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A Computation of Interest Equivalences for Nonprice Characteristics of Bank Products

FOR A NUMBER OF FINANCIAL PRODUCTS, nonprice characteristics may be as important as the price of the product. In stockbroking services, analysts' advice and soft commissions feature prominently, in addition to commission rates. In banking, characteristics such as branch size, ATM access, and service charges are, among others, integral parts of the retail product offered to customers. If one wishes to assess competitive behavior in financial markets, it is important to "price" these characteristics and adjust the price of the product accordingly.

There have been several theoretical contributions to the idea of implicit interest. Feige (1964) treated U.S. bank service charges as negative interest. Klein (1974) assumed fully competitive implicit interest rates and entered these rates in a money demand function. He found the implicit interest rate formulation to be significant and of nearly equal magnitude (and opposite) sign from rates on alternative assets. Mitchell (1979) used a model to establish the conditions under which banks treat explicit and implicit interest (in the form of check-clearing services) as substitutes. His main point was that explicit and implicit rates may move together depending on the degree of substitutability between deposit and checking accounts. There are also numerous empirical contributions in this area, all of which employed U.S. data. These are cited throughout the paper, where appropriate.

This study seeks to achieve two objectives. The first objective is to develop a methodology to test for the significance of nonprice features of bank products, and

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second, to apply this methodology to a selection of British retail bank products, the higher-interest deposit account (HID), the higher-interest checking account (HIC), repayment mortgages (RM), and personal loans (PL).

The British retail banking industry is a good choice for applying and testing this methodology because a number of reforms aimed at encouraging greater competition in this sector have given rise to a proliferation of nonprice features associated with relatively new retail bank products. Heffernan (1991a) provides more detail on the regulatory reforms and their consequences, but it is noteworthy that prior to the first regulatory change in 1971, the industry was dominated by four large clearing banks, some smaller banks, and what at the time were largely savings banks, the Trustee Savings Banks and the National Girobank. Building Societies, as mutual organizations offering services exclusively related to the housing market, were not considered retail banks because they did not offer personal loans or money transmission facilities. By the late 1980s, the structure of retail banking had undergone a dramatic change. Banks had moved into the mortgage market and the largest building societies (in terms of asset size) were retail banks in all but name, offering mortgages, personal loans, a variety of deposit products, checking facilities, and cash-dispensing machines. Indeed in 1989, Abbey National, the largest building society, took advantage of the 1986 Building Society Act and became a bank.

One consequence of these changes was the development of new financial products and an increase in nonprice features associated with these products. Examples include the higher-interest checking account (HIC) and the higher-interest deposit account (HID), introduced in 1984 and 1985, respectively. HIC offers checking and other current account facilities typical of the traditional British current account, but in addition, interest is paid on some minimum balance. HID offers substantially higher interest rates than the standard "7 Day" deposit account. While personal loans have been offered by banks for a long period, building societies began to enter this market in early 1987. Banks entered the mortgage market in 1981, traditionally the exclusive domain of the building societies. The repayment mortgage, one of the products considered in this paper, is one of two major types of mortgage offered in the United Kingdom. It is distinguished from the endowment mortgage in that it does not have an endowment policy attached to it.

This paper is divided into five sections. Section 1 outlines the methodology for identifying and "pricing" the important nonprice features of British bank products. Section 2 discusses the construction of the data series used in the estimation work. Section 3 reviews the results of the estimation exercises and section 4 explains how interest equivalences are computed. Section 5 concludes.

1. METHODOLOGY

A number of empirical studies have attempted to estimate an implicit rate of interest. All of these studies employ U.S. banking data and tend to focus on bank products where, during estimating period, no explicit interest was paid. Klein and

Murphy (1971) used bank service charges as a measure of implicit yield on demand deposits that were prohibited from earning an explicit interest. Barro and Santomero (1972) computed service charge remissions as a measure of implicit interest, for a checking account with no explicit interest. Data were drawn from a survey of large commercial banks. Santomero (1979) constructed an implicit interest rate series using the Functional Cost Analysis Program of the Federal Reserve which is based on bank survey data and provides direct information on the costs of servicing non-interest paying demand deposits. Implicit interest was computed for one nonprice feature, service costs. Total costs were assumed linear in three activities, demand deposits, time deposits, and loans. Having obtained a measure of implicit interest, it was regressed on $(1 - c)r_a$, where r_a is the yield on the alternative asset and c is reserves plus float. Based on time-series cross-section data from 1973–75, Santomero concluded that implicit interest was being paid at one-third to one-half the competitive rate. Becker (1975) defined and computed the net rate of return on demand deposits as the value of services rendered by banks (noninterest expenses per dollar) less any service charges per dollar of demand deposits.

Startz (1983) estimated the implicit interest from the provision of free banking services. The implicit return on the demand deposit account was based on estimates from Barro and Santomero (1972), Becker (1975), and Klein (1974). Also included as a dependent variable was the fixed cost of maintaining the account at the bank per time t. In a regression where demand deposits was the dependent variable, Startz found the coefficients for implicit return, opportunity costs, real income, and lagged demand deposit balances were statistically significant with the right sign.

The methodology employed in this paper differs from the past literature in a number of respects. In the United Kingdom, equivalent functional cost data of the sort provided by the Federal Reserve are not available. Hence the need to construct the data series described in section 2, following. In addition, by the mid-1980s, most retail deposit products paid an explicit rate of interest. There continues to exist a current account that pays no interest, but the consumer can choose a superior product in the higher-interest checking account, which has all the features of the current account and pays interest. Service charges do apply, but only for certain categories of overdraft customers. Thus, explicit interest and nonprice characteristics are not mutually exclusive.

In this paper, the product interest rate is regressed on market interest rates (current and lagged) and the nonprice characteristics of bank products, with the objective of identifying explanatory variables that are statistically significant. The equation, estimated by OLS, takes the following form:

$$r = a + b_i x_i + c_0 LIBOR + c_i LIBOR_{-i} + eTT + u_i \qquad (1)$$

r = the rate of interest offered/levied by a bank on the product;

x_i = the nonprice characteristic x, $i = 1, \ldots, n$;

$LIBOR$ = the three-month £ London Interbank Offer Rate;

$LIBOR_{-i}$ = $LIBOR$ lagged by i, i = 1, 2 months;

TT = Time Trend;

u_i = error term.

This equation is estimated for a pooled cross-section time-series database (described in section 2) for the higher-interest checking account, the higher-interest deposit account, and pooled interest rates for the products for HIC and HID (HICD). In addition, repayment mortgages and personal loans (RMPL) were pooled in order to estimate certain interest equivalences such as the mortgage condition that the borrower offer security as insurance against the possibility of default. Coefficients on correctly signed, statistically significant explanatory variables are used to compute an interest equivalence for each nonprice characteristic.

2. CONSTRUCTING THE DATA SERIES

Data for this study come from an unpublished source, one of the major clearing banks in the United Kingdom. The bank collects the following information on itself, other banks, and the large building societies: (1) Monthly information on interest rates offered/levied on retail bank products in the United Kingdom. The series goes as far back as 1976 but for the purposes of this paper, the observation period runs from 01.08.85 to 01.11.89, depending on the bank product. It is not a consistent monthly series, the interest sheet normally being updated if there is a change in a central bank rate. Rates used in this study are net of composite rate tax for the deposit products and are annual percentage loan rates for the loan products. Deposit rates are annual rates, unless otherwise stated, that is, unless the interest on the deposit is paid more than once a year. (2) An annual or twice-annual summary of the nonprice features of these bank products.

This information permitted construction of a pooled cross-section, time-series database on interest rates and nonprice features for a number of products. For the purposes of this study, data on higher-interest checking and deposit accounts, repayment mortgages, and personal loans are used.

Interest rates and other characteristics for higher-interest checking and higher-interest deposit accounts vary according to deposit levels, which range from £0 to over £53,000. Initially a series was created for eleven deposit levels, ranging from £96.00 to £53,500. These deposit levels were chosen in such a way that they were in the middle range, to avoid being close to interest rate threshold kinks, where there is a sudden jump in the interest rate offered as a consequence of the size of the deposit rising by some small amount. The deposit levels were also deflated by a quarterly money GDP deflator. Earlier work (Heffernan 1991a) revealed similar trends across deposit levels and for the purposes of this study, we concentrate on two deposit

levels: D4 (£765.00) and D6 (£4,590). These correspond closely to the average deposit levels for, respectively, current accounts and deposit accounts in the late 1980s.

This exercise resulted in forty interest rate points for HIC and HID, from 01.08.85 to 01.11.89, at two deposit levels, D4 and D6. The number of firms included in the sample ranged from six to eleven for HID and from four to eleven for HIC. The sample of firms tended to be lower for the earlier observation points because fewer firms offered these products.

For mortgages and personal loans, it was not necessary to specify a loan amount because banks and building societies tend to quote one interest rate that does not vary with the size of the loan. They do set minimum and maximum amounts, and these were included as nonprice features of bank loans. The interest rate series constructed for banks and personal loans was from 01.06.86 to 01.11.89, giving a total of thirty-two interest rate points for each firm. The number of firms in the sample varied from ten to twelve for mortgages, and from three to sixteen for personal loans. In the early part of the period, fewer firms offered these products, especially personal loans.

Information on the nonprice characteristics of these products was compiled once or twice a year. It was assumed that in the interval between reporting dates, the characteristics were unchanged. The monthly product interest rate was associated with the set of characteristics reported closest to that month. There are a number of characteristics common to all firms. For example, they tend to offer the same service in the provision of bank statements. Nonprice features of bank products common to all the firms in the sample were eliminated. The series created was based on characteristics that showed substantial variance among firms.

For the higher-interest checking account (HIC) the characteristics included the following: a minimum investment requirement (*MI*), a minimum deposit requirement (*MD*), a minimum check constraint (*MC*), where the customer is constrained to write checks for values in excess of some minimum amount, the number of branches for the firm offering the product (*BRAN*), the number of times interest is paid in a given year (*INTPAID*), and the number of automatic teller machines available (*ATM*). The branch variable is included as a proxy for other nonprice and near-bank features a bank may offer, such as convenience of location, retail stockbroking services, and foreign exchange facilities. In the United Kingdom, it is the larger branch banks (especially the big four clearing banks) that offer these sorts of services. Nelson (1985, 1988) showed the theoretical and empirical importance of the dimension "convenience" for bank costs and market structure retail banking. For the higher-interest deposit account the nonprice characteristics included *MI*, *BRAN*, *INTPAID*, a maximum withdrawal (*MW*) constraint (a customer may only withdraw a specified maximum amount in a given day or week), and *NOTICE*, whether or not notice of withdrawal is required.

Data from the HIC and HID were pooled at the two deposit levels, with the objective of establishing an interest equivalence for checking facilities, the key feature that differentiates these two products. The aggregated product is called

HICD (D4 and D6) and includes the following characteristics: a check dummy (*CHQ*), *MI*, *MW*, *BRAN*, *INTPAID*, *NOTICE*, and *ATM*.

Data for repayment mortgages and personal loans (RMPL) were pooled and a security dummy inserted. Since security is required for mortgages (the bank holds the title deeds to the house) but not for personal loans, the dummy allows one to estimate an interest equivalence for security. Similarly for insurance (the borrower is required to take out insurance to cover the mortgage repayments in the event of death), though a 0.5 dummy is inserted to allow for optional insurance, where applicable. In addition, the minimum and maximum amount available for loans (*MIN*, *MAX*), minimum and maximum terms (*MINT*, *MAXT*), and number of branches are considered.

The list of nonprice characteristics used is by no means exhaustive. For example, it is known that at least two banks offer some form of home banking, but this feature is excluded from the list. The author was limited by the data because only selection of nonprice features was reported. However, the information was gathered by a major clearing bank, and one would expect that it was interested in nonprice features it thought to be the most important from the standpoint of its competitive strategy. In addition, it is only possible to include characteristics that showed a high degree of variance between banks. Omitted nonprice characteristics must weaken the results of the empirical work. On the other hand, given that our sample probably includes the most important characteristics, they should not be ignored.

Another concern relates to the extent to which pooling is acceptable within this model. There is pooling over months, firms, and over two types of products, mortgages and personal loans. An F statistic was computed for two types of pooling and compared in F tables. The F statistic was obtained by computing an unrestricted residual sum of squares for each year, or banks; limited degrees of freedom prevented testing for the validity of pooling over months. The residual sum of squares was that obtained for the pooled sample. Though not reported here, pooling restrictions were accepted at the 5 percent level of significance in most cases. Where they were not, an acceptable F statistic was obtained by inserting dummy variables for variables which showed a significant variation over the individual years.

3. RESULTS

Equation (1) was estimated using OLS. Space constraints prevent a detailed report of the results, but they are available from the author on request. The diagnostics are briefly discussed. The R^2 range from .6871 to .9599 and these are acceptable given that the data are pooled cross-section time series. The adjusted R^2 was not very different from R^2.

One concern is the possibility of serial correlation because the interest rate changes only when there is a change in the central bank rate. The Durbin Watson (DW) tests show the null hypothesis of no autocorrelation cannot be rejected for most of the products while for the other products, a Lagrange multiplier test for

higher autocorrelation allow us to accept the null hypothesis at the 1 percent and 5 percent significance levels.

The presence of heteroskedasticity is another concern given the cross-section nature of the data. The Lagrange multiplier test for heteroskedasticity was used, where the null hypothesis is that the disturbances have a constant variance. It was tested for significance at the 1 percent and 5 percent levels using the F distribution. For the deposit products, the null hypothesis of homoskedasticity cannot be rejected at the 1 percent and 5 percent significance levels but for loan products, heteroskedasticity problems meant only the estimates from one subset of the 1988 pooled RMPL product could be used with any confidence.

For the higher-interest checking account (HIC4), the following variables were found to be statistically significant with the right sign: *LIBOR*, minimum investment (*MI*), and the number of branches (*BRAN*). The *t*-ratio for minimum deposit (*MD*) is nearly significant with the right sign. At deposit level six (£4,590) (HIC6), *LIBOR*, *LIBOR*-2, *MD*, and branches are statistically significant with the expected sign. The constant term (*CON*) is insignificant for HIC4 but negative and significant for HIC6. The *ATM* variable (number of ATMs) is statistically significant for HIC4 and HIC6 but the sign is positive at D4 and negative at D6.

For the higher-interest deposit account, the following explanatory variables were found to be correctly signed and statistically significant for HID4: *LIBOR*, *LIBOR*-2, *MI*, branches, maximum withdrawal (*MW*), and the number of times interest is paid in a given year (*INTPAID*). Required notice of withdrawal (*NOTICE*) is significant but is wrong signed. The time trend (*TT*) is negative and significant, suggesting that interest rates are falling over time. The constant term is positive and significant. Similar results are obtained for HID6 except that *MW* and the number of branches are no longer significant at this higher deposit level.

The *ATM* variable is difficult to interpret. On one hand, it is a characteristic that eases consumer access to deposit funds, and using this reasoning, it should have a negative sign: the provision of ATM facilities lowers the interest rate offered on the product, as it appears to do for HIC6. On the other hand, it is a piece of technology which, if used instead of a check or withdrawal from a cashier-attended counter, reduces the cost of money transmission for banks. In this case we would expect a positive sign, as we observe for HIC4, HID4, and HID6. van der Velde (1985) of the Bank Administration Institute, using U.S. data, found that ATMs have a largely neutral effect on bank costs, because although costs per transaction were lower when compared to a full teller service, customers use the ATM more often, thereby raising overall costs. This point is supported by a recent survey of large U.S. banks, which found that automation technology is offered to provide a better service rather than to reduce costs (*The American Banker*, 6 October 1990). Unfortunately, similar information on British ATM costs does not exist.

Turning to the aggregated product, HICD, all the variables tested are significant with the expected sign with the exception of *LIBOR*-1, *NOTICE*, *ATM*, and the HIC time trend ($TT2$) at D4 and *LIBOR*-1, *MW*, *INTPAID*, *NOTICE*, and $TT2$ at D6. These results do not mean very much since this is a synthetic product. However, the

check dummy (1 for HIC, 0 for HID) is statistically significant with a negative sign, that is, if a checking facility is offered, the interest rate falls.

For the period data on repayment mortgages and personal loans, the presence of heteroskedasticity means attention is confined to the 1988 coefficients. The insurance and security dummies (*INSURANCE*, *SEC*), and the number of branches are statistically significant with the expected sign.

For most deposit products, *LIBOR* and *LIBOR* lagged by two months were statistically significant suggesting that, in general, there is a substantial lag in the responsiveness of deposit rates to a change in the market rate of interest. The 1988 pooled mortgage/personal loan product had a statistically significant *LIBOR*-1 but an insignificant *LIBOR*. Recall that in most cases, the constant term is positive and significant. These findings are suggestive of "smoothing" by the banks; that is, they adjust interest rates slowly and in discrete jumps. There are several possible explanations for smoothing including the presence of menu and/or switching costs or price-making behavior. Heffernan (forthcoming, 1991b) explores the competitive behavior of the British retail banking industry.

4. COMPUTATION OF INTEREST EQUIVALENCES

The coefficients from the OLS regressions enable us to compute interest equivalences for the nonprice features of bank products found to be statistically significant with the expected sign. These are reported in Table 1 for HIC and HID at deposit levels D4 (£765) and D6 (£4,590). Results for the 1988 pooled repayment mortgage and personal loan set are reported in Table 2. Recall that the interest rate is an annual rate, unless interest is paid to customers more than once a year, a practice picked up by the nonprice characteristic, interest paid. Hence the coefficients on the nonprice features give us a direct measure of the interest sacrificed or obtained as a result of the presence of a positive or negative nonprice feature.

The results are best interpreted by considering some examples. The coefficients on the branch variable tell us that as the number of branches increases, the interest offered on the deposit falls. In 1989, the average branch size for the big four clearing banks was 2,477. Table 1 tells the consumer that for HID, up to 3.2 percent interest could be foregone at the lower deposit level because of the choice of a bank with an extensive branch network. On the other hand, the customer who could deposit £4,590 would lose only .003 percent in interest if the no-branch bank is chosen. On average, the interest foregone is 0.75 percent at deposit level 4 and 0.01 percent at deposit level 6. For the higher-interest checking account, the average interest sacrificed is between 0.1 percent and 0.3 percent, depending on the deposit level.

The number of times interest is paid on a HID account (one, two, or four times a year) was found to be significant, and the interest sacrificed ranges between 0.09 percent and 1.7 percent. ATMs add to interest paid on HID but at the higher deposit level for HIC, the consumer actually loses interest because of the ATM facility.

TABLE 1

INTEREST EQUIVALENCES FOR DEPOSIT PRODUCTS

	Interest Equivalence[1] Min (%)	Max (%)	Avg (%)
Higher-Interest Deposit Account			
(1) Minimum Investment (£0–£1,000)			
D4 = £765	0.02	1.12	0.54
D6 = £4,590	0.006	0.26	0.15
(2) Maximum Withdrawal			
D4 = £765	−0.75	−0.45	−0.66
D6 = £4,590	na	na	na
(3) Number of Branches (0 to 20,954)			
D4 = £765	−3.2	−0.2	−0.75
D6 = £4,590	−0.04	−0.003	−0.01
(4) Interest Paid (1, 2, 4 times per year)			
D4 = £765	−1.7	−0.14	−0.28
D6 = £4,590	−1.1	−0.09	−0.23
(5) Number of ATMs (0 to 2,700)			
D4 = £765	0	0.6	0.05
D6 = £4,590	0	0.3	0.02
(6) SUM [(1) + (2) + (3) + (4) + (5)]			
D4 = £765	−5.6	0.9	−1.1
D6 = £4,590	−1.1	0.5	−0.07
Higher-Interest Checking Account			
(1) Minimum Investment (£0 to £2,500)			
D4 = £765	0	2.4	1.71
D6 = £4,590	na	na	na
(2) Minimum Deposit (£0 to £250)			
D4 = £765	0	0.3	0.07
D6 = £4,590	0	0.46	0.09
(3) Number of Branches (0 to 3,062)			
D4 = £765	−0.2	0	−0.1
D6 = £4,590	−0.5	−0.01	−0.3
(4) Number of ATMs (0 to 2,700)			
D4 = £765	0	0.6	0.09
D6 = £4,590	−0.6	0	−0.1
(5) SUM [(1) + (2) + (3) + (4)]			
D4 = £765	−0.2	3.3	1.8
D6 = £4,590	−1.1	0.5	−0.3
(6) Checking Facility	No check	Check	
D4 = £765	0	−1.2	
D6 = £4,590	0	−0.4	

1. An interest equivalence is the interest earned (foregone) because of the presence of a nonprice feature in a product that is, from the standpoint of the consumer, negative (positive). It is obtained from the statistically significant right-signed coefficients in the estimations of equation (1). Minimum interest equivalence (MIN) is the smallest amount of interest gained or foregone because of the nonprice feature, maximum interest equivalence (MAX) is the greatest amount gained or lost, and AVG is the average interest equivalence.

The summation lines in Table 1 provide the reader with an idea of the overall interest lost/gained as a result of the presence of nonprice features. For HID, the consumer loses an average of 1.1 percent at deposit level 4 and 0.7 percent at the higher deposit level. The respective average nominal rates of interest over the period were 7.15 percent and 7.43 percent. On average, the consumer gains 1.8 percent as a result of nonprice features associated with the higher interest checking account at the lower deposit level and loses 0.3 percent at deposit level 6. However, the provision of checking facilities will increase the amount of interest foregone on this type of account. Average nominal rates of interest offered on HIC over the period were 6.57 percent at deposit level 4 and 7.33 percent at deposit level 6.

Table 2, for loan products, is far more limited in the information it can provide

TABLE 2

INTEREST EQUIVALENCES FOR LOAN PRODUCTS (RMPL88[1])

(1) Number of Branches (0 to 21,071)				
0–104	0–829	0–1,546	0–3,086	0–21,071
0.055%	0.15%	0.20%	0.29%	0.75%
(2) Insurance (0 = No Insurance, 1 = Insurance, 0.5 = Insurance Option)				
0	1	0.5		
0	−2.09%	−1.05%		
(3) Security (0 = No Security Required, 1 = Security Required)				
0	1			
0	−7.80%			

1. Based on 1988 pooled data for repayment mortgages and personal loans (RMPL88)

because it is based on pooled 1988 data. The presence of security on the loan will reduce the interest rate charged by 7.8 percent. Insurance will lower it by 2.1 percent, and the option of insurance (under the heading 0.5) reduces it by just over 1 percent. Note that the interest contribution made by branch size is much smaller than for deposit products, ranging from .05 percent to 0.29 percent for banks with branches that range from 1,546 to 3,086. Over the period, the average nominal interest rate for repayment mortgages was 11.6 percent and 20.86 percent for personal loans.

5. CONCLUSIONS

This paper has sought to identify interest equivalences for nonprice characteristics of British retail bank products. It differs from earlier work in that it relies on U.K. data, constructs a data series with both explicit interest and nonprice features, and uses this database to obtain statistically significant coefficients that can be employed to compute interest equivalences. Nonprice features found to be important were the levels of minimum investment, minimum deposit, and maximum withdrawal. The number of branches, ATM outlets, frequency with which interest is paid, and the provision of a checking facility were also correctly signed and statistically significant.

The findings in this paper are useful because they permit one to adjust explicit interest for these interest equivalences. This in turn will provide a more accurate measure of price behavior in the retail banking markets. More generally, a similar methodology may be applied to financial products in other markets, such as stockbroking services.

Perhaps the greatest constraint to this approach lies in gathering the appropriate data for the estimation procedures, especially information on the nonprice features associated with retail bank products.

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