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Determinants of Household Check Writing: The Impacts of the Use of Electronic Banking Services and Alternative Pricing of Services

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In recent years, there has been a simultaneous deregulation of interest ceilings on household deposits and a dramatic deployment of automatic teller machines (ATMs) by the banking industry. At one time, there was a belief that the U.S. would evolve into a "checkless society" because of the development of electronic funds transfer systems such as the ATM. That has clearly not happened. The purpose of this paper is to estimate the impacts of both the use of ATMs and the change in pricing due to deregulation on household check writing. The source of the data is a survey of households conducted by the Board of Governors of the Federal Reserve System. The results of the tests indicate that use of electronic banking services had no discernible impact on check writing while different methods of pricing checking account services did have a substantial impact on check writing.

INTRODUCTION

It has been almost 20 years since the prognostication of a "checkless society," and there are still some 47 billion checks written each year in the United States. At the same time, the banking industry has deployed over 60,000 automatic teller machines (ATMs). The purpose of this paper is to estimate the impacts of the pricing of checking account services and the usage of electronic banking devices on the number of checks written by households in the United States.

In a recent paper, Humphrey and Berger indicate that the lack of response on the part of payment system users is largely due to a divergence between the social and private costs of alternative payments media (Humphrey and Berger, 1988). Specifically, the users of checks do not bear the full social cost of that method of making payment. Humphrey and Berger estimate that the largest divergence occurs for business users in which the float benefit exceeds the cost of processing the check. However, they indicate that households are not as able

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to capture such benefits, and their usage patterns should reflect a more efficient use of resources. This is due to the nature of the fixed costs involved in a cash management system, first noted by Baumol (1952). There is one problem with that notion. That is, the pricing of checking services in many cases does not reflect the marginal costs of providing the service, and, thus, there may not be any incentive for households to economize. A primary reason for this underpricing is a holdover from the era of regulated interest ceilings in which non-price competition emerged in the form of reduced or no service charges in lieu of explicit interest payments to depositors (Spellman, 1982).

At least part of the reason for the deployment of ATMs was a hope that households would economize on check writing. Earlier studies did not indicate much, if any, support for the notion that ATM usage affected check writing (Murphy, 1979). More important, perhaps, was a desire to provide transaction services that displace lobby traffic in branch offices (Murphy, 1990). The branch office delivery system was built up during the era of regulated interest ceilings and may be viewed as an expensive provision of convenience in lieu of explicit interest payments (Taggart, 1978). The deployment of ATMs may then be viewed as an attempt to economize on the provision of convenience, substituting more cost effective ATMs for branch offices.

With the introduction of NOW accounts in the 1970s in New England and in 1980 nationwide, along with the subsequent deregulation of all household deposit interest payments, the stage was set for a restructuring of pricing of a number of household financial services that should lead to incentives that result in a more efficient allocation of resources. Banks pay explicit interest to attract deposits, creating incentives for them to recover directly the cost of providing payments services and reducing the incentives to proliferate branch offices. Instead, less costly ATMs can be deployed. Customers can then be confronted with a combination of interest payments, service charges, and delivery systems that allow them to select the combination of balances, checks written, and transactions that best suits their needs. However, the transition is not instantaneous (Berger and Humphrey, 1986). Banks do not shut down all their redundant branch offices nor do they immediately impose full cost service charges. Rather, they selectively close offices, reduce the rate of growth of new offices, and slowly increase service charges (Canner and Kurtz, 1985). This results in an environment with many different pricing arrangements (Dunham, 1983). Therefore it is possible to obtain a cross-section of households using different configurations of prices and electronic banking services. This permits tests to determine the impact of different pricing as well as the usage of ATMs on check writing.

In Section I, the data source and the model development are discussed while the results of the analysis are presented in Section II. Section III is the summary and conclusion.

I. Data Source and Model Development

Between May and August 1984, the Survey of Currency and Transaction Account Usage was conducted by the Survey Research Center of the University of Michigan. That survey was commissioned by the Board of Governors of the Federal Reserve System. The descriptive results of the Survey as well as the survey methods were discussed in some detail by Avery, Elliehausen, Kennickell and Spindt (1986). The original sample contained 1,946 interviews from a randomly selected sample of 2,500 families residing in the United States. The survey was a personal interview in which respondents reviewed the details of their currency and transactions account usage from their own records. The respondent was either the head of the family or a financially knowledgeable spouse. For purposes of this paper, the sample size was smaller because some households do not have checking accounts. The resulting sample size for the analysis is 1,596 households.

The model is based upon the assumption that households will attempt to minimize the total cost of making payments. This includes not only the explicit costs charged by the bank, but also the costs of transportation and the use of time. Considerations of acceptability, safety, control, and record-keeping also enter into the decision process in selecting a method of making payment. It is important to note that the benefits from cost minimizing behavior are relatively small for most households. In the corporate sector, there are sophisticated techniques and services available to permit corporations to collect payments quickly, control disbursements, and invest any surplus funds in the money markets. Moreover, there is a professional organization, the National Corporate Cash Managers Association, and a professional designation, the Certified Cash Manager (CCM) for corporate cash managers, implying substantial benefits from aggressive management of payments costs. Thus, more sophisticated approaches to household payments management will develop more slowly, but the forces are clearly the same. The opportunity cost of household time, the availability of alternative methods of making payment, and the movement, albeit slow, to explicit pricing should all push in the direction of cost minimizing behavior on the part of households (Murphy, 1977). The model contains three sets of independent variables:

1. Demographic variables
2. Payment system variables
3. Pricing variables

The dependent variable in the model is the number of checks written per month (or its logarithmic transform).

There are a number of demographic variables that reflect income, age, marital status, education, etc. These variables reflect factors that affect

household payments costs. For example, income is a measure of the opportunity cost of time in making payments. Education is related to the opportunity cost of time as well as the ability to understand and choose payments methods that minimize cost. These variables also hold constant the influence of all other factors and allow the analysis to be focussed on payment system and pricing variables. Those variables that were found to be statistically significant in explaining check writing are household income, marital and employment status, some educational categories, and the sex of the head of the household. It is expected that those with higher incomes will purchase more goods and services that will be reflected in more payments by check, although it is not clear what the nature of the relationship would be. While total consumption expenditure may show a strong proportional increase with changes in income, total checks written would not necessarily increase at the same rate as more transactions and higher amounts per transaction simultaneously occur as income rises. Hence, a positive coefficient is expected, but the elasticity of checks written with respect to income would likely be less than the elasticity of consumption with respect to income. Employment status and education reflect the need and ability to control expenditures and maintain payments records. Hence, it would be expected that more checks would be written. There is no economic basis to the finding that gender affects the number of checks written, but the estimated coefficient is statistically significant.

There are three payments system variables:

1. The use of ATMs by the household.
2. The use of direct deposit by the household.
3. The number of credit cards used by the household.

Approximately 25% of all households were active users of ATMs. Whether or not check writing should be affected is not obvious *a priori.* Most people use ATMs to obtain cash or to deposit funds in their account. For example, if cash were normally obtained when a paycheck is received, and the recipient splits the amount of the paycheck between a deposit and cash, there would be no necessary relationship between check writing and ATM use if the household merely changed the location of the split deposit from the teller line to the ATM.

Almost 21% of all households in the sample received either their paycheck or social security check via direct deposit. It is conceivable that such an arrangement may increase the amount of check writing as households must now access their accounts for cash rather than taking it at the time such a payment (check) is received.

Finally, the number of credit cards may affect check writing. Since credit cards are used at the point of sale, they may be a substitute for either cash or checks. Previous work has suggested that credit cards primarily substitute for cash and as such increase the number of checks written (Mandell, 1971; Murphy

TABLE 1.
Variables Used Estimating Model

Variable	*Description*
LNCKS	Natural logarithm of the number of checks written per month per household
LNHHINC	Natural logarithm of the annual household Income
MARR&EMP	Takes a value of 1 if head of household is married and employed, 0 for all others
HSDIPL	Takes a value of 1 if head of household has high school diploma, 0 for all others
COLLDGR	Takes a value of 1 if head of household had a college degree, 0 for all others
SEX	Takes a value of 1 if payroll or social security payments are received via direct deposit
DIRDEP	Takes a value of 1 if payroll or social security payments are received via direct deposit
CRCD	Number of credit cards used by household
ATMUSE	Takes a value of 1 if household uses ATM, 0 for all others
INTCHK	Takes a value of 1 if interest is received on checking account, 0 for all others
CHKFEE	Takes a value of 1 if service charges are based upon the number of checks written, 0 for all others

1979). That is, more checks are written to pay the credit card bills than are displaced at the point of sale.

Since the implementation of nationwide NOW accounts, households have faced an array of pricing arrangements. These involve interest payments, service charges imposed on a flat fee basis when a certain balance is not maintained, service charges tied to the number of checks written sometimes contingent upon a certain balance being maintained, and various combinations thereof. In some cases, the same bank offers as many as five or six configurations (Dunham, 1983). Because so many configurations exist, it is possible to observe differing costs to check writing in the resulting sample. For purposes of this study, two pricing variables were specified.

1. The payment of interest was noted. If a household receives interest on deposit balances, there is some incentive to keep funds invested for as long as possible. Since each check removes interest bearing funds from the account, there may be an incentive to write fewer checks. Of course, the same number of checks may be written for a different time pattern.

2. The basing of service charges on the number of checks written was noted also. Holding constant all other factors, it is expected that households that are charged on a per check basis would write fewer checks than households with either no service charges or flat rate service charges. On the one hand banks wish to institute service charges that recover costs. This would lead to service charges based on activity. On the other hand, banks wish to simplify account pricing so as not confuse and annoy customers, which would lead to flat service charges. The variables used in the model are described in Table 1.

II. Statistical Results

The model is estimated using ordinary least squares with both the dependent variable and household income in logarithmic form. This specification gives the best statistical results and is consistent with the results of previous studies (Murphy, 1979). Moreover, the dependent variable is measured in number of checks per month while the income variable is measured in dollars per year. In Table 2, the means and standard deviations of the variables are shown. The logarithmic transformation changes the dimensions of the variables so that they are more comparable, and the coefficient is interpreted as an elasticity.

As shown in Table 3, the overall performance of the model indicates that check writing is subject to random determinants or is influenced by variables not measured here. The model is statistically significant as indicated by the F Statistic of 36.5. However, the coefficient of determination (R-Square) is only .1874.

TABLE 2.
Means and Standard Deviations of Variables in Equation

Variable	*Mean*	*Standard Deviation*
LNCKS	13.2701	2.3960
LNHHINC	20,075.46	2.1908
MARR&EMP	.5334	.4990
HSDIPL	.5143	.4999
COLDGR	.2835	.4508
SEX	.7842	.4114
DIRDEP	.2102	.4076
CRCD	3.8042	4.2439
ATMUSE	.2533	.4350
INTCHK	.3196	.4664
CHKFEE	.1671	.3731

Note: Geometric mean is computed for LNCKS and LNHHINC since variable is measured in natural logarithms.

TABLE 3.
Regression Results for Determinants of Checks Written
(Dependent Variable Is LNCKS)

Variable	*Coefficient (t-statistic)*
INTERCEPT	-.467
	(-1.422)
LNHHINC	.264
	(7.434)
MARR&EMP	.268
	(4.831)
HSDIPL	.249
	(3.776)
COLLDGR	.303
	(4.102)
SEX	-.152
	(-2.375)
DIRDEP	.132
	(2.762)
ATMUSE	.010
	(.219)
CRCD	.034
	(6.442)
INTCHK	-.065
	(-1.557)
CHKFEE	-.121
	(-2.327)
R^2	.1874
F value	36.542
N	1,596
df	1,585

As expected, the demographic variable having the most explanatory power is the logarithm of household annual income with an elasticity of .26 and a reported t-statistic of 7.4. The other demographic variables are statistically significant at the 5% level. Employment and marital status, educational levels and the sex of the head of household all have impacts on the number of checks written.

For the payment system variables, there appears to be no substitution for checks written. On the contrary, both direct deposit and credit cards increased check writing. Apparently the direct deposit creates a need for more check writing to obtain cash. The use of ATMs had no impact at all on the number of checks written. It was thought that the combination of direct deposit and ATM use may have a different impact than either one separately. That is, the household would have payments directly deposited and then use the ATM to

obtain cash, removing the need to write checks for cash. When this was tested, the results were not affected. The question of how cash is obtained and the role of the ATM in that overall process are interesting questions beyond the scope of this paper.

The two pricing variables in the model have negative coefficients, and the coefficient on the check-based pricing variable is statistically significant at the 5% level. While the effect of any particular price is not known, the impact of shifting to any service charge based upon activity is substantial. Furthermore, the impact of moving to pricing based upon activity cost is understated since the observed per item charges are much less than the social or private costs of processing a check estimated by Humphrey and Berger (1988).

Because the equation has the dependent variable in logarithmic form and the pricing variable in binary form, it is not possible to interpret directly the regression coefficient for that variable. Therefore, the expected value of the dependent variable was calculated with representative values for the other independent variables and the binary pricing value taking a value of zero and then one. For the household with the geometric mean annual income, male head of household employed and married, with a college degree, with neither direct deposit nor ATM usage, with the mean number of credit cards, and interest on his checking account, a shift to check based service charges results in an expected reduction of checks written per month of 1.6, a percentage reduction of 11.4%. That is, when all variables are held constant at the values indicated above, the expected value of the dependent variable is 13.9 checks written when service charges are not based upon activity while it is reduced to 12.3 checks when the service charge is based upon activity.

III. Summary and Conclusion

In their paper, Humphrey and Berger note that "consumer checks only have a small float benefit, so that the private costs are positive ($.72) and almost as high as the social costs ($.79), indicating only a minor market failure" (1988). However, the pricing of checking account services does not reflect the marginal (or average) cost of processing a check. In many cases, the service charge is not related at all to the number of checks, and, if it is, the charge is likely to be much less than $.79 (or $.72).

In this paper, the determinants of check writing by households were estimated using a cross section of 1,596 households. The results suggest that electronic banking usage has contributed little to the reduction of check writing, but the use of a charge per check has a significant and substantial impact on household check writing. Since households were estimated to have written 25.8 billion of the 47 billion checks written in 1987 (Humphrey and Berger, 1988), the potential for economizing is substantial. Moreover, the results have

implications for the introduction of other payments services. The use of an ATM represents households dealing with their own bank rather than interacting with third parties. Since households have been shown to reduce their use of checks in response to pricing, it should follow that they will substitute other third-party payments services if *the relative prices provide the proper incentive.* Of course, rational explicit pricing and true cost savings are required before this can happen. While the results from one cross-section should not be extrapolated without caution, the results suggest that the adoption of pricing based on the cost of producing checking services is an attractive candidate for improved allocation of resources in the use of the payments system. It certainly merits attention on *a priori* grounds as well as being supported by the results of this paper.

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