distribution of transaction deposits and the number and value of checks paid are skewed toward a small number of very large institutions.⁴

3. All historical values reported in this article are given in 2000 dollars. Adjustments to historical values were made using the implicit price deflator for GDP. Given that prices have roughly doubled since 1979, \$1 in 1979 was equivalent to about \$2.05 in 2000. An estimate of the value of checks paid in 1995 could not be constructed.

4. Depository institution subsidiaries of multibank holding companies are treated as a single depository institution. Commercial banks include branches of foreign banks; checks paid by the latter group constitute a very small proportion of the total number and value of checks paid. Savings institutions include savings and loan institutions, cooperative banks, and savings banks. Transaction deposits are deposits held in transaction accounts—types of accounts for which the number of payments is not restricted by regulation. Although payments may be made from other types of depository institution accounts, such as savings accounts, such payments are limited by regulation to six per month.

3. Number and value of checks paid, by type of institution, selected years

Year and type of institution	Number (billions)	Value (trillions of dollars)	Memo: Transaction deposits (billions of dollars)
1979			
Commercial banks	31.4	n.a.	744
Credit unions .....	.3	n.a.	4
Savings institutions .....	.3	n.a.	4
All depository institutions ..	32.0	49.6	752
U.S. Treasury checks and postal money orders ..	.8	1.1	...
Total	32.8	50.7	...
1995			
Commercial banks	42.0	n.a.	855
Credit unions	3.5	n.a.	34
Savings institutions	3.4	n.a.	64
All depository institutions ..	48.9	n.a.	953
U.S. Treasury checks and postal money orders ..	.7	.6	...
Total	49.5	n.a.	...
2000			
Commercial banks	33.3	36.6	602
Credit unions	4.7	.9	51
Savings institutions	4.0	1.6	62
All depository institutions ..	42.0	39.0	715
U.S. Treasury checks and postal money orders ..	.5	.3	...
Total	42.5	39.3	...

NOTE: All values are in 2000 dollars.

n.a. Not available.

... Not applicable.

Trends across Depository Institutions

Credit unions and savings institutions generally did not offer checking accounts (or their equivalent) until the late 1970s. Since that time, transaction deposits at, and the number and value of checks paid by, these institutions have grown briskly.

Despite the overall decline in the number of checks paid between 1995 and 2000, the number paid by credit unions and savings institutions continued to grow (table 3). These institutions together paid an estimated 14 percent of checks in 1995 but more than 20 percent in 2000. The 1.8 billion increase in the number of checks paid annually by these institutions, however, was more than offset by a dramatic decline of about 8.7 billion in the number paid annually by commercial banks.⁵

5. The increase in checks paid by credit unions is consistent with independent evidence from the Survey of Consumer Finances conducted periodically by the Federal Reserve: The share of households that reported using credit unions for checking accounts rose from 10.5 percent in 1989 to 17.4 percent in 1998. The share that reported using savings institutions for checking accounts declined, however, from 20.2 percent to 11.5 percent, perhaps suggesting that the increase

Differences across Depository Institutions in 2000

The average value of checks paid in 2000 varied by type and size of depository institution, presumably because of the mix of business and consumer customers served by different institutions. Large commercial banks and some large savings institutions serve corporations and other businesses as well as consumers. Because large corporations tend to make larger-value payments, the average value of checks paid by depository institutions that serve them tends to be larger. Community banks (small commercial banks and savings institutions) typically serve smaller businesses and consumers, so the average value of checks they pay is smaller. Credit unions overall have the smallest average check value because they generally provide accounts only to consumers (table 4).⁵

The importance of check payments relative to other types of payments at individual depository institutions cannot be known precisely because data on the proportion of total payments made using checks at individual depository institutions are unavailable.

in check use at savings institutions was due to increased use by businesses. The share that reported using commercial banks increased slightly, from 68.6 percent to 69.5 percent. See Dean F. Amel and Martha Starr-McCluer, "Market Definition in Banking: Recent Evidence," *Antitrust Bulletin*, vol. 47 (Spring 2002), pp. 63-89.

6. In some cases, however, credit union accounts are used for business purposes. In 1998, about 3.8 percent of small businesses used a credit union for checking. See Marianne P. Bitler, Alicia M. Robb, and John D. Wolken, "Financial Services Used by Small Businesses: Evidence from the 1998 Survey of Small Business Finances," *Federal Reserve Bulletin* (April 2001), vol. 87, pp. 183-205.

However, looking at the number and value of checks paid in terms of the value of an institution's transaction deposits can give some indication of the importance—or intensity—of check use. Specifically, the relative intensity of check use can be approximated as the number and value of checks paid per \$1,000 of transaction deposits—the number-to-deposits ratio and value-to-deposits ratio respectively. In 2000, these ratios appear to have varied by type and size of depository institution (table 4). The largest commercial banks, for example, had the highest value-to-deposits ratio among all categories of depository institutions, likely reflecting the high average value of checks paid by these institutions. In contrast, these banks had a number-to-deposits ratio similar to those of the smallest banks and small savings institutions. Midsize banks had the lowest number-to-deposits ratio and a value-to-deposits ratio below the ratios for the largest and smallest banks. These results suggest that checks may be used less intensively at midsize commercial banks than at institutions in other categories.

The amount of transaction deposits held by a depository institution can be affected by both the willingness of account holders to hold idle balances and the institution's use of sweep accounts to reduce the balances their customers hold overnight in transaction accounts.⁷ The use of such deposits in mea-

7. Generally, depository institutions use two types of sweep programs. Wholesale sweeps, which have been offered to business customers since the 1970s, keep customers' non-earning assets low, by moving funds between non-interest-earning demand deposits, such as transaction deposits, and interest-earning money market mutual funds

4. Checks paid by and transaction deposits of depository institutions, by type and size of institution, 2000

Type and size of institution (transaction deposits in millions of dollars)	Number of institutions	Check ; paid						Transaction deposits			Memo	
		Number (billions)	Value (trillions of dollars)	Average value (dollars)	Percent of interbank checks returned	Average value of interbank checks returned (dollars)	Percent on-us	Amount (billions of dollars)	Number- to- deposits ratio	Value- to- deposits ratio ⁴	Number- to- assets ratio ³	Value- to- assets ratio ²
Commercial banks	6,852	33.3	36.6	1,099	.79	859	34	602	55	60,682	53	58,256
250-60,000	170	23.6	29.6	1,254	.82	964	38	411	57	72,090	54	67,681
50-250	1,104	4.3	3.4	790	.72	646	26	99	43	34,106	48	37,897
0-50	5,578	5.4	3.6	663	.75	595	26	93	58	38,523	53	35,386
Credit unions	6,551	4.7	.9	186	1.03	244	6	51	93	17,254	111	20,613
75-2,000	106	1.2	.3	208	.98	305	6	16	75	15,621	96	20,068
0-75	6,445	3.5	.6	178	1.05	223	6	35	101	18,028	117	20,845
Savings institutions	1,293	4.0	1.6	389	.99	507	18	62	65	25,226	34	13,296
200-6,500	35	2.2	.9	413	1.22	533	14	30	72	29,567	36	14,752
0-200	1,258	1.8	.7	360	.67	444	22	31	58	20,985	32	11,706
All institutions	14,696	42.0	39.0	928	.85	700	29	715	59	54,522	53	49,539

NOTE. Excludes U.S. Treasury checks and postal money orders, which are paid by the Federal Reserve Banks. Transaction deposit ranges may include amounts equal to the upper boundary but do not include amounts equal to the lower boundary. Institutions without transaction deposits are not included.

1. Number of checks paid per \$1,000 of transaction deposits.
2. Value of checks paid per \$1,000 of transaction deposits.
3. Number of checks paid per \$1,000,000 of assets.
4. Value of checks paid per \$1,000,000 of assets.

asures of the relative intensity of check use may exaggerate the intensity of check use at the largest institutions because such institutions also tend to use sweep accounts most extensively. An alternative approximation that may control for various effects on transaction deposits is the number and value of checks paid per \$1 million of assets—the number-to-assets ratio and value-to-assets ratio respectively. While the number-to-assets ratio exhibits the same general U-shaped pattern as the number-to-deposits and value-to-deposits ratios, the value-to-assets ratio for commercial banks does not. Instead, the value-to-assets ratio increases as the size category of commercial banks increases.

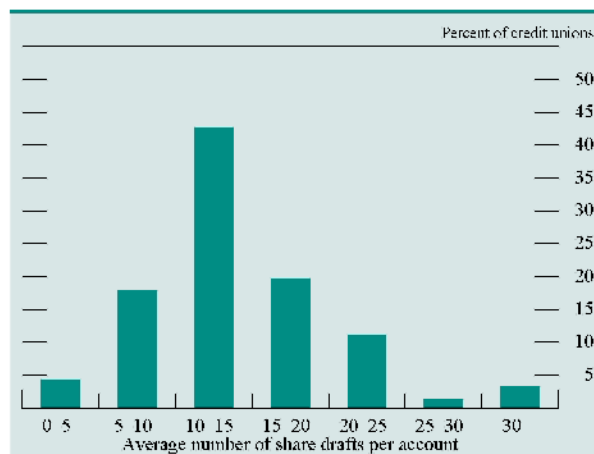
Whether viewed in terms of transaction deposits or assets, credit unions stand out as the type of institution at which checks are used the most intensively by number. The intensity of check use by both number and value declines as size increases, suggesting that check use is less intense at larger credit unions.

Without directly measuring the number and value of all payments initiated by depository institutions, approximating the intensity of check use is difficult because of the complexity of factors affecting the data. Nevertheless, the results presented here provide preliminary evidence that the intensity of check use does vary by type and size of depository institution.

The average number of check payments per transaction account can be estimated for credit unions because data are available on the number of transaction (share draft) accounts at these institutions. Because credit unions generally do not offer business accounts, the number of checks (share drafts) paid per account is an approximation of the number of checks paid per consumer account. The average number of checks per account varies across these institutions (chart 2). Differences in payment services offered may explain some of the variation. The monthly average number of checks paid per share draft account in 2000 (about fifteen) was somewhat lower than the monthly average number of checks estimated to have been written by households in that

or other financial instruments. Retail sweeps, which first appeared in 1994, move idle funds from transaction deposit accounts to special-purpose money market deposit accounts (MMDAs) and return them to transaction accounts only as needed to cover payments, limiting the number of withdrawals from the MMDAs to six per month in accordance with regulatory restrictions. This practice does not adversely affect the account holder but allows the depository institution to reduce its non-interest-earning assets. Both types of sweep programs reduce the amount of funds depository institutions must hold to meet their reserve requirements. See Cheryl L. Edwards, “Open Market Operations in the 1990s,” *Federal Reserve Bulletin*, vol. 83 (November 1997), pp. 859–74, for a discussion of sweep programs.

2. Distribution of credit unions by average number of share drafts paid monthly per account, 2000



NOTE: Ranges may include the upper boundary but do not include the lower boundary.

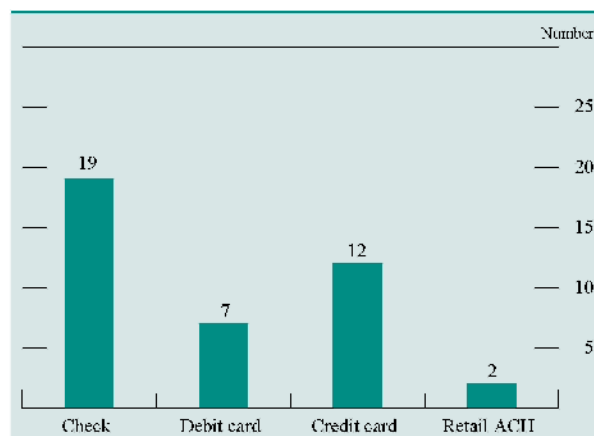
year (about nineteen; chart 3). One reason for the difference is that some households write checks on accounts at more than one institution.

“On Us” Checks

A check that is deposited in or cashed at the same depository institution on which it is drawn is referred to as an on-us check. An estimated 29 percent of checks paid in 2000 were on-us checks (table 4), about the same as in 1979.

The apparent absence of an increase in the aggregate share of on-us checks is surprising in light of the consolidation of the banking industry that has occurred since 1979. When institutions merge, the

3. Average number of retail noncash payments per household per month, 2000



probability that a check written by a customer of one of the institutions will be an on-us check for the new institution generally increases; the increase is large if the institutions that merged tended to serve customers that wrote checks to each other, though not so large if they tended to serve customers that did not. If the merger is between institutions in different geographic areas, and assuming that most checks are local, the effect of the merger on the proportion of on-us checks is small. That the share of on-us checks remained virtually unchanged from 1979 to 2000 as extensive consolidation of depository institutions both within and across regions was taking place suggests that other, behavioral changes in check-writing offset the effects of consolidation. One such change likely was the way account holders obtain cash: In the 1970s, account holders commonly obtained cash by cashing checks at the counter of their own banks; since then, the use of ATMs to obtain cash has increased dramatically, reducing the use of checks for this purpose.

Several factors in addition to the effects of consolidation or banking concentration may affect the probability that a check paid by a particular institution is an on-us check. These include the extent of branching, the range of customers served, and the extent of business activity of account holders with nonlocal payment counterparties or financial institutions.⁸ A comparison of the proportions of on-us checks paid in 2000 reveals some patterns among depository institutions of different types and sizes (table 4). Among commercial banks, the proportion of on-us checks was greater for larger institutions than for smaller institutions. Among credit unions, however, no relationship between size and proportion of on-us checks was evident; as a group, credit unions had the smallest share of on-us checks, consistent with the finding that in 2000, the share of consumer checks for which the payee was also a consumer was relatively small (23 percent). The estimated proportion of on-us checks for small savings institutions was large relative to the proportion for large savings institutions, possibly because of the types of communities the smaller institutions serve. In fact, many community banks reported a large share of on-us checks. The 1979 study also found a large share of on-us checks among community banks.

8. A complete analysis of the effects of these factors is beyond the scope of this article; a simple cross-sectional regression of the share of on-us checks on the logarithm of transaction deposits and the number of own-bank branches revealed no significant relationship between the number of branches and the share of on-us checks.

Returned Checks

Because an account has been closed, funds in the payer's account are insufficient, or another reason, some checks presented to a paying institution are returned unpaid to the collecting institution. An estimated 251 million interbank (non-on-us) checks were returned in 2000, about 0.85 percent of interbank checks paid, or 8.5 checks out of every 1,000 interbank checks paid (table 4).⁹ This estimate is an upper bound on the number of returns, as some checks may be returned more than once, leading to some double counting.¹⁰

The estimated proportion of checks that are returned unpaid appears to vary by type and size of depository institution. Credit unions as a group had the highest return rate (10.3 checks returned for every 1,000 paid), suggesting that interbank checks written by consumers are returned more frequently than are those written by businesses. The estimated average value of a returned check in 2000 was \$700.

VARIATIONS IN CHECK USE BY REGION AND DEGREE OF URBANIZATION

The size and diversity of the sample of depository institutions were sufficient to estimate the number and value of checks paid in 2000 for four broad regions of the country—Northeast, South, Midwest, and West. The apparent variation among regions can be explained in part by population size and level of economic activity (table 5).¹¹ Differences persist after controlling for those variables, however, an indication that regional differences may be associated with other factors, such as the availability of and willingness to use payment instruments other than checks.

By number of checks paid per capita, the Midwest led the regions, followed by the South, West, and

9. An on-us check would not be returned to another depository institution, as the payer and payee are using the same institution; an on-us check could be returned unpaid to the payee, however. The surveyed depository institutions reported only the number and value of checks returned to other institutions. The percentage of returned checks was computed as the number of returned checks divided by the difference between the number of checks paid and the number of on-us checks. (As a share of total checks paid, interbank returned checks accounted for an estimated 0.60 percent.)

10. Technological advances in the processing of returned checks may have reduced the incidence of multiple returns of the same check by helping collecting banks re-present checks when there is a greater likelihood of sufficient funds in the account on which the check is drawn.

11. Economic activity was measured by economic output, which was estimated as the sum of the gross products of the states making up the regions. Gross state product is a measure of state output similar to GDP.

5. Number and value of checks paid by depository institutions, by location of deposits, 2000

Location of deposits	Number of institutions	Number				Value					Memo: Transaction deposits (billions of dollars)
		Total (billions)	Per capita	Per \$1,000 of output ¹	Number-to-deposits ratio ²	Total (trillions of dollars)	Per capita (thousands of dollars)	Per \$1,000 of output ¹	Value-to-deposits ratio ³	Average per check (dollars)	
<i>By region</i>											
Northeast ⁴	2,417	7.1	132.6	3.3	46.0	9.1	169.8	4,233	58,909	1,280	154
Multiregion institutions	55	3.6	...	...	40.2	7.0	...	...	77,883	1,938	89
Single-region institutions	2,362	3.5	...	...	54.0	2.1	...	...	32,763	606	65
South ⁵	4,841	15.3	152.8	4.7	61.9	14.6	145.8	4,467	59,096	955	247
Multiregion institutions	92	4.9	...	...	59.6	5.7	...	...	68,824	1,155	82
Single-region institutions	4,749	10.4	...	...	63.1	9.0	...	...	54,242	860	165
Midwest ⁶	5,396	10.8	168.4	5.0	61.6	8.0	123.9	3,683	45,362	736	176
Multiregion institutions	94	4.1	...	...	51.9	4.4	...	...	56,387	1,086	78
Single-region institutions	5,302	6.8	...	...	69.4	3.6	...	...	36,570	527	98
West ⁷	2,182	8.8	138.5	3.7	64.1	7.3	115.5	3,102	53,437	834	137
Multiregion institutions	72	4.2	...	...	69.1	4.0	...	...	65,235	944	61
Single-region institutions	2,110	4.6	...	...	60.1	3.3	...	...	43,959	732	76
<i>By urbanization</i>											
Urban	10,173	33.3	145.3	...	57.6	33.0	144.2	...	57,215	992	578
Rural	5,970	8.7	167.0	...	63.8	6.0	114.0	...	43,575	683	137

NOTE. Includes only checks paid by commercial banks, savings institutions, and credit unions. Multiregion institutions are those that have deposits in more than one region; single-region institutions have deposits in only one region. Urban areas are those defined as metropolitan statistical areas or New England county metropolitan statistical areas; rural areas are those defined to be outside urban areas. Figures for the number of institutions do not sum to the total number of institutions because some institutions operate in more than one region or in both urban and rural areas.

1. Output is measured as the sum of the gross products of the states in the region.

2. See table 4, note 1.

3. See table 4, note 2.

4. Includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

5. Includes Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

6. Includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

7. Includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

... Not applicable.

SOURCES. Federal Reserve; and Department of Commerce, Bureau of Economic Analysis and Bureau of the Census.

Northeast. By value of checks paid per capita, the Northeast led, followed by the South, Midwest, and West. Thus, no region stood out as the greatest user of checks by both number and value. Nonetheless, some differences among regions appear to have been large. For example, the number of checks paid per capita was 27 percent higher in the Midwest than in the Northeast, and the value of checks paid per capita was 47 percent higher in the Northeast than in the West.

The Northeast had the lowest number of checks per capita, the lowest number of checks per \$1,000 of output, and the highest average check value. In addition, the Northeast had the lowest number-to-deposits ratio. The smallest region as measured by area and population size, the Northeast includes New York State, which is home to a significant concentration of financial and corporate activity. This activity appears to have had a large effect on checks and deposits in the region. For example, average check value for the region was more than 20 percent lower when New York State was excluded from the calculation, bringing the average value for the rest of the Northeast closer to the average values for the other regions.

Interestingly, the average check value and value-to-deposits ratio for depository institutions operating only in the Northeast (single-region institutions) were considerably lower than for institutions operating in the Northeast and at least one other region (multiregion institutions). Among single-region institutions, those in the Northeast and Midwest had the lowest average check values and value-to-deposits ratios, suggesting that these institutions were used less frequently for paying larger-value business checks. Correspondingly, the very high average check value and value-to-deposits ratio for multiregion institutions operating in the Northeast suggest that these institutions were used more often than others for paying such larger-value business checks.

The Midwest, the region with the largest number of depository institutions per capita, had the highest number of checks per capita. The West had the smallest value of checks per capita and per \$1,000 of output, possibly indicating that payers in the region, perhaps led by businesses, had a greater propensity to replace higher-value checks with electronic payments. The South had the highest value of checks per \$1,000 of output and a value-to-deposits ratio similar

to that for the Northeast, suggesting that checks were used by businesses more often in these two regions than in the other regions.

Almost 80 percent of checks were paid using transaction deposits located in urban areas (table 5).¹² On a per capita basis, however, the number of checks paid was more than 14 percent higher in rural areas, perhaps because of lesser availability of or willingness to use electronic payment alternatives. The average value of rural checks was about 30 percent lower than that of urban checks.

DISTRIBUTION OF CHECK PAYMENTS BY PAYER, PAYEE, AND PURPOSE

The share of checks written by consumers appears to have increased somewhat since the 1970s. According to the 2000 survey, consumers wrote about 58 percent of the sampled checks for which the payer could be classified, with business and government checks making up the rest.¹³ Studies by the Bank Administration Institute and Arthur D. Little, Inc., in the early and mid-1970s that classified check payments by payer and payee found that consumers wrote about half of all checks.¹⁴ The increase in the share written

by consumers and the corresponding decline in the share written by businesses and governments partly explain the decline in the real value of checks over time.

Checks can be classified according to the broad purpose of the payment—point-of-sale (POS) (generally, in-person purchases of merchandise at such locations as grocery and office-supply stores); income (payments to consumers by businesses and governments, including payroll, rebates, refunds, and dividends); remittance (payments of one-time or recurring bills); and casual (consumer-to-consumer payments). The value of checks paid in 2000 varied by purpose of payment (table 6). For example, nearly three-fourths of POS checks were for less than \$100. In contrast, slightly fewer than half of casual-payment checks were for less than \$100, and nearly as many were for \$100 to \$1,000.

Comparison of the results from the 1970s with the results for 2000 shows that, combined, the share of checks written by consumers at the point of sale and for the payment of bills decreased about 13 percent over the period, with a proportionate increase in consumer-to-consumer check payments.¹⁵ Consumers apparently, over time, replaced checks written at the point of sale and for bill payment with electronic payments to a greater extent than they replaced

12. Urban areas were defined as metropolitan statistical areas (MSAs) or New England county metropolitan statistical areas (NECMAs), and rural areas as all other areas.

13. Approximately 11 percent of checks could not be classified into payer and payee categories.

14. See L.M. Femer and R.H. Long, "The Check Collection System: A Quantitative Description" (Chicago: Bank Administration Institute, 1970), and Arthur D. Little, Inc., "The Consequences of Electronic Funds Transfer: A Technology Assessment of Movement toward a Less Cash/Less Check Society," prepared for the National Science Foundation, Research Applied to the National Needs (RANN), under contract NSF-C844 (Government Printing Office, 1975).

15. In 1979, individuals wrote an estimated 50 percent of their checks to pay bills. Another 40 percent were written at the point of sale (of which 80 percent were written to make retail purchases and about 20 percent were written for cash), and about 10 percent were written to other consumers. In 2000, 36 percent of checks written by consumers that could be classified by purpose were for bill payment and 29 percent were written at the point of sale; an additional 13 percent were identified as either for bill payment or written at the point of sale. The remaining 23 percent were consumer-to-consumer payments. (Only 1.6 percent of checks written by consumers in 2000 could not be classified by purpose.)

6. Distribution of check values, by payer, payee, and purpose, 2000

Percent

Check value (dollars)	All checks	Payer		Payee		Purpose			
		Consumer	Business ¹	Consumer	Business ¹	POS ²	Remittance ³	Income ⁴	Casual ⁵
0-100	48.1	64.0	25.3	32.2	55.8	72.1	51.8	21.7	48.6
100-1,000	38.7	30.5	50.6	52.4	32.1	21.7	36.0	59.6	41.0
1,000-2,500	6.3	3.0	11.2	8.9	5.2	2.9	5.9	11.1	5.6
2,500-10,000	5.3	2.1	9.5	5.6	4.8	2.7	4.3	6.6	4.2
More than 10,000	1.7	.4	3.4	.9	2.0	.7	2.1	1.1	.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

NOTE. Check value ranges may include checks written for amounts equal to the upper boundary but do not include checks written for amounts equal to the lower boundary.

1. Includes state and local government checks, which constituted only a small percentage of checks paid by and to businesses.

2. Point-of-sale payments from any type of payer to either a business or a government payee.

3. Payments from any type of payer to either a business or a government payee that did not occur at the point of sale.

4. Payments to an individual from either a business or a government entity.

5. Payments from one individual to another.

checks written to pay other consumers. In 2000, consumer-to-consumer payments accounted for about 23 percent of checks that could be classified as having been written by consumers.

The average value of checks written in 2000 was considerably greater than the average value of credit and debit card payments (table 7). In contrast, the average value of ACH payments, which are used more often for larger-value, recurring payments such as mortgages, credit card bills, and payroll, was somewhat higher than the average value of check payments.

Despite the high average value of checks relative to debit and credit card payments, many checks in 2000 were for small amounts (table 7). About 29 percent were for less than the average value of debit card payments (\$42), and 85 percent were for less than the average check value of \$925. In comparison, approximately 95 percent of checks written in 1979 were for less than the average check value that year of \$1,544. The proportion of checks for less than \$500 decreased from 85 percent in 1979 to 77 percent in 2000. However, the proportion of the highest-value checks (those above \$500,000) also decreased. Thus, most of the decline in the average (and total) value of checks from 1979 to 2000 was due to the replacement of the highest-value checks with electronic payments.

ELECTRONIC PAYMENTS

The number of retail electronic payments made in 1979 was small, accounting for about 15 percent of all retail noncash payments (table 2). Since then, the number made annually has grown at a high rate. Over the latter part of the period, the growth in electronic payments accelerated, nearly doubling between 1995 and 2000 and accounting for 40 percent of all retail noncash payments in 2000. Most of the growth was due to a dramatic increase in the number of debit card payments.

Payments by Households

An estimate of the average number of check payments made monthly by a household in 2000 can be estimated from data collected in the survey on check use. Because of the nature of the data from the electronic payments survey, however, a household average for retail electronic payments cannot be estimated without making assumptions. A large proportion of credit and debit card payments are likely made by households, although businesses also use credit

7. Average value of retail noncash payments, 2000

Type of payment	Average value (dollars)	Percent of checks below average
Check	925	85
Debit card	42	29
<i>Credit card</i>		
General-purpose	87	44
Private-label	59	36
Retail ACH	1,009	87

NOTE. See table 1, notes 1–4.

cards extensively, and a large proportion of ACH payments are undoubtedly made by businesses and governments. To estimate an upper bound for retail noncash electronic payments made by households, assume that households made all debit and credit card payments in 2000 and were the payers for half of all ACH payments.¹⁶ Under these assumptions, the average number of retail electronic payments per household per month in 2000 would have been about twenty-one (chart 3), or slightly more than half the retail noncash payments per household per month in 2000. For purposes of comparison, assume that in 1979, households made all retail electronic payments but half of all check payments. Under these assumptions, the average number of retail electronic payments per household per month would have been about six, or about one-fourth of the retail noncash payments made per household per month in 1979; check payments would have accounted for the other three-fourths (about seventeen per household per month).

Although the number of checks written per household increased from 1979 to 2000 (in part because the number of households with some type of checking account increased), electronic payments per household as a proportion of retail noncash payments increased more than checks. The apparent increase in the share of retail electronic payments suggests that consumer checks have been replaced by electronic payments to some extent. The increase in the estimated number of checks written per household per month, however, suggests that further growth in electronic payments could occur through the replacement of some consumer checks.

16. Data are not available to estimate precisely the share of retail ACH payments made by households, but research suggests that the share is about half. Of those household payments, about 40 percent are ACH debits—mainly prearranged payments (authorized by households and initiated by business recipients) that households have traditionally made by check, such as payments of recurring obligations to mortgage, insurance, and utility companies. The other 60 percent are ACH credits—mainly payroll payments from businesses to households but also some payments by households. See Vantis International, “Market Analysis and Segmentation for Direct Deposit and Direct Payment among Consumers, Businesses, and Financial Institutions” (1998).

Payments by Businesses and Governments

The use of electronic payments by businesses and governments has also increased since 1979. Many businesses have adopted direct deposit of payroll, for example. The proportion of payroll payments made via direct deposit rather than paper check increased from close to zero in 1979 to about 50 percent in 2000.¹⁷ Some businesses have also begun to experiment with programs for converting checks to electronic payments at point-of-sale locations and for the processing of bill payments. In addition, a number of businesses are seeking ways to combine electronic payment processing with invoicing, which could reduce the number of check payments. The U.S. Department of the Treasury now makes most of its payments using the ACH (chart 4) (though federal government payments constituted only about 1.5 percent of all retail noncash payments in 2000).¹⁸

Large-Value Payments

In addition to the retail payments that are the focus of this article, some very large payments, including federal government and business payments once

made by check, are now made using large-value funds transfer systems. Increased use of these systems helps explain the decline in the average value of checks from \$1,544 in 1979 to \$925 in 2000. Relative to retail noncash payments, payments made using these systems are few in number but tend to be large in value.¹⁹ From 1979 to 1995, the rate of growth of large-value payments by number (table 8) was similar to that for retail electronic payments (table 2). From 1995 to 2000, however, the number of retail electronic payments grew more than twice as fast as the number of payments processed by the large-value funds transfer systems.

Some payments made using large-value funds transfer systems replaced some larger-value business and government payments made by check, and this switch apparently had a significant effect on the real value of check payments over time. One large-scale change in business practices that motivated the replacement of some large-value checks was the switch to same-day funds for the settlement of trades between securities dealers in the U.S. equities markets in 1996.

NONCASH PAYMENTS IN OTHER COUNTRIES

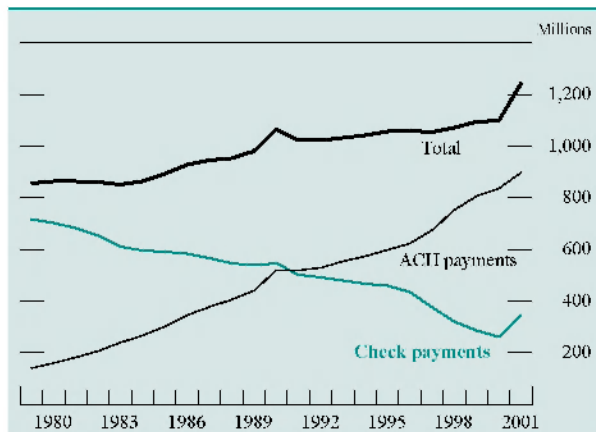
A look at noncash payments in other countries provides some perspective on the use of checks and electronic payments in the United States. Compared with other industrialized economies—Japan, the European Monetary Union (EMU), the United Kingdom, and Canada—the number of noncash payments of any type per capita is considerably higher in the United States, as is the number of check payments per capita (chart 5). The number of electronic payments per capita is also higher in the United States, though not substantially so. Detailed data (not shown) indicate that the number of electronic payments per capita in some countries of the EMU, such as Finland, Germany, and the Netherlands, is higher than in the United States (similarly, the use of electronic payments may be greater in some regions of the United States than in others).

The number of noncash payments per capita is higher in the United States than in the other economies mainly because of the more extensive use of checks. Given the very low level of noncash pay-

17. National Automated Clearing House Association; and Vantis International, "Market Analysis and Segmentation for Direct Deposit and Direct Payment" (1998).

18. For more on federal government payments, see Paula V. Hillery and Stephen E. Thompson, "The Federal Reserve Banks as Fiscal Agents and Depositories of the United States," *Federal Reserve Bulletin*, vol. 86 (April 2000), pp. 251–59.

4. Number of retail payments initiated by the U.S. Treasury, 1979–2001



NOTE. The 2001 uptick in check payments was due to the midyear tax refund payment sent to almost 100 million taxpayers as prescribed by the Economic Growth and Tax Relief Reconciliation Act of 2001. The U.S. Treasury also makes a small number of payments using other mechanisms such as Fedwire.

19. Nonetheless, many payments made via the large-value funds transfer systems, such as Fedwire, are low in value compared with the average (\$3.8 million). In fact, about one-fourth of Fedwire payments in 2000 were for amounts less than \$4,000. The median Fedwire payment was \$30,000, the 75th percentile was \$183,000, and the 95th percentile was \$5.1 million.

8. Number, value, and rate of growth of large-value funds transfer payments, selected years

Item	1979	1995	2000	Growth (percent, annual rate)		
				1979–95	1995–2000	1979–2000
Number (millions)	45.9	126.9	168.1	6.6	5.8	6.4
Value (trillions of dollars)	186.6	581.5	671.9	7.4	2.9	6.3

NOTE. Includes Fedwire fund transfers and fund transfers processed by the Clearing House Inter-Bank Payment System (CHIPS).

SOURCES. Federal Reserve and CHIPS.

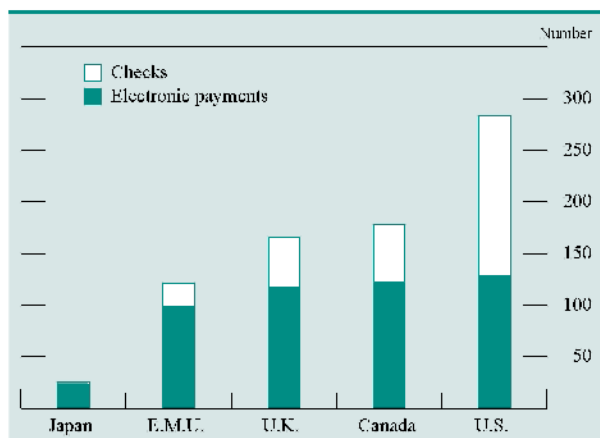
ments per capita in some countries, it seems likely that cash is used more extensively in these countries than in the United States.²⁰ If that is true, measures of the importance of checks as a share of noncash payments may overstate the relative use of paper-based payment instruments in the United States. Without reliable measures of cash use, however, a comprehensive comparison across countries of the extent to which electronic payments have replaced paper-based payments (mostly cash and checks) is not possible.

SUMMARY AND CONCLUSIONS

Statistical estimates indicate that the number of checks paid in the United States rose from 32.8 bil-

20. Some researchers have argued that in the 1980s and 1990s, the number of payments by cash was lower in the United States than in other countries. See Diana Hancock and David B. Humphrey, "Payment Transactions, Instruments, and Systems: A Survey," *Journal of Banking & Finance*, vol. 21 (1998), pp. 1573–624.

5. Number of noncash payments per capita in one year, selected economies



NOTE. Includes both retail payments and payments made using large-value funds transfer systems. Data for United States are for 2000; for France, 1998; for others, 1999. The European Monetary Union includes Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, and Spain.

SOURCE. European Central Bank, "Blue Book: Payment and Securities Settlement Systems in the European Union"; Bank for International Settlements, "Statistics on Payment Systems in the Group of Ten Countries"; and Federal Reserve.

lion in 1979 to 49.5 billion in 1995 but declined to 42.5 billion in 2000. These three estimates are highly suggestive, though not conclusive, evidence that the total number of checks paid per year peaked in the 1990s. Despite the apparent decline since 1995, the number of checks paid remained higher in 2000 than in 1979.

The estimated value of checks paid declined from \$50.7 trillion in 1979 to \$39.3 trillion in 2000, suggesting that electronic payments have increasingly replaced larger-value checks. Moreover, although the real value of transaction deposits declined slightly from 1979 to 2000, the decline was not as great as the decline in the value of checks paid, a further suggestion that electronic payments originated from transaction deposits likely replaced check payments.

The number and value of checks paid vary among institutions in interesting ways. The average value of checks paid, as well as the intensity of check use, differs by type and size of institution, reflecting in part the types of customers served. Differences also exist according to geographic region. Generally, the per capita value of checks paid is highest in the Northeast, and the number of checks paid per capita is highest in the Midwest. In addition, the number of checks paid per capita apparently is greater in rural areas than in urban areas.

Although the number and value of checks may have begun to decline, it appears likely that checks will continue to play a significant role in the U.S. payment system, particularly when electronic payments are not well suited for meeting consumer or business needs. U.S. authorities have generally relied on market forces to provide new payment products and services. In this environment, the fact that checks are still widely used suggests either that checks are an efficient means of payment for many purposes relative to alternatives or that barriers to innovation are inhibiting the development of alternatives. The Federal Reserve has emphasized the need for the public and private sectors to identify any such barriers and to work to reduce or eliminate them when doing so is in the public interest.

APPENDIX: DATA SOURCES AND METHODS OF ESTIMATION.

Described in this appendix are the surveys that provided the data analyzed in this article. Also described are methods used to estimate the total number and value of checks for 2000, 1995, and 1979.

2000 Data

The most recent data were collected through a set of three surveys sponsored by the Federal Reserve and known collectively as the Retail Payment Research Project.²¹ The three surveys were

- *Depository Institution Check Study*—Survey of a stratified random sample of insured commercial banks, credit unions, and savings institutions in the United States to estimate the number and value of checks paid in 2000 from data for March and April 2001²²
- *Check Sample Study*—Survey of individual checks submitted for collection by a stratified random sample of depository institutions during 2000 to characterize check payments in that year in terms of payer, payee, and purpose
- *Electronic Payment Instruments Study*—Survey of the universe of electronic payment networks, card issuers, and third-party processors to estimate the number and value of retail electronic payments originated in the United States in 2000. Covered in the survey were credit cards (both general-purpose and private-label cards), debit cards (both on-line cards, which are used by entering a personal identification number, and signature-based cards, which generally involve signing a receipt), and ACH transactions.

The collection of data on electronic payments was straightforward because the processing of electronic payments is largely centralized. Credit and debit card

transactions are processed through a small number of networks, and payments flow through these networks, even if the payer and payee are customers of the same bank. Because more than one network can process the same payment, double counting could have been an issue. To avoid this potential problem, the networks were asked to report only those payments that were originated on their own network.

The check-clearing system is far less centralized than the electronic payments processing system. Checks are paid by several types of institutions—commercial banks, credit unions, savings institutions, and U.S. branches of foreign banks. To obtain payment for a check, the depository institution into which the check is first deposited, usually the payee's bank, must present it to the paying bank. Presentment commonly requires that the check be physically delivered to the paying bank to receive payment (though presentment can be made electronically if the paying bank agrees). Presentment can be done directly or through an intermediary such as a correspondent bank, a clearinghouse, or a Federal Reserve Bank. Although the number and value of checks collected by the Reserve Banks each year are known, the number and value of checks presented directly or through other intermediaries are unknown. Because such data are not included in reports filed by depository institutions, they must be estimated on the basis of surveys. Sample design and methods of estimation are described below.

Estimation of the Number and Value of Checks Paid

The number and value of checks paid, the share of on-us checks, and the number and value of returned checks for 2000 were estimated using data from the Depository Institution Check Study. In this study, the surveyed depository institutions were instructed to report only those checks paid on behalf of their own customers and to exclude checks that they collected on behalf of other depository institutions. To account for checks written on money market and other accounts at brokerages, respondents were instructed to include in their figures the checks they settled on behalf of those nondepository institutions.

Sample design. Whether checks are written on traditional checking accounts provided by depository institutions, on accounts provided at brokerages or other nondepository institutions, or are money orders, cashiers checks, rebate checks, or travelers checks,

21. Global Concepts, Inc., and Westat assisted with the first and second surveys, and Dove Consulting assisted with the third. The preliminary results of the three surveys were announced in November 2001. A complete description of the project is available at the Federal Reserve Financial Services web site (www.frbservices.org) under the topic Key Initiatives.

22. Almost all checks in the United States are written against insured transaction deposits held at these types of institutions. Depository institutions serve as paying banks for checks written by the customers of nondepository institutions, such as checks written against money market and mutual fund deposit accounts with check-writing privileges.

they are generally paid by depository institutions. The population of depository institutions from which the sample was drawn encompassed commercial banks (including branches of foreign banks), credit unions, and savings institutions. Depository institution subsidiaries of multibank holding companies were treated as a single institution. Depository institutions in the population that had transaction deposits at the close of business on September 30, 2000 (June 30, 2000, for credit unions), were grouped by type—commercial bank, credit union, or savings institution—and stratified by value of transaction deposits (excluding the transaction deposits of other banks and the U.S. government), as reported to federal depository institution regulators.

The sampling procedure was designed to achieve 95 percent confidence intervals no larger than ± 5 percent of the size of the estimates of total number and value of checks paid. Six strata were defined for commercial banks, five for credit unions, and three for savings institutions. The boundaries of the strata and the probability of selection for institutions in each stratum were set to maximize the precision of the estimates of the number and value of checks. Because transaction deposits are concentrated in the largest institutions, the probability of an institution's being sampled increased with the value of its transaction deposits, although the probability of selection was the same for all the institutions in a given stratum. Using the assumption of a response rate of 65 percent or greater, 2,365 depository institutions were sampled. The probability of selection for the largest 533 commercial banks, 104 credit unions, and 40 savings institutions was 100 percent.

There were 1,256 valid responses for the number and value of checks; 1,011 valid responses for the share of on-us checks; and 1,036 valid responses for the number of returned checks. For the total number and value of checks, the overall response rate was about 53 percent. In part because response rates were higher for strata with larger depository institutions, the desired precision was achieved for the estimate of check number; it was not, however, for the estimate of check value.

Estimation. To improve the accuracy of the estimates, the strata used for estimation were updated using transaction deposit information for the population of depository institutions with transaction deposits at the close of business on March 31, 2001 (December 31, 2000, for credit unions) (14,696 institutions). For the final estimation, commercial banks were grouped into seven strata, credit unions into six, and savings institutions into four.

Check figures were annualized by summing the figures for March and April 2001 and multiplying by six. For simplicity, these annualized figures were assumed valid for 2000, an assumption supported by data on Federal Reserve check collections: The number of checks collected by the Federal Reserve Banks, which may track total checks for short intervals, declined slightly but was relatively flat between 2000 and 2001. The annualization factor implied by the number of checks collected by the Reserve Banks would have been slightly smaller than six because check collection volume in March and April tends to be higher than in other months.

Estimates of the number and value of checks were based on separate ratio estimators for each stratum using transaction deposits as the covariate. (Within a stratum, the amount of transaction deposits was highly correlated with the number and value of checks reported by the responding institutions.) The estimate of total number (or value) of checks paid by depository institutions was equal to the sum of the estimates for the strata. Data on the number (or value) of U.S. Treasury checks and postal money orders paid in 2000 were added to that estimate to obtain the estimated total for 2000.

The precision of the estimates is characterized by the 95 percent confidence intervals reported below. Confidence intervals were computed by multiplying ± 1.96 by the sampling standard errors. The sampling standard errors reflect the variability within the sample data as well as the number of survey responses.

The estimates reported in this article for the number of checks paid in 2000—42.5 billion (95 percent confidence interval of 40.9 billion to 44.1 billion)—and the value of checks paid in 2000—\$39.3 trillion (95 percent confidence interval of \$36.9 trillion to \$41.8 trillion)—are revised from preliminary estimates released in November 2001.²³

Estimation of the Number and Value of Checks Paid by Location of Deposits

Although the survey of depository institutions was not explicitly designed to facilitate a comparison of check use by geographic region, sufficient responses were received to make such a comparison possible. For each of four regions—Northeast, South, Midwest, and West—separate estimates of the number

23. Revisions were based on the correction of several data errors identified during the preparation of this article.

and value of checks paid were made for single-region institutions (those having deposits in only one region) and multiregion institutions (those having deposits in more than one region). For multiregion commercial banks and savings institutions, checks and transaction deposits were allocated to regions according to the proportion of the institution's total deposits in each of the regions. The allocation method assumed that within these institutions, the ratios of transaction deposits to total deposits, check number to transaction deposits, and check value to transaction deposits were constant. Information on the location of deposits at credit unions and branches of foreign banks was unavailable, and data for these institutions were assigned to the state in which the head office of the depository institution was located. Except for several of the largest credit unions (about ten), most of these institutions operate within the boundaries of a single state.

To produce the regional estimates, institutions were stratified first by region and then by type and size. For each region, the strata were constructed by separating institutions into multiregion and single-region, type, and size categories, with strata boundaries selected according to an approximation to Neyman allocation.²⁴ New ratio estimators were produced using these strata, following the procedure described in the preceding section.²⁵

About 138 institutions had branches in more than one of the four regions. (These institutions paid about 40 percent of all checks and accounted for just over 40 percent of transaction deposits.) For each of these multiregion institutions, prior to estimation, transaction deposits and check data (number and value of checks) were allocated to regions in proportion to the location of their total deposits. Allocating transaction deposits according to total deposits assumes that, for the institutions in the sample, transaction deposits and checks are in the same proportion to total deposits for every region. This allocation method appears reasonable for the construction of an aggregate regional estimate but may not hold true for some institutions. Whether large regional differentials in this proportion for some very large institutions would weaken or strengthen the apparent regional differences reported here is unclear.

24. The approximation method used was from Tore Dalenius and Joseph L. Hodges, "Minimum Variance Stratification," *Journal of the American Statistical Association*, vol. 54 (1959), pp. 88–101.

25. The national estimates obtained from aggregating these regional estimates for commercial banks and savings institutions were about the same as those obtained from the original study but were slightly more precise. The increased precision appears to have been a result of additional homogeneity among the institutions in the resulting strata.

Estimates of urban and rural check use were constructed using a method similar to that used to construct estimates by region. Urban areas were defined as metropolitan statistical areas (MSAs) and New England county metropolitan statistical areas (NECMAs), and rural areas as all other areas.

Characterization of Checks by Payer, Payee, and Purpose

The survey of individual checks was intended to gather information about the shares of checks written by and received by businesses, consumers, and governments and the purposes of the payments. Data were collected on almost 30,000 checks from nearly 150 depository institutions.

A two-tiered sample design was used to collect a representative sample of checks. First, a stratified, random sample of depository institutions was generated from the population of commercial banks, savings institutions, and credit unions. Then each selected institution was asked to retrieve a random sample of the checks it collected in 2000, using its internal records. The number of checks provided by an institution was in proportion to the amount of its transaction deposits. For each sampled check, the institution recorded certain objective characteristics useful in determining the type of payer and payee and the purpose of the payment. The institution also recorded a subjective assessment of the type of payer and payee—information that was used later to verify the validity of the categories assigned using the objective characteristics. To protect privacy, the institutions did not provide information that could be used to specifically identify the payer or payee. For the reported figures, separate ratio estimates for the strata were summed to produce an estimate for the population.

1979 Data

The 1979 data were collected in a survey conducted in that year by the Federal Reserve Bank of Atlanta and cosponsored by the Reserve Bank, the American Bankers Association, and the Bank Administration Institute.²⁶ The estimates of the number and value of checks for 1979 were produced from separate ratio estimates of the total number of checks reported by a stratified sample of 343 banks.

26. Federal Reserve Bank of Atlanta, "A Quantitative Description of the Check Collection System: A Report of Research Findings on the Check Collection System" (1980).

1995 Data

The 1995 data were collected in a survey conducted in 1996 for a report to the Congress on funds availability and check fraud.²⁷ The estimate of number of checks paid was based on the sum of two figures requested in the survey questionnaire: number of checks paid during 1995 that had been received from other institutions and number of checks paid during 1995 that were on-us checks. The survey provided information on checks paid by a random sample of depository institutions. On the basis of 606 valid responses, Board staff produced, for this article, an estimate of the number of checks paid in 1995 for comparison with the estimates for 1979 and 2000. The definition of the amount of transaction deposits was the same as that used for the 2000 estimates.

27. Board of Governors of the Federal Reserve System, "Report to Congress on Funds Availability Schedules and Check Fraud at Depository Institutions" (Board of Governors, 1996).

Unlike the 2000 estimate, the population in this study was defined as individually chartered depository institutions.

For the estimation of the number of checks paid, the population of depository institutions was stratified using the value of transaction deposits in December 1995, with optimal strata boundaries set using an approximation to Neyman allocation as described above. Seven strata were defined for commercial banks, three for credit unions, and three for savings institutions. The estimate of the total number of checks paid by depository institutions was equal to the sum of separate ratio estimates for the strata. The number of U.S. Treasury checks and postal money orders paid in 1995 was added to that estimate to obtain the estimate of the total for 1995. The estimate was 49.5 billion (95 percent confidence interval of 44.3 billion to 54.8 billion). The estimate for 1995 was higher than the 2000 estimate, and the difference was statistically significant, showing that the difference is unlikely to be due to sampling error. □