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Adverse Selection, Search Costs and Sticky Credit Card Rates

O. Felix Ayadi

Several scholars of financial economics observed that during the 1980s, market interest rates declined continuously with little or no impact on credit card rates. Recently, Meyercord (1994), Sinkey and Nash (1993), and Sullivan and Worden (1995) recorded significant changes in the credit card market indicating an increased level of competition. This study represents an attempt to determine the sensitivity of credit card rates to the costs of funds in the U.S. economy. The evidence from the Johansen Cointegration test confirms that credit card rates and cost of funds possess a long-run equilibrium relationship with one another. Furthermore, the results of the error correction models are indicative of a sluggish rate at which credit card interest rates adjust to the costs of funds. Between 1982 and 1994, credit card rates adjust to changes in the cost of funds at about 15 percent per quarter. These results represent anecdotal evidence for the validity of adverse selection, search and switch costs explanations that have been discussed in the financial contracting literature.

I. INTRODUCTION

Credit is the present use of future income. Credit cards are probably the most convenient form of credit of all competing financial assets. They are both payment and credit devices. Some holders of credit cards use them in lieu of cash for a variety of transactions while many holders use them to gain access to a revolving line of preset credit (Pozdena, 1991). It is no surprise that a myriad of consumers applaud the use of credit cards primarily for its credit feature rather than its convenience (Mandell, 1990). Thus, the use of credit cards has become more widespread in the past decade because they are easy to obtain, convenient to use, safer than cash and above all, they serve as a source of credit.

The pricing of bank credit cards in the United States was not a concern until after 1979 when interest rates became more volatile (Shay, 1987). Prior to this time, interest rates were relatively stable through usury regulations. Berlin and Mester (1989), Rose (1990), Ausubel (1991), Mester (1993) and Calem (1992) observed that during the 1980s, market

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interest rates declined continuously with little or no impact on credit card rates. The nonresponsiveness of credit card rates to market rates led to several proposals for reinstatement of usury ceilings. This did not materialize. However, in late 1988, Congress passed the Fair Credit and Charge Card Disclosure Act requiring banks and card issuers to provide more information to consumers. The intent of this legislation was to reduce search and switch costs associated with holding credit cards (Sullivan & Worden, 1995).

Recently, Meyercord (1994), Canner and Luckett (1992), Carnes and Slifer (1991), Federal Reserve Board (1994), Sinkey and Nash (1993) and Sullivan and Worden (1995) recorded several dramatic changes in the credit card market leading to increased competition. Meyercord observes the entrance of nonbank credit card issuers into the industry and that card issuers have become increasingly sophisticated in targeting their clientele. Thus, card issuers are now more aggressive than ever before in attracting potential cardholders. All of these together are indicative of a more conducive environment for credit card rates to reflect market rates of interest.

This paper examines the problem of sticky credit card rates and the associated search/switch costs and adverse selection explanations. It applies Johansen cointegration test and error correction model (ECM) to quarterly time series data on credit card rates and cost of funds from 1982 through 1994. This paper proceeds as follows. The second section examines the current market structure for credit cards in the United States, and the third focuses on the pricing of bank credit cards. The fourth section discusses the data and methodology while the fifth section presents the research results. Finally, section six contains commentary on the results.

II. MARKET STRUCTURE FOR BANK CREDIT CARDS

To the current generation of consumers, credit has become a way of life. The previous generations detested debt and took great pride in seldom borrowing for personal reasons, because borrowing is assumed to signify character weakness. But in today's world, credit seems to be a sign of strong character. Shepherdson (1991) and Worthington (1995) note that the use of credit has become commonplace, particularly in the United States and the United Kingdom more than in other countries. Along with the change in attitude, consumers have become more susceptible to financial problems. Many are using as much as 40 to 50 percent of their income to repay outstanding loans (Shepherdson, 1991).

The credit card market is quite broad and relatively unconcentrated. For example, the top ten card issuers control only forty percent of the credit card market (Sinkey, 1992). The Nilson Report, a credit card newsletter, estimates the number of credit card issuers in the United States in 1991 at about 5,000. These issuers make a profit of 2.5 percent a year, after taxes, on all charges. Moreover, Sullivan and Worden (1995) and Sinkey and Nash (1993) note that banks realize more revenue from credit cards operation compared to other services. Moreover, a typical cardholder in the U.S. owes Visa and MasterCard $400 in early 1980s, $1,096 in 1993 and $1,750 in 1994. According to Ausubel (1991) and Pozdena (1991), Americans charge more than $200 billion a year on their credit cards. Fewer than 20 percent of households are without any credit cards.

Prior to the Marquette (National Bank Vs. First of Omaha) decision of the U.S. Supreme Court of 1978, credit card issuers were subject to state usury laws. The court decision led to the practical elimination of price regulations. Historically, credit card business was not subject to the strict regulations that were applicable to banking business. Thus, credit card issuers operated free of interstate banking and branch banking restrictions. The situation changed in the 1980s when several attempts were made to reintroduce usury laws at the federal level (Canner and Fergus, 1987). The motivation was the perception by many Americans that credit card rates were insensitive to the cost of funds. This public opinion led Congress to pass the Fair Credit and Charge Card Disclosure Act in late 1988. As noted earlier, Sullivan and Worden observe that the Act was designed to reduce search and switch costs by requiring banks to disclose information on the costs of their services.

The operators in today's credit card market are more aggressive than ever before by offering packages that include: more favorable interest rates, waivers of annual fees rebates of various types, co-branding, and accounts consolidation (Ayadi and Onashile, 1994). The introduction of no fee with low APRs but no interest free periods and the intensification of competition among card issuers, have led to an increasingly fragmented market. Co-branding is the process in which a financial institution unites with a company to offer a credit card with unique incentives tied to the use of the card. Co-branded cards have gained momentum because they offer discounts on cars, merchandise or airline tickets in proportion to the amount a cardholder charges. Examples are General Motors' GM Card issued through Household International, Shell Oil and Chemical Bank, and Apple Computer partnership with Citicorp. A few years ago, credit card issuers began a competitive strategy of persuading cardholders to consolidate their credit balances. For example, Chase Manhattan Bank recently began to offer the Chase Reward Consolidator in which holders of reward cards can transfer balances on their other cards to Chase. In the process, they pay a lower interest rate, and keep their rewards. Finally, Pozdena (1991) notes that although credit card issuers do offer lower rates to more carefully selected consumer segments, this gesture is consistent with risk management but, does not prove that the credit card market is as competitive as it should be.

III. THE PRICING OF BANK CREDIT CARDS

Rose (1985) documented several models for pricing business and consumer loans (including credit card loans) by banks. The lenders would charge a rate that incorporates risk as well as a reasonable level of profit. On the other hand, the loan rate should be low enough to accommodate the customer who must think of how to repay the loan. The models documented by Rose are: cost-plus loan-pricing model, price-leadership model, cost-benefit loan pricing, customer profitability analysis and present value loan pricing. More importantly, Lown and Peristiani (1996) examine the loan pricing behavior of commercial banks and report that the average consumer borrowing rate is highly correlated with Treasury rates. Thus, one expects that in a deregulated financial system, the cost-plus loan-pricing proposed by Rose has practical usefulness.

With the cost-plus loan-pricing method, the annual percentage rate (APR) of interest is defined as:

$$\text{RATE}_t = \beta_0 \text{COST}_t + \beta_1 K_t + \beta_2 R_t + \beta_3 \Pi_t + e_t \tag{1}$$

According to Rose (1985), the loan interest rate or APR (RATE_t) is the sum of the marginal cost of raising loanable funds (COST_t), nonfunds bank operating costs (K_t), estimated margin to protect the bank against default risk (R_t) and the bank's desired profit margin (Π_t). In a comprehensive analysis of the U.S. credit card market, Ausubel (1991) acknowledges the apparent stickiness in credit card rates. He argues that the cost of funds should be the primary determinant of the marginal cost of lending through credit cards. The intuition behind his model is consistent with the aforementioned Rose's pricing model. Consequently, one expects a relatively high level of correlation between the interest rate charged on credit cards and the bank's cost of funds. Ausubel reports that between 1982 and 1989, the volatility of credit card rates is less than one-fifth that of Treasury bills rate. The same sentiment has been expressed by DeMuth (1986), Pozdena (1991), Sinkey (1992), Mester (1993), and Duca and Whitesell (1995).

Ausubel (1991) argues that the primary determinant of credit card rates is the cost of funds to card issuers. He proceeds to test the responsiveness of credit card rates to changes in the cost of funds, defining the cost of funds as the quarterly one-year Treasury-bill yield plus 75 basis points and concludes that credit card rates are sticky. He concludes that the credit card market fails to pass the tests of a competitive model if one focusses on price responsiveness to costs and zero excess profits. Furthermore, the author suggests the presence of adverse selection problem, search and/or switch costs and consumer irrationality in the credit card market.

The credit card industry is susceptible to both search and switch costs. The costs include information cost of discovering which banks are offering lower interest rates, cost in time, effort, and emotional energy in filling out an application for a new card and the time lag between applying and receiving one. The fact that the card fee is usually billed on an annual basis, so that if one switches bank at the wrong time, one forgoes some money. There is also the perception that one acquires a better credit rating or a higher credit limit by holding the same bank card for a longer time.

Calem and Mester (1992, 1995) analyze the dilemma facing undisciplined card users as follows. They do not intend to borrow on their cards, but always find themselves in debt. Once in debt, they believe the situation will be short-lived and consequently are not motivated to search. There are other cardholders who are bad credit risks because they carry substantial amounts on their credit cards and thus have no choice but to hold onto their credit cards. For this group of cardholders, it difficult if not impossible to switch from one credit card to another because of the negative effect of existing outstanding balances.

While credit card consumers undoubtedly face some positive level of search and switch costs, there remains an empirical question as to whether the actual search/switch costs are of sufficient magnitude to justify what is observed. The adverse selection argument implies that interest rate should not be used as an instrument for competition since it becomes much more difficult for credit card issuers to compete away profits. Thus, adverse selection helps to explain the observed extraordinary profits reported by most of the card issuers.

Mester (1993) models a consumer credit market in which banks use collateral to screen borrowers. In her model credit card rates stickiness is shown to be consistent with rational behavior on the part of issuers. Mester's model incorporates asymmetric information between consumers and banks, regarding consumers' future incomes. The model offers an explanation why low-risk consumers select collateralized loans while high-risk consumers select credit card loan. More importantly, the recent movements in rates and the move of creditworthy customers to collateralized loans is said to be consistent with rational behavior.

IV. DATA AND METHODOLOGY

A) Data

The data used in this study are the credit card rates ($RATE_t$) and Treasury bill rates for February, May, August and November each year from August 1982 through August 1994 as reported in the Federal Reserve Bulletin. In order to define a proxy for cost of funds ($COST_t$), I added 75 basis points to the respective one-year Treasury bill rates. Calem and Mester (1995) and Stavins (1996) report results indicating the appropriateness of the Treasury bill rate as a proxy for cost of funds. More importantly, Ausubel's (1991) results suggest that credit-card-backed securities have yields in the vicinity of 75 basis points above those of Treasury securities with comparable maturities between 1987 and 1989.

B) Cointegration Test and Error Correction Model

The two major econometric tests used in this study are cointegration test and error correction model (ECM). Prior to the application of these techniques, the stationarity characteristics of the time series data are established by applying the augmented Dickey-Fuller (ADF), Phillips-Perron (P-P), and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. These three tests are applied to determine the consistency of the results therefrom. Two of the aforementioned unit root tests (ADF and P-P) are performed on the autoregressive Equation 2. The lag selection is done by applying the Modified Akaike Information Criterion (MAIC).

The cointegration method assumes that if the two variables $RATE_t$ and $COST_t$ contain some stochastic trend, each can be described as an integrated variable. Furthermore, if a linear combination, (say, $RATE_t$ - $\alpha COST_t$) is stationary, the two variables are said to be cointegrated. As noted earlier, the ADF, P-P, and KPSS tests are used to establish the stationarity characteristics of each data series prior to the application of the cointegration method. The ADF and P-P tests are performed on the following equation:

$$\Delta Z_t = \lambda t + \rho z_{t-1} + \sum_{i=1}^{q} \beta_i \Delta Z_{t-i} + \varepsilon_t \tag{2}$$

where

$$\Delta \equiv (1-L) \quad \text{e.g. } \Delta Z_t \equiv (1-L)Z_t = Z_t - Z_{t-1}$$

z_t = series under consideration;
t = time trend; and
q = The lag is chosen such that it is large enough to ensure that ε_t is white noise.

In Equation 2 above, Engle and Yoo (1987) suggest the use of Modified Akaike Information Criterion (MAIC) in order to choose the optimal q. The MAIC is defined as:

$$\text{MAIC}(k) = \text{N} \ln(\text{SSR/N}) + 2k \tag{3}$$

where

N = number of observations to which the model is fitted;
SSR = The sum of squared residuals from an OLS regression on Equation 2;
$k = q+1$ (number of parameters in Equation 2); and
MAIC(.) = Modified Akaike Information Criterion.

The appropriate order of the model is determined by computing Equation 2 over selected grids of values of q and choosing a q which minimizes MAIC(k).

Once the optimal lag (q) of Equation 2 is selected, an ordinary least squares regression is applied to Equation 2 in order to determine the order of integration of each time series. This is a necessary pre-test of the data series. The test statistic for ADF test is the ratio of ρ to its calculated standard error obtained from the least squares regression. The decision rule is to reject the null hypothesis if ρ is significantly negative. The statistic derived here does not have a t-distribution, but Dickey and Fuller (1979) provide a table of significance levels. Recently, MacKinnon (1991) produces a replication of the underlying critical values which has wider applicability than those of Dickey and Fuller. In this case the hypothesis of a unit root is rejected if the t-statistic lies to the left of the relevant MacKinnon critical value.

In addition to the ADF test, the Phillips-Perron (P-P) test is applied to test the null hypothesis that each time series has a unit root. The specification of the P-P test is the same as the ADF test except that the former adjusts for error autocorrelation. The third test is recently developed by Kwiatkowski, Phillips, Schmidt and Shin (1992) [hereafter, KPSS] to determine the stationarity property of any time series. This new test is more innovative in the way it makes allowance for error autocorrelation. More importantly, unlike other traditional tests, the null hypothesis under the KPSS test is that the time series under examination is stationary. The test statistic is defined as:

$$\text{KPSS} = \frac{N^{-2}\sum_{t=1}^{N} S_t^2}{S^2(L)} \qquad (4)$$

where

N = number of observations; and
S_t = cumulative sum of the residuals ($\sum e_t$) from a regression of series on a constant

$$S^2(L) = N^{-1}\sum_{t=1}^{N} e_t^2 + \sum_{j=1}^{L}(1 - j/(L+1)) \sum_{t=j+1}^{N} e_t e_{t-j}$$

The null hypothesis of stationarity is rejected if the calculated KPSS statistic exceeds the critical value.

To test for cointegration, one needs to run the following ‘cointegration regression’:

$$\text{RATE}_t = \alpha + \beta\text{COST}_{t-1} + \mu_t \qquad (5)$$

The null hypothesis that the residuals are integrated is then tested using the Augmented Dickey-Fuller statistic. If it is shown that RATE_t and COST_t are cointegrated, the short-run dynamics can be described by an error correction model (ECM). This is known as Granger representation theorem. Johansen developed a maximum likelihood estimator within a multivariate cointegration model. This procedure calculates and tests the number of cointegrating vectors in an OLS setup.

According to Maddala (1992), the Granger representation theorem implies that $RATE_t$ and $COST_{t-1}$ may be considered to be generated by error correction models of the form:

$$\Delta RATE_t = \rho_1 w_{t-1} + \text{lagged}(\Delta RATE_t, \Delta COST_{t-1}) + \varepsilon_1, t \quad (6)$$

$$\Delta COST_{t-1} = \rho_2 w_{t-1} + \text{lagged}(\Delta RATE_t, \Delta COST_{t-1}) + \varepsilon_2, t \quad (7)$$

where

$$w_t = RATE_t - \alpha - \beta\, COST_{t-1}$$

In the equations above, at least one of ρ_1 and ρ_2 is nonzero and ε_{1t} and ε_{2t} are white noise errors.

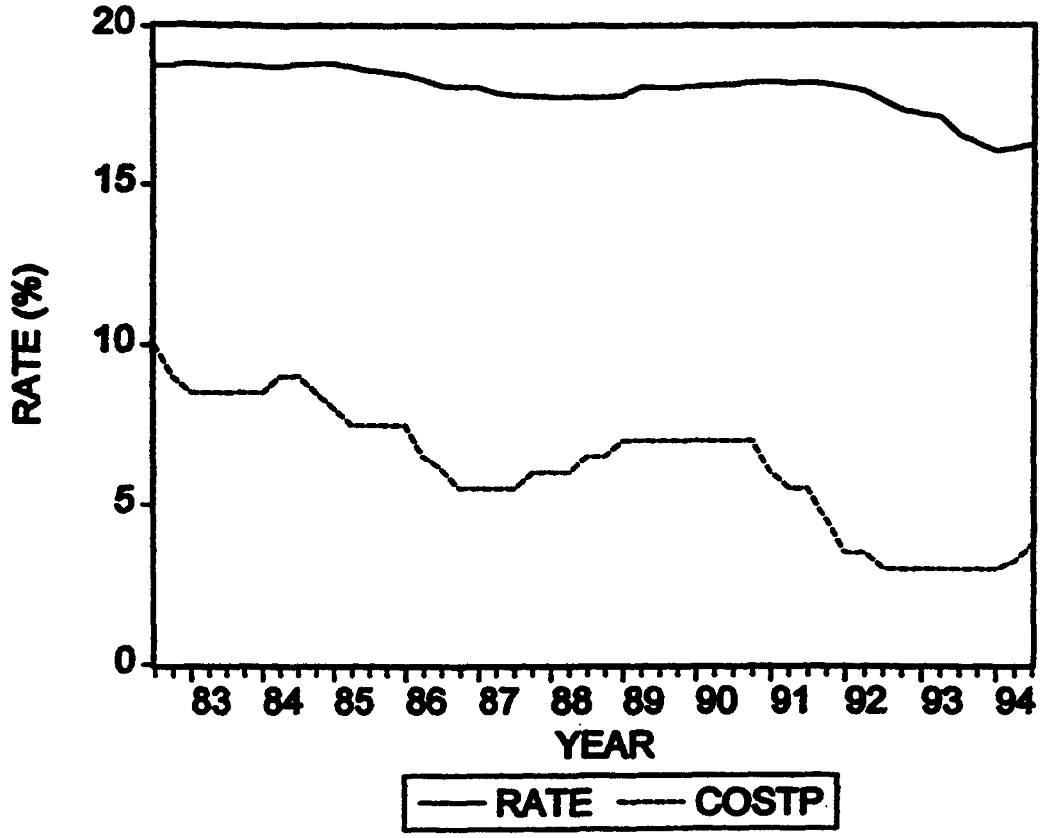
As noted above, the statistical notion of cointegration of two time series reflects a theoretical long-run equilibrium relationship between them. Taylor (1988) observes that if economic theory suggests a long-run equilibrium relationship between $RATE_t$ and $COST_t$, then a linear combination of the two series will not only be stationary, but their cointegration is a necessary condition for them to have a stable long-run relationship. This suggests that the existence of a stable long-run relationship between two integrated variables means that they are also cointegrated.

Given that two time series are cointegrated, the ECMs are appropriate when the dependent variable is known a priori to exhibit short-term changes in response to changes in the independent variable (Durr, 1993). According to Durr (p. 165), "error correction models presume that there exists an equilibrium state in which the levels of the time series are typically located vis à vis one another." Thus, if a shock disturbs the "moving equilibrium" by forcing the series to diverge from their long-run relationship, the equilibrium error is corrected by pushing the relationship to a new level that captures the long-run equilibrium state. The error correction model is estimated within the vector autoregression framework in line with Engle and Granger (1987).

The process of determining the long-run equilibrium relationship between credit card rates and cost of funds proceeds as follows. The first necessary pre-test is to establish the stationarity property of each time series noting that a time series that is integrated of order d (denoted I(d)), should be differenced d times in order to make it stationary. This study applies the ADF, P-P and KPSS tests at this stage. In the second stage, I apply Johansen cointegration test to determine the long run equilibrium relationship between credit card rates and cost of funds. The final part applies the vector error correction estimates to study the adjustment process when the two cointegrated variables deviate from their long-run equilibrium relationship.

V. EMPIRICAL RESULTS

A statistical summary of the sample data indicates that between 1982 and 1994 credit card issuers charge an average annual rate of interest of 18.02 percent while the average



Notes: RATE refers to credit card rate
COSTP refers to one-year Treasury bill rate plus 0.75%

***Figure* 1.** Credit Card Rate and the Cost of Funds.

cost of funds in the economy was 7.43 percent. In terms of variability, credit card rates are less volatile with a standard deviation of 0.732 percent compared to 2.047 percent for cost of funds. Moreover, the distribution of credit card rates is skewed to the left while one-year treasury bill rate's distribution is about normal. The two series are shown in Figure 1. The characterization in this section is meant to describe the credit card market conditions contemporaneous with the sample period rather than an effort to depict the current market conditions.

Table 1 reports the results of stationarity tests performed on credit card rate series and cost of funds. As indicated earlier, the Modified Akaike Information Criterion (MAIC) was employed in the selection of an appropriate lag (q) for each series. The ADF, P-P and KPSS tests are applied to level of the series (RATE and COST) as well as the first difference of the series (ΔRATE and ΔCOST). The null hypothesis of unit root in RATE and COST could not be rejected under the ADF and P-P tests. However, one could not reject the null when the time series are differenced once (ΔRATE and ΔCOST). On the other hand, the KPSS test could not reject the null hypothesis of stationarity for ΔRATE and ΔCOST. Thus, the results from the ADF, P-P and KPSS tests show that each time series is integrated of order one. These results are robust even with the inclusion of a time trend in the respective test equations. This means that each series should be differenced once in order to achieve stationarity. Since both series are

TABLE 1
Unit Root Test on RATE and COST

	Unit Root Test Performed On			
	Rate	*ΔRate*	*Cost*	*ΔCost*
ρ	-0.011	-0.465	-0.030	-0.621
ADF Statistic	-0.398	-3.060*	-1.275	-4.511*
ADF(TREND)	-1.719	-3.019*	-2.214	-4.462*
P-P Statistic	-1.266	-3.606*	-2.367	-5.053*
P-P(TREND)	-1.266	-3.641*	-2.397	-6.181*
KPSS Statistic	0.524*	0.198	0.856*	0.271
KPSS(TREND)	0.281*	0.055	0.521*	0.102

Notes: The Unit Root Test is based on the following equation:

$$\Delta z_t = \lambda t + \rho z_{t-1} + \sum_{i=1}^{q} \beta_i \Delta z_{t-i} + \varepsilon_t$$

The Null Hypothesis of a Unit Root is based on the coefficient, ρ under ADF and P-P tests.
* indicates significance at the 5 percent level.
ADF Statistic is the Augmented Dickey-Fuller Test Statistic.
ADF(TREND) is the ADF statistic from the equation above with a time trend.
P-P Statistic is the Phillips-Perron Test Statistic.
P-P(TREND) is the P-P statistic from the equation above with a time trend.
KPSS Statistic is based on the residuals from regression of variable under consideration on a constant term only. The critical value of this statistic at the 5 percent level is 0.463.
KPSS(TREND) in based on the residuals from regression of variable under consideration on a constant and time trend. The critical value of this statistic at the 5 percent level is 0.146.

similar in terms of their stationarity properties, it is conceivable to think that they are cointegrated based on Engle and Granger (1987) representation theorem.

The results of the Johansen Cointegration test are reported in Table 2. The likelihood ratio test of the maximum eigenvalue indicates only one cointegrating equation between credit card rates and cost of funds. The implication is that credit card rates and the cost of funds have an equilibrium condition that keeps them in proportion to each other in the long-run. The results here indicate that between 1982 and 1994, credit card rates have a consistent long-run equilibrium relationship with the cost of funds. These results are consistent with those of Brito and Hartley (1995) who report that credit card interest rate and the 6-month CD rate are cointegrated. The estimated long-run or cointegrating relationship is of the form $RATE_t = 14.703 + 0.448\ COST_{t-1}$. This relationship implies that the long-run spread between $RATE_t$ and $COST_{t-1}$ is 14.703 percent less 0.552 $COST_{t-1}$. The implication of this is that the long-run spread increases as the cost of funds falls and decreases as the cost of funds rises.

The preceding results indicate that credit card rates and cost of funds are cointegrated. Therefore, an error correction model can be fitted to determine the short-term changes in the response of credit card rates to changes in the cost of funds. In Table 3, the coefficient of the cointegrating equation (CointEq1) measures the rate at which disequilibria in the long-term relationship are corrected. In other words, it is the speed of

TABLE 2
Johansen Cointegration Results

	Zero C.E.	*At Most One C.E.*
Eigenvalue	0.253	0.098
Likelihood Ratio	18.207*	4.761

Normalized Cointergrating Equation:

$$RATE_t - 14.282 - 0.504COST_{t-1}$$

Notes: *rejection of the null hypothesis at the 5 percent level.
C.E. = cointegrating equation.
Likelihood Ratio test = 1 cointegrating equation at the 5% level.

adjustment of any disequilibrium towards a long-run equilibrium state. Thus, a number of -0.146 reported in Table 3 (column 2) means that equilibrium errors are corrected in the short-run at the rate of about 15 percent per quarter. The negative sign associated with the error correction term assures that both credit card rates and cost of funds converge to their long-run equilibrium, following a response to innovation shocks. The evidence here indicates that credit card rates adjust relatively slowly to equilibrium errors. Based on these results, the single-equation error correction model of credit card rates is of the form:

$$\Delta RATE_t = -0.044 + 0.321\Delta RATE_{t-1} - 0.146 \quad (8)$$
$$(RATE_{t-1} - 0.448COST_{t-2} - 14.703) + e_t$$

The restricted vector autoregression (VAR) approach is used here in an effort to correctly specify the lag lengths for the short-term effects (Johansen, 1988). From the equation above, it is obvious that there is no short term dynamics between RATE and COST, because the coefficients of $\Delta COST_{t-2}$ and $\Delta COST_{t-3}$ are not statistically significant (see Table 3). Moreover, the error correction mechanism also shows that changes in the credit card rate is influenced by previous changes.

The Granger causality test results also confirm that the Treasury bill rate (COST) has a strong predictive power for explaining credit card rates (RATE). Incidentally, the credit card rate does not Granger-cause the cost of funds as defined in this study. An interesting part of this result is the strong exogeneity of the cost of funds. The F-test of the lagged credit card rates suggests that cost of funds is weakly exogenous. The statistical insignificance of the coefficient of the error-correction equation reported in Table 3 (column 3) is also evidence of a weakly exogenous cost of funds. An exogeneity test is carried out following Kwan and Kwok (1995). An F-statistic of lagged credit card rates of 3.023 confirms the weak exogeneity of the cost of funds. In addition to this, an F-statistic of 3.734 from the Pairwise Granger causality test leads one to reject the hypothesis that the cost of funds does not Granger cause credit card rates. Moreover, an F-statistic of 0.437 could not reject the hypothesis that credit card rate does not Granger cause cost of funds. Kwan and Kwok note that strong exogeneity includes weak exogeneity and Granger noncausality (p. 1161). Thus, one can conclude that the cost of funds is strongly exogenous. The econometric implication of an exogenous cost

TABLE 3
Vector Error Correction Estimates

Cointegrating Equation	*Cointeq1 Coefficients*	
$RATE_{t-1}$	1.000	
$COST_{t-2}$	-0.448 (0.093) [-4.801]*	
Constant	-14.703	
Error Correction	$\Delta RATE_{t-1}$	$\Delta COST_{t-2}$
Cointeq1	-0.146 (0.043) [-3.378]*	-0.149 (0.266) [-0.561]
$\Delta RATE_{t-1}$	0.321 (0.147) [2.177]*	0.757 (0.908) [0.833]
$\Delta RATE_{t-2}$	-0.028 (0.141) [-0.195]	-1.589 (0.871) [-1.825]
$\Delta COST_{t-2}$	-0.026 (0.031) [-0.842]	-0.082 (0.192) [0.429]
$\Delta COST_{t-3}$	-0.014 (0.028) [-0.512]	-0.106 (0.169) [0.062]
Constant	-0.044 (0.019) [-2.268]*	-0.130 (0.120) [-1.087]
Adj. R-Squared	0.395	-0.006

Notes: *indicates significance at the 5 percent level.

of funds is that there is no feedback effect from credit card rate to cost of funds. The relationship between the variables is unidirectional with credit card rate being the dependent variable and the cost of funds as the independent variable.

The dynamic relationships between cost of funds and credit card rates can best be appreciated by examining the impulse response functions. Impulse responses represent the dynamic response of the level of endogenous variable to innovations in disturbance terms. Table 4 reports the dynamic responses of the level of each variable to one standard deviation innovation shock in Equations 6 and 7. A credit card rate innovation shock will increase the movement in level of the credit card rate over several quarters. However, a cost of funds innovation shock will make credit card rate to rise and later makes a downward movement toward its equilibrium level. On the other hand, the cost of funds responds only to its own innovation shocks. Its response to innovation shocks from credit card rates occurs only within four quarters after which the cost of funds returns to its long-run equilibrium level.

TABLE 4
Impulse Response to One Standard Deviation Innovation

	Response of Credit Card Rate to:	
Period	*Credit Card Rate Innovation Shock*	*Cost of Funds Innovation Shock*
1	0.098	0.000
2	0.121	0.023
3	0.119	0.060
4	0.108	0.105
5	0.094	0.148
6	0.077	0.185
7	0.061	0.213

	Response Of Cost of Funds to:	
Period	*Credit Card Rate Innovation Shock*	*Cost of Funds Innovation Shock*
1	0.149	0.584
2	0.231	0.671
3	0.081	0.675
4	0.009	0.695
5	-0.001	0.702
6	-0.002	0.685
7	-0.002	0.661

Ordering: Rate, Cost of Funds

VI. COMMENTARY

Meyercord (1994), Sinkey and Nash (1993), Ritzer (1995), Stavins (1996) and Lown and Peristiani (1996) document evidence suggesting that significant changes are taking place in the credit card market. More specifically, there is increased participation in the market by nonbank card issuers, the overall cost of funds and interest rates are declining; credit losses are rising; and credit card issuers are becoming increasingly sophisticated in targeting right value propositions. All of these imply that the credit market might not be insensitive to the cost of funds afterall.

In view of the aforementioned, this study examines the relationship between credit card rates and the costs of funds from 1982 through 1994. The evidence from the Johansen Cointegration test confirms that credit card rates and cost of funds possess a long-run equilibrium relationship with one another. Furthermore, the error correction models are indicative of the slow rate at which credit card rates adjust to the cost of funds. Between 1982 and 1994, credit card rates adjust to the cost of funds at about 15 percent per quarter. More importantly, the Granger Causality results suggest that the one-year Treasury bill rate has a strong predictive power in explaining credit card rate.

In a recent study, Lown and Peristiani (1996) report that after accounting for funding costs, the premium charged on consumer loans by low-capitalized banks is highly significant. Stavins (1996) also finds a high correlation coefficient between APR and the fraction of overdue loans suggesting that high-APR plans are associated with high rates of delinquency. These results represent indirect evidence for the validity of the cost-plus loan pricing model proposed by Rose (1985). Given Rose's model, the cost of funds may not be the most important determinant of credit card interest rate as Ausubel (1991) argues. Stavins' results imply that risk factor is another major determinant of credit card rates. Therefore, it is logical for the credit card rates to respond sluggishly to the costs of funds as reported in this study.

The results of this study are consistent with the financial contracting literature on asymmetric information and the associated adverse selection consequences as discussed in Berlin and Loeys (1988) and Best and Zhang (1993). In the credit card market, Calem and Mester (1995) argue that credit card issuers face adverse selection from the search behavior of cardholders and also the cost associated with switching. The presence of asymmetric information between banks and consumers in respect of consumers' probability of default based on their future incomes leads banks to use collateral to screen loan applicants. In general, high-risk customers will prefer credit card loans to collateralized bank loans. On the other hand, low-risk consumers prefer collateralized loans. According to Mester (1993), when the cost of funds goes down, low-risk consumers would naturally abandon the credit card market and use the collateralized loan market. The credit card market would be dominated by high-risk consumers. Therefore, credit card issuers are not motivated to drop rates in response to a decline in the cost of funds.

The implication of this phenomenon, according to Mester, is that the spread between the rate of interest on credit card and the cost of funds will be positively correlated with the default rate. This argument represents the position of the proponents of adverse selection as an explanation for nonresponse of card rate to the cost of funds. The results reported by Sullivan and Worden (1995) suggest that the estimated value of cardholders' option to default is significantly higher for bankruptcy than outright default. This situation is particularly captivating in light of the loan pricing Equation 1. Any decline in the cost of funds leads to an increase in default risk. Consequently, the overall loan rate (credit card rate) is relatively inflexible to changes in the cost of funds.

Calem and Mester (1992) have also written about borrowers' switching costs. Once a consumer carries a substantial amount of debt on a credit card, it is difficult for the consumer to transfer from one issuer to another. The rationale is that the new issuer would consider the existing debt as a negative strike against the consumer. Calem and Mester observed that the switching cost argument is consistent with nonprice competition in the credit card market as we currently witness.

There is a pool of consumers who are reluctant to search for the card that offers the best rate of interest. The undisciplined card users do not always plan to borrow but find themselves in debt because of inability to settle their card bills. Because this group of card users do not plan to exploit the credit feature of their cards, they are not motivated to search. They always believe that their peculiar situation will be short-lived. This population of cardholders also includes those who refuse to search because of the fear that such an action would reflect negatively on their credit reports.

In view of the aforementioned, the large pool of potential high-risk card holders motivates credit card issuers to charge rates that reflect maximum risk. With reference to Equation 1, one can observe that as the cost of funds ($COST_{t-1}$) goes down, the risk factor (R_t) increases because the low risk cardholders seek collateralized loans. The pool of cardholders now consists of mostly the high-risk customers. Thus, the downward pressure on credit card rates from a decrease in the cost of funds is offset by an upward pressure from an increase in the riskiness of the credit card issuer's portfolio. All other things being equal, the overall impact of these two forces on credit card rates will be insignificant.

This study shows that credit card rates and credit card funding costs are cointegrated and that credit card rates adjust to changes in funding costs in a sluggish fashion. These results are only applicable to the 1982-1994 period. However, the results explain why past empirical work has failed to identify a significant relationship between credit card interest rates and costs of funds, and they offer empirical support for alternative explanations why credit card rates appear invariant to funding costs in the financial economics literature. Moreover, within Rose's cost-plus loan-pricing framework, the credit card market can indeed be characterized as a competitive market. The difficulty in measuring the competitive nature of the market is related to a set of specific institutional characteristics at work in the marketplace. Finally, the presence of asymmetric information, adverse selection due to search and switch costs can obscure the relationship between credit card interest rates and the costs of funds.

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