AN INVESTIGATION OF CASH MANAGEMENT PRACTICES AND THEIR EFFECTS ON THE DEMAND FOR MONEY

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I. INTRODUCTION

During the mid-1970s standard regressions explaining the demand for money underwent a- well-documented shift.[1] This shift was largely attributed to the adoption of more sophisticated methods of cash management practices by firms. Specifically, techniques were developed that allowed firms to perform a given level of transactions while holding lower average money balances. Therefore, for given levels of transactions income and interest rates the demand for money was lower than that implied by any historical relationships.

This article investigates the effects that a number of variables related to cash management have on the demand for money. These variables are generally suggested by analyzing specific methods of cash management and developing measures that incorporate the intensity and sophistication of these methods. All of the variables examined help explain the shift in the demand for money. Most notably, the number of electronic funds transfers made over the Federal Reserve's wire system restores stability to the estimated demand for money function.

Since the use of more sophisticated cash management techniques is believed to have its main effect on demand deposit balances, this study concentrates on demand deposits. The empirical work uses annual data over the period 1920-1979. Annual data is used to avoid controversy over the use of lagged dependent variables. The starting date represents the earliest date for which reliable data on all variables could be obtained, while the terminal date was selected to avoid the problems introduced by NOW accounts. This relatively long sample highlights the significant effects that more sophisticated cash management methods have had on the demand for demand deposits.

[1] For some examples see Lieberman [16], Kimball [12], Porter, Simpson, and Mauskopf [19], and Simpson and Porter [20].

The paper is organized as follows. Section II provides an overview of some of the more popular methods of economizing on cash balances. Section III discusses a number of proxies that have been employed in attempts to capture the effects of cash management on the demand for demand deposits. Section IV analyzes the relative ability of these proxies to help explain cash management effects, while Section V provides a summary and conclusion.

II. POPULAR METHODS OF CASH MANAGEMENT

This section provides an overview of some popular techniques used by firms in economizing on cash balances. These techniques are an outgrowth of changing technology, as well as a response to the higher opportunity costs of holding transactions or cash balances in the 1970s. The desire to economize on the holdings of demand deposits has always been present. However, changing economic conditions alter the profitability of investing in new methods of managing transactions balances. For example, lower computer costs may make previously unprofitable procedures profitable and advances in computer technology may make new methods in cash management feasible. Firms that are attempting to minimize the costs involved in carrying out transactions, costs that involve the interest foregone on idle balances, will respond to changes in their economic environment by altering the levels and types of cash management services. The degree to which cash management technology is employed will be arrived at in a manner analogous to the choice of any other investment project.

The major changes that have spurred the growth of more sophisticated and more widespread use of cash management techniques in the 1970s have been the improvement of computer technology, the lowering of computer costs, and the rise in market interest rates. These changes have increased the benefit for reducing transactions balances while lowering the

costs of doing so. As a result, there has been a proliferation of ways in which firms manage their cash balances. Examining these methods will indicate the exact ways that a firm can reduce its demand for money.

The various methods used in managing cash balances can be divided into three basic types. One type speeds up the collection of receivables, another allows firms to consolidate accounts, while a third helps control disbursements. Most of the techniques are linked with improved means of accounting, enabling the firm to more efficiently monitor its cash position. Also, many of the techniques are used together, thereby providing a full range of complementary ways for economizing on transactions balances.

Methods For Speeding Up Receivables

Lock Boxes Essentially a lock box is a centrally located collection post office box selected to minimize the mailing time taken to receive payments from customers. A firm will usually operate a number of lock boxes in various areas of the country. Several times a day, the firm's local bank will open the lock box, sort out the checks and deposit the money in the firm's account. The bank will then send the invoices and a record of the deposit to the firm. Often photocopies of checks will be sent and, in many cases, the information will be processed on magnetic tapes that can directly interface with the firm's accounting system. For a given availability schedule, the firm will have a good idea of the amount of money clearing into each account on any given day. On average, lock boxes can reduce mail float from one to four days.

Preauthorized Checks A preauthorized check is a signatureless check used for accelerating the collection of fixed payments. The customer signs an agreement with the corporation allowing the corporation or the corporation's bank to write a check at specified dates for specified amounts on his account. The corporation, through the use of a computer file, sends the bank the necessary information for performing this function. The bank then informs the firm by means of a computer tape of the deposit and the availability of the funds. This process lowers the uncertainty in income flows as well as reducing mail float.

Preauthorized Debit A preauthorized debit has the same effect as a preauthorized check. In the case of a preauthorized debit, the customer's account is automatically debited on a specified date and funds are electronically wired from the customer's bank to the firm's bank.

Consolidating Cash Balances

Concentration Accounts Concentration accounts allow firms to pool the balances collected by or deposited in local banks. Local banks automatically transfer funds, either by wire or by a depository transfer check to a central concentration bank. This process is advantageous for a number of reasons. It allows the firm to consolidate its cash balances, making it easier and less expensive to switch idle funds into market instruments. It also reduces the amount of total cash balances that need to be held since it allows for some offsetting of local disturbances to transactions balances.

Depository Transfer Checks Depository transfer checks, like preauthorized checks, are a signatureless check. They are issued by the concentration bank against one of the firm's local collection banks based on deposit information sent from the collection bank to the concentration bank, usually over a data processing network. Specifically, the concentration bank receives the deposit data and issues a check the same day for collection. It then sends the information concerning the collected funds and their availability to the firm.

Wire Transfers A wire transfer is a transfer of funds most often sent over either the Federal Reserve's wire system or a bank wire system. In this case, the local bank transfers funds from the corporation's account to the concentration bank. The wire transfer's advantage is that it allows for same day use of funds, while its disadvantage is that it is somewhat more costly than depository transfer checks. Therefore, wire transfers are predominantly used for larger transfers than are depository transfer checks. For example, at an interest rate of 6 percent, it would require a one-day transfer of $36,000 to cover the typical $6.00 wire transfer cost. Naturally, as interest rates rise, the minimum profitable level of the transfer would fall.

There have been a number of innovations in the use of wire transfers. Most notable is the ability of a firm's cash manager to initiate a wire transfer from a computer terminal that either interfaces with the bank's computer controlled wire system or with the data base of a third party that is used by the bank. Often this service is linked with other cash management services, such as programs that forecast a company's cash flows, and produces wire transfers that are less costly and that provide hard copy verification of funds transferred.

Methods For Controlling Disbursements

Controlled Disbursement A firm may also exert more control over its cash balances by being able to better predict disbursements on a day-to-day basis. The firm can achieve this by using a bank that receives only one shipment of checks from the Federal Reserve each morning. The bank informs the firm of the value of checks drawn on its account and the firm then knows, usually before noon, how much of its balances are unnecessary.

Zero Balance Accounts This procedure is a special case of controlled disbursement that allows the firm to maintain zero transactions balances at a number of banks from which it writes checks. When the value of checks presented against the firm's account is tabulated, the appropriate amount of funds are wired from a central account. This allows the firm to greatly economize on the level of balances held at each disbursing bank, and provides centralized data on transactions.

Summary of Cash Management Services

It is clear from the description of the methods used in managing cash balances that many of these procedures will be simultaneously employed. For instance, a firm is likely to have zero balance arrangements with local banks that also provide lock box services. Also, the firm will use both depository transfer checks and wire transfers to facilitate the quick movements of funds. Crucial to the desire to economize on transactions balances is the ability to invest these funds in short-term market instruments at relatively low costs. Otherwise there would be no reason to incur the costs involved in reducing the average level of balances.

III. METHODS OF CAPTURING CASH MANAGEMENT EFFECTS IN MONEY DEMAND EQUATIONS

The preceding discussion described how various cash management techniques are able to reduce the demand for money. Therefore, failure to incorporate cash management effects in a demand deposit regression will result in a misspecified equation. Since the degree to which cash management procedures are used is a choice Variable of the firm and is related to the cost and benefits of investing in these procedures, this misspecification will have serious consequences for any estimated equation.

For example, in inventory models of money demand, either stochastic or nonstochastic, some of the investment in cash management services can be viewed as lowering transactions costs. For instance, a firm having a cash management system that allows it to perform investments in repurchase agreements from a computer terminal has invested in a procedure that greatly reduces transactions costs. In stochastic inventory models, many of the cash management services can be viewed as ways for reducing the variance of cash flows (see Porter and Mauskopf [18]). Therefore, some key elements of the demand for money, namely transactions costs and the variance of cash flows, are not exogenous variables from the standpoint of individual deposit holders, but are variables that can be influenced by the level of cash management sophistication.

This line of reasoning implies that firms are simultaneously choosing the level of investment in cash management services and their average deposit balances. Since a number of the parameters that influence the demand for demand deposits are functions of the level of cash management, the level of cash management should appear in the demand for money equation.[2]

Failure to include a measure of the effects of cash management in the demand for demand deposits will therefore result in a seriously misspecified regression. As a result, coefficient estimates will be biased and predictions from the regression will be inaccurate in periods when cash management practices are changing. Further the regression will appear to be unstable (leading one to believe that the demand for money is unstable), when in fact the instability is totally due to an omission on the part of the econometrician.

In this section a number of variables for capturing cash management technology are examined. These candidates are generally related to the actual methods used in cash management and to the underlying costs and benefits associated with investing in techniques that help economize on transactions balances.

A Time Trend (T) The first and simplest way to represent cash management innovations in a money. demand equation is by use of a time trend. This was initially employed by Lieberman [16]. The motivation behind this variable is that the adoption of new technology will be fairly uniform and proceed at an exponential rate. This procedure explicitly, treats the

[2] The result of the optimization process by which firms choose the level of cash management services and average demand deposit balance is a two-equation system that is recursive. For more detail see Dotsey [9].

process of changes in cash management practices as exogenous. It therefore omits from consideration any economic forces, such as changes in costs or returns, that would be expected to alter the rate at which cash management techniques are implemented. However, it serves as a useful benchmark for comparing the effects that more sophisticated methods of incorporating the consequences of cash management have had on the demand for money. One practical problem in using a time trend is choosing the starting date for the trend.

A Ratchet Variable (RATCHET) In general, a firm would adopt new methods of cash management if the expected benefits outweigh the costs. That is, investing in a new cash management system would involve the same considerations as investing in any other project. The motivation behind the use of a ratchet variable constructed from interest rates is to capture some of the economic conditions that would lead to firms' implementing more sophisticated cash management techniques.

Since much of the costs of employing innovations in cash management are start-up costs (e.g., putting in the necessary computer hardware and software), it follows that once a new cash management system is in place it will remain in operation until it is replaced by more advanced technology. For the investment to be profitable, the interest rate savings incurred from lower average money balances must be substantial and expected to last for some time. One would therefore expect that major innovations would occur when long-term interest rates are high relative to their past history, and that these innovations would continue to affect the demand for money once they are initially adopted. Long-term rather than short-term interest rates are the relevant variable, because they indicate that a movement in interest rates is expected to persist. One is also interested in the movement of long-term rates with respect to its past, since upward movements will spur new investment in cash management due to the increased return obtained from economizing on transactions balances.

The preceding discussion suggests that a nondecreasing variable based on long-term interest rates, which increases (or ratchets up) when rates are relatively high, would be helpful in explaining changes in cash management practices and hence changes in the demand for money. The specific formulation investigated in this study is the one derived by Simpson and Porter [20]. Specifically,

$$(1)\quad RATCHET_t = RATCHET_{t-1} + \left(r_t - \frac{1}{n}\sum_{i=t-(n-1)}^{t} r_i\right)^+$$

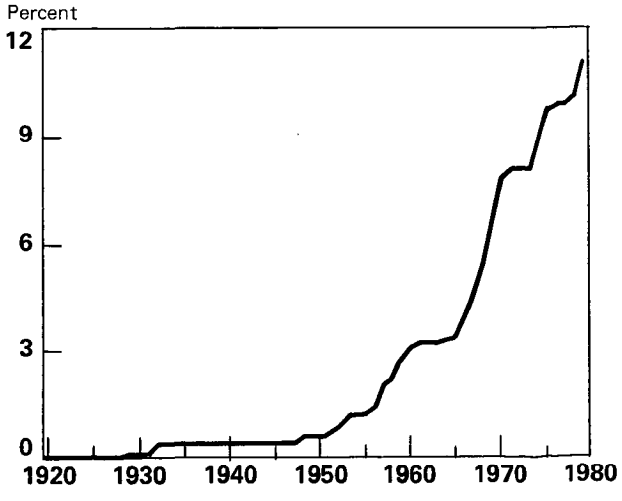
where r_t is the long-term bond rate (Moody Aaa) and the + sign indicates that only positive values of the expression in parentheses are used. The variable is somewhat sensitive to the value of n chosen, so variables using n = 3, 4, 5, 6 were constructed. All gave similar results and only the values for n=4 are reported. A graph of the RATCHET is depicted in Figure 1.

One can see that the formulation given by equation 1 captures the ideas behind the ratchet variable. For example let n=4. Then the current value of RATCHET is equal to last period's value plus an additional term. The additional term reflects the value of today's long-term interest rate relative to its average over the latest four periods. If today's rate is higher than this average, then RATCHET increases indicating an increase in investment in cash management services. If today's rate is lower than the average, then RATCHET remains the same as it was last period. This implies no new investment in cash management technology, and that today's level of technology is the same as last period's level.

Although the ratchet variable possesses some useful features, it does have certain limitations. It only considers the potential benefits of new technology but

Figure 1

THE RATCHET VARIABLE
1920 - 1979



not its cost. Furthermore, the benefits are only potential, since one doesn't know how much economization occurs as a result of new technology. Also, the variable does not consider depreciation.

The Price of Office Computing and Accounting Equipment (P) The discussion in Section II makes it clear that much of the use of cash management techniques involve computers and accounting equipment. Therefore the costs of this equipment will be closely related to the costs of cash management. In constructing a variable that captures these costs, it is important that the variable take into account adjustment in quality. For example, a new computer model may cost slightly more than the one it replaces, but it may be able to perform many more operations in much less time. In terms of what the computer actually does, the newer model is much less expensive than the older model even though its price may be somewhat higher. A true index of the computer's cost will take account of the change in quality. Such an index is referred to as a hedonic price index.

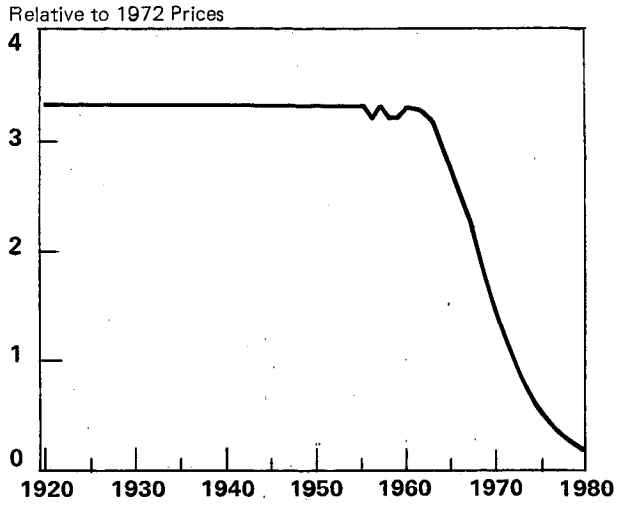
As the cost of technology falls, more firms will adopt the technology thus reducing the demand for demand deposits. Therefore the price of office computing and accounting equipment could help to explain shifts in the demand for money induced by cash management. However, the price variable does have certain limitations. It does not account for technology already in place, nor does it reflect depreciation. Further it does not consider changes in the benefits that occur from the implementation of new cash management services. Therefore, it would be natural to use this variable in conjunction with a ratchet variable.

For the years 1956-1979 data on the hedonic price of office computing and accounting equipment was obtained from McKee [17]. Although his procedures are somewhat rough, they are the best available. For the time period 1920-1955, it is assumed that the real cost of technology remained constant at its 1956 level. A graph of this variable is given in Figure 2.

The Number of Electronic Fund Transfers (EFT) The motivation for this variable is largely attributed to Kimball [12]. The use of many of the cash management techniques discussed in Section II involves the rapid movement of money so that it may be invested in short-term market instruments. In many cases idle transactions balances may only be

Figure 2

REAL PRICE OF OFFICE COMPUTING EQUIPMENT 1920 - 1979



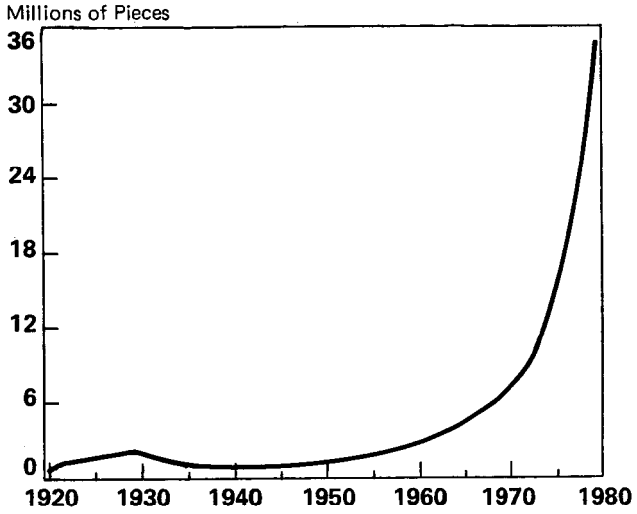
invested overnight: To implement this type of activity often requires the use of immediately available funds. Therefore, much of the transfer of money is done over either the Federal Reserve's wire system or over Bank wire.

For instance, a firm may use a number of lock boxes, have a zero balance account with a disbursement bank, and a consolidation account with another bank. On any given day, funds would be wired from the lock box collecting banks to the bank maintaining the consolidation account and from the consolidation account to the zero balance account. Funds may also be wired to another bank for the purpose of executing a repurchase agreement if it can not be done with the consolidating bank. In general there is good reason to believe that the number of electronic funds transfers is largely determined by the degree of cash management practices. Because of this relationship, the number of electronic fund transfers is a logical variable for helping explain the shift in the demand for money (for more detail see Dotsey [9]).

The value for the number of electronic fund transfers used is restricted to funds transfers made over the Federal Reserve's wire transfer system and is depicted in Figure 3. Since there are other wire transfer systems this value is not totally accurate. However, it is believed that the time series properties of the measure is not much different than what would be observed if data on total wire transfers could be obtained.

Figure 3

NUMBER OF ELECTRONIC FUNDS TRANSFERS 1920 - 1979



IV. EMPIRICAL RESULTS

In order to appreciate the severity of the effect of cash management on the demand for demand deposits, a regression explaining demand deposit behavior is run over the period 1920-1965, a period in which cash management innovations are believed to be unimportant. (An examination of Figures l-3 indicates that the various proxies are fairly constant over this time span.) This regression is then rerun over the extended sample period (1920-1979), and the results are compared. This is depicted in Table I.

The regression equation examined is based on an inventory model of the demand for money used in Dotsey [8], [9]. Specifically,

$$(2)\quad LND_t = a_0 + a_1 LNC_t + a_2 LNRD_t + a_3 LNRS_t + a_4 LNRCP_t + a_5 LNW_t + a_6 LNPCR_t + e_t$$

where the letters LN refer to the natural log of a particular variable (i.e., LNX equals the log of X). The letter D represents the level of real demand deposits, C represents the level of real consumption expenditures, RD is the own rate of return on demand deposits calculated using Klein's [14] methodology, RS is a weighted average of the interest rate on passbook savings accounts and money market mutual fund shares, RCP is the commercial paper rate, W is the real wage rate, and PCR is the ratio of credit to consumption where the level of credit includes installment retail credit, noninstallment retail credit, credit outstanding on bank credit cards, credit owed to gasoline companies, and check credit. The letter e refers to the disturbance term.

Consumption expenditures are used to represent transactions income, while RD captures the desirability of holding a demand deposit.[3] RS and RCP are used to capture the return earned on alternative assets held by different classes of economic agents. The real wage rate is a proxy for the value of time and is therefore related to transactions costs, while PCR attempts to net out the percent of transactions income spent via credit.[4]

[3] The use of Klein's rate involves some empirical issues that make interpreting its effect difficult (see Carlson and Frew [6]). However, to the extent that one believes that corporations earn a competitive rate on their deposits, omission of RD leads to specification bias. (For more detail see Dotsey [9], especially footnotes 6 and 7.)

[4] Since the emphasis of this article is to illustrate the effects of cash management practices on the demand for demand deposits, equation 2 is not discussed in detail. For a full discussion see Dotsey [S].

Table I

REGRESSION ANAYLSIS FOR DEMAND DEPOSITS

Independent Variables	1920-1965	1920-1979
CONSTANT	−1.34 (−2.73)**	1.33 (1.71)
LNC	.79 (10.49)**	.31 (2.99)**
LNRD	.075 (2.86)**	.12 (2.51)*
LNRS	−.24 (−13.27)**	−.25 (−8.04)**
LNRCP	−.11 (−3.46)**	−.11 (−1.82)
LNW	.36 (3.73)**	.93 (6.17)**
LNPCR	−.28 (−9.66)**	−.30 (−5.69)**
$\bar{R}^2$	.9959	.9840
D.W.	1.79	.73
S.E.E.	.0306	.0589

The numbers in parentheses are t-statistics.

* indicates significance at the 5 percent level.

** indicates significance at the 1 percent level.

The results of the regression run over the period 1920-1965, yield coefficients that are consistent with an inventory model of money demand. The error term does not exhibit any serial correlation and one can not reject the stability of the regression. The tests for stability used were a standard F-test, a test using the cusum of squares statistic developed by Brown, Durbin and Evans [5], and a test for stability using the varying parameters model of Cooley and Prescott [7].[5] The regression coefficients also converge fairly quickly to their full sample values, when the sample period is continually extended from 1928 to 1965. This combination of evidence strongly implies that the specification in equation 2 is a well-behaved representation of the demand for demand deposits over the period 1920-1965.

When the sample period is extended through 1979 this is no longer the case, and equation 2 is no longer an accurate model of the demand for demand deposits. Most importantly, the error structure of the regression changes. This is evident from the low value of the Durbin-Watson statistic, implying serial correlation in the errors. This means that the standard errors of the regression coefficients are biased making it impossible to state whether the coefficients in column 2 of Table I are significant. After correcting for serial correlation the wage variable becomes insignificant. Also, the presence of serial correlation is often indicative of a missing variable or variables. A good candidate, or candidates, for this missing variable would be variables that take into consideration the effects of cash management.

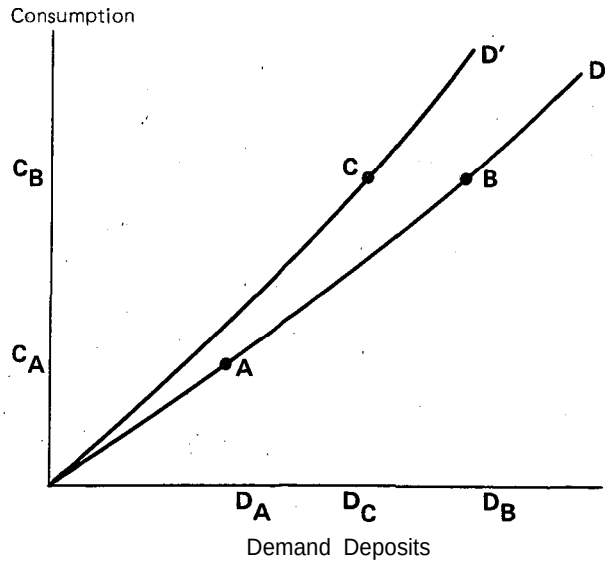
The reduction of the coefficients on consumption and the real wage is consistent with the omission of variables that represent a general decrease in transactions costs, or a lowering of the variance of cash flows associated with a given level of business. Consider the graph in Figure 4. The locus of points labelled D, represents a relationship between real consumption C, and real demand deposit balances with all other variables (i.e., interest rates, PCR, and W) held fixed. The locus D' represents the same relationship depicted for a more sophisticated use of cash management. As shown, less real balances are held for any level of consumption, interest rates, real wages, and the intensity of credit purchases. Now as consumption rises (as it did over the period 1965-1979), instead of moving from point A to point B along D, there is a movement from point A to point C. Thus, excluding the incorporation of cash management implies that demand deposits will appear to be less sensitive to changes in consumption.

A similar argument would apply to the real wage rate. With respect to interest rates, however, the effect of omitting cash management could be ambiguous. This is because interest rates both rose and fell over the period 1966-1979. For example, consider the commercial paper rate. Failure to explicitly include the effects of cash management would imply a greater sensitivity of demand deposits to increases in the commercial paper rates when this rate was rising, while just the opposite would occur when the rate was falling.

Adding Proxies For Cash Management If a movement toward more sophisticated cash management techniques is the sole or primary reason for a shift in, the demand for demand deposits, then incorporating variables that accurately account for this movement should have a pronounced effect on estimated demand for demand deposit equations. Specifically, the errors should be white noise and the coefficients should return to the values found in the regression run over the 1920-1965 period. Further, stability of the regression over the extended 1920-1979 sample should

Figure 4

AN EXAMPLE OF HOW CASH MANAGEMENT AFFECTS THE MEASURED RESPONSE OF DEMAND DEPOSITS TO CONSUMPTION



[5] Descriptions of these test statistics are quite technical and are therefore omitted. The interested reader can find a more detailed discussion in Dotsey [8] or can read the referenced articles. An excellent summary can also be found in Boughton [4].

not be rejected and there should be a significant increase in the predictive power of the equation. The various proxies described in Section III will be examined with respect to all of the properties just listed.

First, examine the regressions in Table II. All of the proxies return the coefficients approximately to the values estimated in column 1, Table I. However, only in the case of EFT, can one reject the presence of first order serial correlation of the residuals[6] Since RATCHET proxies for the potential benefits

[6] The discussion of EFT in Section III indicates that its effects should be examined within the context of a simultaneous system. Since the analysis indicates that this system is recursive, simultaneity bias will occur only if the errors in the two equations are correlated. A two-stage least squares estimation technique gave similar results to those obtained using OLS, implying that simultaneity bias is not a problem. For a more detailed discussion see Dotsey [9].

Table II

REGRESSION ANALYSIS FOR DEMAND DEPOSITS (1920-I 979) WHEN VARIOUS PROXIES FOR CASH MANAGEMENT ARE INCLUDED

	I	II	III	IV
CONSTANT	−1.74 (−2.56)*	−.91 (−1.11)	−1.31 (−2.22)**	−1.08 (−2.49)*
LNCON	.93 (9.10)**	.85 (7.05)**	.92 (10.17)**	.78 (12.21)**
LNRSAV	−.22 (−7.31)**	−.19 (−4.24)**	−.23 (−9.10)**	−.21 (−14.84)**
LNRDD	.078 (2.37)*	.088 (2.36)*	.077 (2.52)*	.079 (3.18)**
LNRCP	−.14 (−3.38)**	−.15 (−3.21)**	−.13 (−3.54)**	−.10 (−3.48)**
LNPCR	−.21 (−3.86)**	−.21 (−2.93)**	−.22 (−4.91)**	−.26 (−9.70)**
LNWAGE	.25 (1.86)	.41 (2.64)*	.24 (2.03)*	.40 (4.67)**
T	−.026 (−6.51)			
RATCHET		−.035 (−3.21)**		
LNP			.14 (8.39)**	
EFT				−.013 (−12.71)**
RHO	.56 (5.67)*	.71 (7.15)**	.44 (4.15)**	
$\bar{R}^2$	.9947	.9932	.9928	.9960
D.W.	1.98	1.88	1.99	1.74
S.E.E.	.0325	.03695	.0353	.0293

The numbers in parentheses are t-statistics.

* indicates significance at the 5 percent level.

**indicates significance at the 1 percent level.

RHO is the coefficient for first order autocorrelation.

of cash management, while LNP attempts to capture costs in adopting new technology, it would be natural to use both variables simultaneously. This was attempted, but only LNP retained its significance, perhaps because these variables only reflect general trends and are therefore only picking up an overall tendency toward increasing cash management sophistication. Finally a regression including LNP, RATCHET, and EFT was run with only EFT retaining its significance.

Second, all of the proxies decrease the instability of the regressions in the sense that the cusum of square statistic is lowered. However, only by using EFT could a lack of stability be rejected using the Brown-Durbin-Evans test. Also, one could not reject stability of the regression with EFT under the procedure developed by Cooley and Prescott. However, when the sample was divided in 1949, stability was rejected using a standard F-test. Given that EFT only includes the number of wire transfers over the Federal Reserve wire system, and is therefore an imperfect measure of total wire transfers, the net result of the stability tests is encouraging.

Third, an examination of one step ahead out of sample forecast errors is depicted in Table III. Again, all the proxies generally improve the forecasts, with EFT performing the best. Using EFT resulted in a reduction of the average absolute error of the forecast by 52 percent and a reduction in the root mean square error by 34 percent.

Table III

THE LOGARITHM OF ONE PERIOD AHEAD FORECAST ERRORS

	None	T	RATCHET	LNP	EFT
1966	- .19	.04	- .15	.00	.05
1967	- .24	.04	- .13	.00	.11
1968	- .16	.16	.08	.18	.18
1969	- .15	.14	.16	.17	.23
1970	- .18	.15	.19	.17	.21
1971	- .14	.10	.06	.12	.17
1972	- .25	.05	- .12	- .03	.07
1973	- .17	.07	- .04	.10	.32
1974	- .26	- .02	- .08	.03	.20
1975	- .71	- .04	- .47	- .38	- .28
1976	- .94	- .62	- .72	- .53	- .26
1977	- .63	- .48	- .70	- .36	.02
1978	- .73	- .48	- .80	- .33	.05
1979	- .69	- .30	- .60	- .40	.41
Avg. Error	- .38	- .12	- .24	- .07	.11
RMSE	.29	.28	.35	.24	.19

V. SUMMARY AND CONCLUSION

This article, in a somewhat different empirical setting than that underlying most conventional studies of money demand, presents confirmation of the recent shift in the demand for money. The hypothesis that a shift has taken place in the function is supported by stability tests and the poor predictive performance of the model in the mid- and late 1970s. The empirical evidence combined with documentation on the increased use of sophisticated cash management practices by firms makes changes in cash management techniques a probable explanation for the shift in the historical demand deposit relationship.

An attempt is made to capture this process by the use of variables which are believed to be related to innovations in the management of transactions balances. This process seems to be captured quite well by the variable EFT. The other proxies perform reasonably well in reducing the forecasting errors of the demand deposit relationship, but were not in general able to capture the entire movement in the function. The results are by and large encouraging enough to make future research into transactions technology and its relation to money management a potentially rewarding avenue in helping to explain the current behavior of the demand for money.

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