Customer Inertia, Decision Avoidance and Deposit Interest Rate Setting

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Abstract

This study examines why banks offer multiple and similar deposit services with different interest rates. This question is examined both theoretically and empirically by considering the influence of discounting the costs and benefits of switching decision by depositors. The model examines if the number of deposit services and the levels of interest rates are influenced by banks awareness of depositors time inconsistencies in decision making. It is predicted banks aware of this bias can enhance profits by introducing duplicate deposit accounts with competitive interest rates for new customers and lowering interest rates on existing deposit accounts for active customers which are reluctant to switch deposit services. These predictions are tested empirically; high levels of duplicate accounts are reported, underperforming deposit accounts appear commonplace and the age or length of time a deposit account has been offered for investment is a significant determinant of the competitiveness of deposit interest rates.

1. Introduction

Why do banks offer similar financial services with different levels of interest? Facing these circumstances customers' would surely switch to the financial service with the highest rate of return or lowest cost? Despite such expectations, interest rate setting for many financial services, and particularly deposits, have been viewed as 'sluggish', 'sticky', or lagged (e.g. Hannan and Berger 1991, De Graeve *et al* 2007, Fuertes and Heffernan 2009) and characterised by high levels of variance (Ashton and Letza 2002, Martin-Oliver *et al* 2008), suggesting factors other than cost influence the setting of interest rates. Indeed the lack of conformity with standard price theory has been viewed to be an attribute of retail financial markets variously attributed to obfuscation by suppliers (Carlin and Manso 2010), consumer ignorance (Carlin 2009, Scitovsky 1950), financial illiteracy (Chio *et al* 2010) and contextual factors within the decision making process (Kamenica 2008). In the UK, Heffernan (2002) examining intra-bank variation in deposit interest rate setting reported dual peaks of more and less competitive interest rates; an outcome attributed to bank interest rate discrimination between informed and ill-informed customers with inertia.

This study explores this issue to assess whether consumers' inertia or decision avoidance is an influential factor in determining such pricing noise and use of multiple interest rates. This research question is addressed using both theoretical and empirical approaches. First a model is presented to determine the interest rates and number of deposit products used by banks wishing to profit from customers' inertia when deciding to switch deposit services. Customers are assumed to have different propensities to switch deposits accounts according to how they discount the costs and benefits of changing deposit accounts. It is predicted if banks are aware of such consumer behaviours and maximise profits by introducing new deposit accounts with competitive rates for customers prepared to switch accounts, and reducing interest rates on existing deposit accounts for customers who avoid switching decisions.

The model predictions are empirically tested using data on UK saving deposit accounts interest rates and characteristics over a 20 year period. Specifically we consider one, do underperforming deposit accounts exist, two, do banks issue duplicate deposit accounts, three, does the introduction of additional 'duplicate' account alter the proportion of underperforming accounts, and four, does the competitiveness of deposit account

interest rates depend on the age of the account, the number of similar products and other factors including size of deposits? In summary underperforming deposit accounts are widespread, banks commonly issue duplicate deposit accounts, significant increases in the proportion of underperforming deposit accounts are recorded when extra accounts are introduced for some types of bank, and the age of the deposit account is a statistically significant determinant of the competitiveness of deposit interest rates.

This examination contributes to literatures considering both how interest rate rigidity may emerge and the influence of behavioural anomalies in altering customers' decision making in saving markets. In the spirit of Ausubel (1991), Kahn *et al* (2001), Ashton and Hudson (2009) and Carlin (2009) who indicate adverse selection, interest rate clustering and market complexity influence interest rate setting, this study indicates another behavioural explanation why rigid or sticky retail interest rates exist; this being how depositors discount potential switching decisions.

Secondly, a large literature has emerged examining how individuals can be poor money managers (see Benartzi and Thaler 2007). This study contributes to this field by responding to concerns that firms change their behaviour to exploit observed behavioural anomalies (Frey and Eichenberger 1994) and that financial decisions are not always presented to investors in a manner which assists optimal decision making (Henderson and Pearson 2011, Hirshleifer 2001). The importance of behavioural anomalies in this context is not really their presence or number, which is not addressed by this study, yet their possible use by banks when setting interest rates. Assuming banks rationally profit maximise and are aware that customers' discount the costs and benefits of switching decisions we both predict interest rate setting behaviours and test whether these predictions are consistent with the interest rate setting behaviours in the UK deposit market. As it is recognised that the actions and inaction of customers have a central role in how competition develops within a market (Scitovsky, 1950; Waterson 2003), this finding also has implications for the assessment of the competitiveness of these markets.

To address these research questions this study is structured into six sections. After this introduction a brief review of pertinent literatures is provided. In section three a model is developed for maximising bank profits when setting deposit interest rates. Within this model customer inertia is represented through the discounting of current and future costs

and benefits of switching deposit accounts quasi-hyperbolically and exponentially. In section four, the data and methods of analysis are outlined and section five provides results of the empirical assessment. Conclusions and recommendations for further research will be provided in section six.

2. Literature Review

This brief review considers many of the questions surrounding why pricing noise can develop in markets and why inertia and decision avoidance may contribute to these outcomes. This discussion does not aim to be comprehensive yet seeks to map the wider contours of these interrelated yet distinct debates.

2.1. Why does pricing noise develop in financial services markets?

Pricing noise in financial services markets is perhaps most clearly indicated by the dramatic growth in the number and pricing of savings products. For example, exploring the US mutual funds industry, Carlin and Manso (2010) report that in 2007 there were 8,029 mutual funds offered in the USA with 21,631 different share classes. These authors report that while financial institutions often offer a range of different product classes to appeal to different types of investor, the regular introduction of new savings products is consistent with obfuscation. They proposed that as financial services providers can profit more within markets populated with a greater proportion of poorly informed customers, firms will change savings products to alter the learning process of customers in order to maximise profits where the more the firm gains from non-expert investors the greater the incentive to introduce more products to obfuscate.

Similarly, Carlin (2009) reports pricing in retail financial markets does not conform with standard price theory with high levels of dispersion arising in many markets to maximise profits. It is suggested that producers of financial services create customer ignorance by making prices complex so many financial services customers are unaware of what they are buying through the use of fees and complex pricing structures and selective advertising. These forms of predictions have been built from a growing literature considering how pricing and product offerings by firms are influenced by a growing

comprehension as to how customers make decisions. For example Kamenica (2008) indicates beliefs of consumers may profitably be manipulated by firms. It is proposed the demands from uninformed consumers will increase with the presence of another product. Subsequently the firm can alter product lines to increase demand for the most profitable product varieties using approaches such as premium products, excessive choice and loss leaders, to attracting greater demand for services. In a similar vein Chio *et al* (2010) report variation in prices is sustained by high search costs or the marketing of these products rather the inclusion of additional services such as financial advice as claimed by investment providers. This perspective is also supported ejected by Elton *et al* (2004) who reported from experiments that almost none of the subjects minimised fees.

More widely these concerns reflect longer term concerns within economics as to the role of customer within the competitiveness of markets. Scitovsky (1950) emphasised the importance of limited buyers' information as a potential source of oligopoly power for firms with market organisation an outcome of buyer information. In particular reduced customer ability to appraise quality, leads to assessment using price where lower price only signal poor quality; a situation leading to a lower price elasticity of demand. Such predictions have pertinence as literatures examining the switching of banking services, report that, neither switching costs or bank specific characteristics are likely to impede a household from changing banks. For example Kim *et al* (2003) report that in loan markets switching costs may not only include psychological and hassle costs, yet also the loss of established relationships. Kiser (2002) using survey evidence to examine US bank switching behaviour reports the causes of why a bank customer wishes to switch or not switch banking services are largely unexplained, and according to Kiser, is most plausibly attributed to branch location (Kiser 2002).

2.2. The importance of customer inertia and decision avoidance

The potential for customers with limited information and decision making ability to display inertia, delaying or avoiding switching decisions, decision avoidance, status quo bias, and procrastination[1] is also widely observed in financial services investment markets. These

[1] Procrastination involves delaying an action rather than just avoiding a decision. This said "*definitions for procrastination tend to be almost as plentiful as the people researching the topic"* (Steel 2007).

outcomes have all been repeated identified within savings markets. In particular these behaviours are reported within enrolment and investment choice decisions for retirement saving. Customer enrolment decisions consider whether an individual opts to join a savings scheme or not. When presented by the choice to opt into such a scheme many individuals defer or have not made decisions despite the clear financial benefits of doing so. It is reported the enrolment of employees in defined contribution pension schemes, such as the US 401(k) scheme, differs when enrolment is undertaken automatically on behalf of the employee as opposed to when the employee has to actively decide to join a scheme (Madrian and Shea 2001). While employees often eventually enrol in savings schemes, the requirement to make a decision can delay this outcome (Choi *et al* 2004). Responding to these concerns Thaler and Benartzi (2004) propose individuals are automatically enrolled into saving schemes to raise enrolment and the level of retirement savings.

After enrolment, individuals need to decide what assets or funds should form their portfolio. These decisions are prone to many biases and rules of thumb, including naïve investment strategies in addition to decision avoidance. It is reported many investors stick to the default settings issued on savings plans and avoid the decision to change these attributes in the USA (Madrian and Shea 2001) and Australia (Fry *et al* 2007). Similarly, when assessing mutual funds, Kempf and Ruenzi (2006) report individuals select sub-optimal alternatives, as these were chosen before. The type of individual prone to such behaviour within financial markets is influenced by demographic variables (Choi *et al* 2004) such as levels of income (Agnew 2006). Stango and Zinman (2009) examining exponential growth bias[2] reports education, income, race and gender are influential in explaining this bias.

A growing, yet fragmented psychology literature has also examined why individuals opt to make no decision in face of changing circumstances. Decision avoidance while universally observed (Steel 2007) and a chronic condition amongst 15% to 20% of the population, is neither a clinical disorder nor does it fit easily with other branches of psychology resulting in this area being overlooked given the division of labour between fields of psychology (Anderson 2003). Unexpectedly, reasons advocated for decision avoidance are diverse and include rational and non-rational explanations (Samuelson and

[2] Exponential growth bias is reported to be isomorphic to hyperbolic discounting (Stango and Zinman 2009).

Zeckhauser 1988) including emotional maintenance, and inconsistencies in the perception of time.

Responding to such evidence of time inconsistencies in decision making, explanations have emerged linking this behaviour to an individuals' discounting of costs and benefits. Specifically, hyperbolic and quasi-hyperbolic discounting functions are forwarded to accommodate situations where exponential discounting approaches appear inappropriate. Hyperbolic discounting assumes individuals discount future monetary rewards at a higher rate than that used to calculate the present value of future monetary rewards (McClure *et al* 2004). As people discount future eventualities in a non-exponential manner, delayed rewards or costs are discounted by functions which are inversely proportional to the delay, reflecting the diminishing impatience of humans and discounting the future at a declining rate (Hepburn *et al* 2010). Quasi-hyperbolic discounting approaches employed in this study (Laibson 1997) have a greater and variable bias towards the present, a defined break point, and adopt distinct discount factors in different time periods (Hepburn *et al* 2010).[3]

Wider reviews of decision making in retirement and saving are provided by Benartzi and Thaler (2007) and Choi *et al* (2004), reviews of decision avoidance and procrastination are provided by Anderson (2003), Andreou (2007) and Steel (2007) and reviews of time inconsistencies in decision making are provided by Berns *et al* (2007) and Kalenscher and Pennartz (2008).

3. Time Inconsistencies and Deposit Interest Rating

[3] We readily acknowledge hyperbolic and quasi-hyperbolic discounting approaches have been repeatedly challenged. Concerns have arisen with the inability of hyperbolic discounting approaches to accommodate the size of costs or benefits, where discounting may be more rapid for smaller amounts rather than larger amounts (Kirby 1997), the stability of these forms of discounting over time and across populations, and the direction and sign of discounting where discounting may be more rapid for gains rather than losses (see Read 2001 and Soman *et al* 2005). Abdellaoui *et al* (2010) also reports that while utility is concave for gains and convex for losses as predicted by hyperbolic discounting, the evidence supporting the degree of curvature and evidence of immediacy bias reflected in quasi-hyperbolic discounting functions is limited. Other approaches have also emerged challenging assumptions central to hyperbolic discounting including future resource slack (Zauberman and Lynch 2005), the sub-additive form of time-discounting (Read 2001) and similarity biases (Rubinstein 2003). Notwithstanding this importance of these criticisms, Frederick *et al* (2002) reports the evidence of hyperbolic discounting as robust and Harris and Laibson (2001) indicates quasi-hyperbolic discounting approaches and the implied variation in impatience predicts observed patterns of pre-retirement wealth accumulation and co-movements observed within many savings markets.

The model assesses the influence of depositor inertia for switching deposit accounts for banks' deposit interest rate setting. This model develops from a general case from O'Donoghue and Rabin (1999), and considers how banks respond to situations where depositors discount switching benefits and costs distinctly. After model preliminaries are established and the general framework from O'Donoghue and Rabin (1999) is applied to decision making in deposit markets, two propositions are examined as to the impact on bank profits of employing one or multiple duplicate deposit accounts and deposit accounts of varying age. Lastly the model predictions to be empirically tested are forwarded.

3.1. Model Framework: Existing depositors and time inconsistent preferences

3.1.1. Model preliminaries. The depositor

Following O'Donoghue and Rabin (1999) we examine depositors with and without inconsistent time preferences. We assume existing depositors with a deposit balance *D* within a deposit product offered by a bank[4] will receive returns, *d,* with optimal balances denoted d^*. The decision to switch deposit accounts is made by the depositor and can occur in any of *t* time periods where $t = 1,\ldots,n$. When undertaking decisions the depositor faces two benefits or costs. Delay costs of not switching deposit accounts are encountered in future periods and are:

$$X_t^d = d_t - d_t^* \tag{1}$$

The marginal cost of delaying a decision to switch a deposit account is $X_{\Delta t}^d = X_t^d - X_{t+1}^d \geq 0$ for all *t* and when a depositor chooses to switch a deposit account the benefits in period *t*, are X_t^d . Task costs include the costs of finding an optimal alternative deposit account and the associated psychological influences. These unknown costs are encountered at the time of switching and have an immediate effect. Depositors are assumed to review their task costs before switching or not switching deposit accounts resulting in a distribution of possible task costs over *t* periods denoted by a cumulative distribution $\underline{c},\overline{c}$, $c \geq 0$ or $F\ c\ = 0$. In cases where a decision is deferred task costs are not encountered and the depositor will be aware that the task costs will need to be undertaken in the future.

[4] This classification is consistent with experimental evidence (Wong 2008) which reports individuals can be divided into groups which are aware and unaware of time inconsistencies in decision making.

3.1.2. Time consistent and inconsistent depositors.

As outlined in O'Donoghue and Rabin (1999a and 1999b) if u_t is the instantaneous utility a person gains in period *t*, then her intertemporal preferences at time *t*, U^t can be represented by the following utility function for all *t*:

$$U^t(u_t, u_{t+1}, ..., u_T) \equiv \delta^t u_t + \beta \sum_{\tau=t+1}^{T} \delta^\tau u_\tau \tag{2}$$

where δ represents long-run time consistent (exponential) discounting. This model includes two types of depositor – those depositors with consistent time preferences, who use exponential discounting $\beta = 1$ and time-inconsistent depositors which will discount future events more than by exponential discounting $\beta < 1$. A time consistent depositor $\beta = 1$ will therefore maximise her utility by choosing t to maximise:

$$U(x_1) = \delta^t \sum_{\tau=t}^{n} X_\tau^d \delta^\tau - c\delta^t \tag{3}$$

The depositor can maximise (3) by determining whether to incur the task costs *c* and, if so, when to incur them. It is only worth switching if

$$c \leq \sum_{\tau=t}^{n} X_\tau^d \delta^\tau \tag{4}$$

If it is worthwhile to switch deposit products, by induction, this should be done as soon as possible. If the switch were done at time *b*, then the resulting utility would be:

$$U(x_1) = \delta^b \sum_{\tau=b}^{n} X_\tau^d \delta^\tau - c\delta^b \tag{5}$$

If the switching were done at time *b-1*, then the resulting utility would be

$$U(x_1) = \delta^{b-1} \sum_{\tau=b-1}^{n} X_\tau^d \delta^\tau - c\delta^{b-1} \tag{6}$$

As delay costs vary over time, (6) will exceed (5); appoint where it is optimal to switch at the earliest possible time *t*.

As task and delay costs are appreciated either immediately or in the future, time inconsistent depositors will discount the potential future costs of delay by $\beta < 1$ and not

discount the immediate task costs. Subsequently these depositors will maximise utility by choosing *t* to maximise:

$$U(x_1) = \begin{cases} X_0^d + \sum_{\tau=t+1}^{n} \beta X_\tau^d \delta^\tau - c\delta^t & \text{if } t = 0 \\ \delta^t \sum_{\tau=t}^{n} \beta X_\tau^d \delta^\tau - c\beta\delta^t & \text{if } t > 0 \end{cases} \tag{7}$$

When values of β are close to zero indicating high level of discounting of future events, the potential to switch account may never resulting in the customer holding the original deposit account indefinitely acting as a money pump as predicted by O'Donohue and Rabin (1999). In other situations equation (7) indicates it is optimal to switch at some point in the future. The model indicates customers are more likely to switch accounts if they are less time inconsistent, if $\sum_{\tau=t}^{n} X_\tau^d = \sum_{\tau=t}^{n} d_t - d_t^*$ is large and the deposit account is relatively less competitive. For the bank, ceteris paribus, lower interest rates on deposit accounts will be more profitable.

3.2. Implications for the bank

In this section we consider how a profit maximising bank will set interest rates on deposit accounts. We assume that the bank is not subject to the behavioural biases that may affect its depositors and, in particular, will not suffer from time-inconsistent discounting. Further the bank is aware a proportion of its customers will quasi-hyperbolically discount future decision costs and benefits and employs this knowledge when managing its deposit portfolio and setting deposit interest rates to maximise its profits. This discussion is developed over two propositions considering, one, how a bank will set interest rates for a single deposit account over repeated time periods and depositors with varying time consistency in decision making, and two, how a bank will set interest rates for multiple deposit account over repeated time periods and depositors with varying time consistency in decision making.

Proposition 1: A bank will set interest rates for a single deposit account over repeated time periods and depositors with varying time consistency in decision making

If a bank currently provides a single deposit account it can alter the interest rate to maximise its profits. For simplicity we assume than general interest rates are constant over time and

that the demand functions the bank faces are set exogenously. Further, all factors (costs, market interest rates, demand curves etc.) except the interest rate on account *i* which the bank sets endogenously are assumed to be time invariant. The bank gains from each unit of deposit provision the current cost of funds[5] d^f minus the current returns on the deposit account offered, d_i for account *i* and the cost of providing this service per unit of deposit, d_c. This relationship is represented as:

$$X^b = d^f - d_i - d^c \tag{8}$$

where $D(d_i, x)$ be the exogenous demand in the market from people without the deposit account *i* given interest rate d_i and a vector *x* of other factors. If A_{it} is the actual amount of funds held in account *i* at time *t* then the bank profit, for deposit product *i*, is given by:

$$d^f - d_{it} - d^c \quad A \;\; d_{it}, x \tag{9}$$

Assuming the bank accommodates the expected behaviour of both existing customers and potential market demand, at time t+1 the bank will set the interest rate this account *i* at d_{it+1} to provide an overall profit of:

$$d^f - d_{it+1} - d^c \quad D \;\; d_{it+1}, x \;\; + P_i A_{it} \tag{10}$$

where is the probability of the original customers not switching account *i* and is a function of search costs, the size of the individual customer's funds, the time inconsistency of decision making and of the attractiveness of d_{it+1} compared to the market. Assuming that (10) a is a concave function of d_i the bank can chose the deposit rate that maximises, d_i^s. The bank can also act in a more sophisticated way to take advantage of time inconsistent customers by initially offering a high rate on deposit accounts to attract customers and then reducing the interest rate. This situation can be demonstrated over a two period model. For simplicity we neglect the time value of money when discounting profits from period 2. The expected profitability of the deposit account over a two period life is given by:

$$d^f - d_{it} - d^c \;\; D \;\; d_{it}, x \;\; + \;\; d^f - d_{it+1} - d^c \;\; \left[D \;\; d_{it+1}, x \;\; + P_i D \;\; d_{it}, x \;\; \right] \tag{11}$$

It can be show that profits will be maximised if d_{it}, the interest rate in the first period, is set high and then reduced in the second period. The degree of this variation in interest rates and the overall competitiveness of deposit interest rates will be a function of both the

[5] The current rate at which the bank can deploy the funds it obtains.

proportion of existing customers with inconsistent time preferences and demands for the potential new customers. Therefore a bank will set interest rates to balance the need for new depositors, customers which may switch as well as depositors needing a competitive rate resulting in competitive interest rates.

Proposition 2: How a bank will set interest rates for multiple deposit account over repeated time periods and depositors with varying time consistency in decision making.

The case of multiple deposit account provision is considered by assessing the case of a bank with one deposit account, account 1, at time *t,* and a second account (account 2) introduced at time *t+1*. If the bank does not introduce another account its overall profit at time *t+1* will be given by:

$$d^{f} - d_{1t+1} - d^{c} \quad D \;\; d_{1t+1}, x \;\; + P_1 A_{1t} \tag{12}$$

If the bank does introduce an additional account its profit at time *t+1* will be given by:

$$d^{f} - d_{1t+1} - d^{c} \quad D \;\; d_{1t+1}, x \;\; + P_1 A_{1t} \;\; + \;\; d^{s} - d_{2t+1} - d^{c} \;\; D \;\; d_{2t+1}, x \tag{13}$$

In equation (13) account 2 will attract customers from the general population in line with the rate offered; account 1 will attract some depositors from the general market but will also retain some existing time inconsistent depositors. This process essential involves price discrimination, where the bank has flexibility to reduce interest rates for existing depositors, yet may also offer a competitive deposit account for customers wishing to switch accounts and also potential new customers.

3.3. Predictions and Empirical Hypothesises

In summary we report the existence of underperforming accounts simultaneously with more competitive accounts can be a profit maximising strategy. Further, profit maximising banks should progressively reduce interest rates on existing deposit accounts and introduce new deposit accounts with higher interest rates. Therefore it is pertinent to empirically examine whether the presence of such underperforming accounts occurs, whether banks actually issue duplicate deposit accounts and critically if the introduction of new duplicate deposit accounts increases the proportion of underperforming deposit accounts. Therefore the age of the deposit account should have a significant influence on the level of interest provided.

4. Data and Methodology

This section begins by introducing a dataset of UK instant access deposit accounts (section 4.1), which we will use to perform both a descriptive analysis (section 4.2) and more in-depth econometric analysis (section 4.3) of the propositions introduced by our model in the previous section: does account age, or the number of similar accounts in the firms portfolio affect the return of those accounts?

4.1. Data employed in the study

The main source of data employed in the study is obtained from Moneyfacts who specialise in surveying UK financial institutions and producing a monthly magazine which collates interest rate data on a range of financial services products. This retail interest rate data for loans, mortgages and savings products is widely used by the financial press, the financial services industry, regulators, and in some academic research.

Starting in January 1990 and running until December 2008, the data we have obtained focuses on currently UK marketed savings products[6]. As before will denote this time-index $t = 1,...,T$. As the survey has matured, the dataset has become increasingly representative of the UK deposit taking market, probably now accounting for over 95% of all such available products. Despite other research using the Moneyfacts data, the time-span and market coverage represented by this particular dataset we believe is unique[7].

We limit our analysis to instant access branch based accounts, as, in line with our model introduced in section 3, we wish to investigate consumer choice where the consumer is able to switch accounts immediately something which wouldn't be possible in the case of notice accounts without monetary penalty[8]. The analysis is restricted to branch based accounts (and firms) since the pricing strategy of the firm for remote access accounts is likely to be

[6] As such, accounts which are classed as "closed issues" aren't included in our dataset. As we are using the data to examine the choice faced by a depositor at any point in time, the exclusion of closed issue accounts does not distort our analysis.

[7] Other papers which have used a smaller scale sample of the Moneyfacts data include: Fuertes *et al* (2010), Ashton (2009a, 2009b, 2002, 2001), Fuertes and Heffernan(2009), Ashton and Hudson (2008), Constanzo and Ashton (2006), Ashton and Letza (2003), Heffernan (2002).

[8] Typically equal to an amount of interest equal to the days notice forgone. As this penalty factor is not included in our decision making model, we exclude such accounts.

very different from branch based accounts and so the inclusion of such accounts might act to distort the analysis. Accounts are indexed $i = 1,...,n$.

For most types of deposit accounts, the interest rate paid by the firm depends upon the balance being invested, giving rise to 'tiered' interest rate structures. To explore whether the factors correlated with product pricing are tier dependent, we repeat our analysis for rates where initial balances are £500, £5k and £50k. The rate at time *t* for product *i* will therefore be denoted subsequently as $r500_{it}$, $r5000_{it}$, $r50000_{it}$ respectively.

To explore proposition 1 with regard to product age and pricing behaviour, as described in section 3.2, we calculate the number of months each product has been observed at each point in time, and denote this variable age_{it}. Likewise to explore proposition 2, we create a variable $products_{it}$ which represents the number of similar branch based instant access accounts available from a particular firm at time *t*[9].

Pricing strategies of the firm are also likely to be linked to wholesale market lending rates. Accordingly we use both a Bank of England Base Rate series, denote BR_t and the London Inter-Bank Offered Rate (LIBOR) – the rate at which banks can acquire short term funds - at horizons including overnight, one-week, one-month, two-months, and twelve-months, denoted $LIBOR_t^{1N}$, $LIBOR_t^{1W}$, $LIBOR_t^{1M}$, $LIBOR_t^{2M}$, $LIBOR_t^{12M}$ respectively[10].

Finally, we allow for not only a correlation between product rate and firm type, but also between rate and the size of the firm. In the former case we categorise firms as one of five types: large high-street banks (HSB), high-street building societies (HSBS), converted building societies (CBS), small banks (SB) or small building societies (SBS). A full set of (mutually exclusive) dummy variables is created to capture this information at the product level, denoted HSB_{it}, BS_{it}, CBS_{it}, SB_{it}, S_{it} respectively. To proxy the size of the institution, we

[9] In effect, this is the number of products each firm has in our dataset at each time period.

[10] Base Rate data was obtained from the Bank of England Statistical Interactive Database and represents the rate prevailing on the last day of the calendar month. LIBOR rates were obtained from the British Bankers Association.

use the asset size information from reported annual accounts[11]. In the subsequent analysis, $size_{it}$ is the variable which records the asset size (in £millions) of the accounts' distributor. In many cases firms have combined, and brands have become subsidiary undertakings within a larger group. Where this is the case, the asset size of the parent firm is used.

To investigate empirically the propositions introduced by our model including the link between product age and return, and product age and duplicate products, we present some rudimentary descriptive analysis of the data, as described above, in section 4.2, while we perform a more in-depth econometric analysis in section 4.3.

4.2. Descriptives

Given the changes in the consumer retail financial services market since 1990, not least the introduction of the voluntary Banking Code and subsequent regulation introduced by the FSA, it would seem indefensible to assume that products have been prices in an identical way by firms throughout or sample period. To account for this possibility, we subdivide the available data in to 4 distinct sub-periods: January 1990 to December 1994, January 1995 to December 1999, January 2000 to December 2004 and January 2005 to December 2008. Summary statistics of the data are presented in Table 1, split in to the 4 date sub-samples and, as discussed previously, the 3 opening deposit levels.

Considering first the statistics for the an opening balance of £500 there were, in the dataset, on average 65 instant access branch-based deposit products during the 1990-94 period. During the subsequent periods this number has markedly increased, particularly between the second and third sub-sample periods. The standard-deviation column would suggest that the largest fluctuations in the numbers of deposit accounts occurred during the third sub-sample period.

[11] Although in some cases information has been obtained directly from institutions reported financial reports, in most cases data was obtained from the Fame database.

Table 1: General Summary Statistics

	£500							
	1990-94		1995-99		2000-04		2005-08	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
N$^{o.}$ of deposit products	64.82	6.91	81.77	8.97	132.68	13.49	145.50	6.19
N$^{o.}$ of brands	60.58	4.58	62.72	2.85	66.80	2.35	70.77	1.02
N$^{o.}$ of brands which are sub-brands	4.88	0.80	6.52	1.89	16.02	3.01	15.29	2.24
N$^{o.}$ of products offered by each firm	1.07	0.05	1.30	0.13	1.98	0.16	2.06	0.09
Average age of product	28.55	9.64	42.31	5.08	47.58	9.01	69.80	4.28
Average 25th percentile rate	5.06	3.17	1.98	0.60	0.94	0.50	1.49	0.34
Average 50th percentile rate	6.72	2.78	2.90	0.67	1.62	0.67	2.47	0.38
Average 75th percentile rate	7.08	2.75	3.43	0.66	2.83	0.64	3.47	0.49
Months in period	60		60		60		48	

	£5,000							
	1990-94		1995-99		2000-04		2005-08	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
N$^{o.}$ of deposit products	69.53	10.26	100.92	13.93	155.88	14.05	165.92	10.21
N$^{o.}$ of brands	62.35	5.57	70.37	1.63	72.00	1.97	72.79	1.29
N$^{o.}$ of brands which are sub-brands	5.92	1.29	9.53	2.69	21.88	4.22	19.27	4.37
N$^{o.}$ of products offered by each firm	1.11	0.08	1.43	0.17	2.16	0.15	2.28	0.12
Average age of product	27.69	8.81	47.78	2.45	59.69	7.51	75.96	3.02
Average 25th percentile rate	6.81	2.86	2.79	0.73	1.44	0.65	1.82	0.36
Average 50th percentile rate	7.33	2.73	3.52	0.71	2.25	0.73	3.08	0.35
Average 75th percentile rate	7.60	2.74	3.97	0.68	3.45	0.72	3.88	0.47
Months in period	60		60		60		48	

	£50,000							
	1990-94		1995-99		2000-04		2005-08	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
N$^{o.}$ of deposit products	71.78	11.49	103.18	13.40	157.92	14.63	168.77	10.54
N$^{o.}$ of brands	62.35	5.57	70.48	1.63	72.42	2.19	73.15	1.50
N$^{o.}$ of brands which are sub-brands	5.92	1.29	9.53	2.69	22.03	4.25	19.33	4.33
N$^{o.}$ of products offered by each firm	1.15	0.10	1.46	0.16	2.18	0.15	2.31	0.12
Average age of product	27.30	8.60	47.49	2.83	59.78	7.18	75.24	2.98
Average 25th percentile rate	7.82	2.64	3.93	0.74	2.28	0.70	2.71	0.34
Average 50th percentile rate	8.25	2.62	4.46	0.71	3.02	0.74	3.57	0.35
Average 75th percentile rate	8.69	2.68	4.83	0.66	3.82	0.75	4.24	0.51
Months in period	60		60		60		48	

The number of distinct firm brands within the sample offering instant access branch deposit services has remained relatively consistent over the entire sample period, at between 60 and 70 firms. Note, however, that in the initial period the standard deviation is slightly higher, as a result of the Moneyfacts survey increasing the survey coverage.

The third row of the table represents the number of sub-brands trading in the market. This number has increased over time with the consolidation which has occurred within the UK financial services sector both as a result of mergers and acquisitions[12]. It is interesting to note that brands are often retained by new the new parent so potentially giving rise to different pricing strategies funding the same overall financial entity.

On average, the number of products marketed by each firm has risen from an average of around 1 to an average of 2. Further descriptive analysis will follow before the econometric analysis to explore the issue of whether these duplicate products are priced in a way consistent with firm profit maximising behaviour, as suggested by proposition 2.

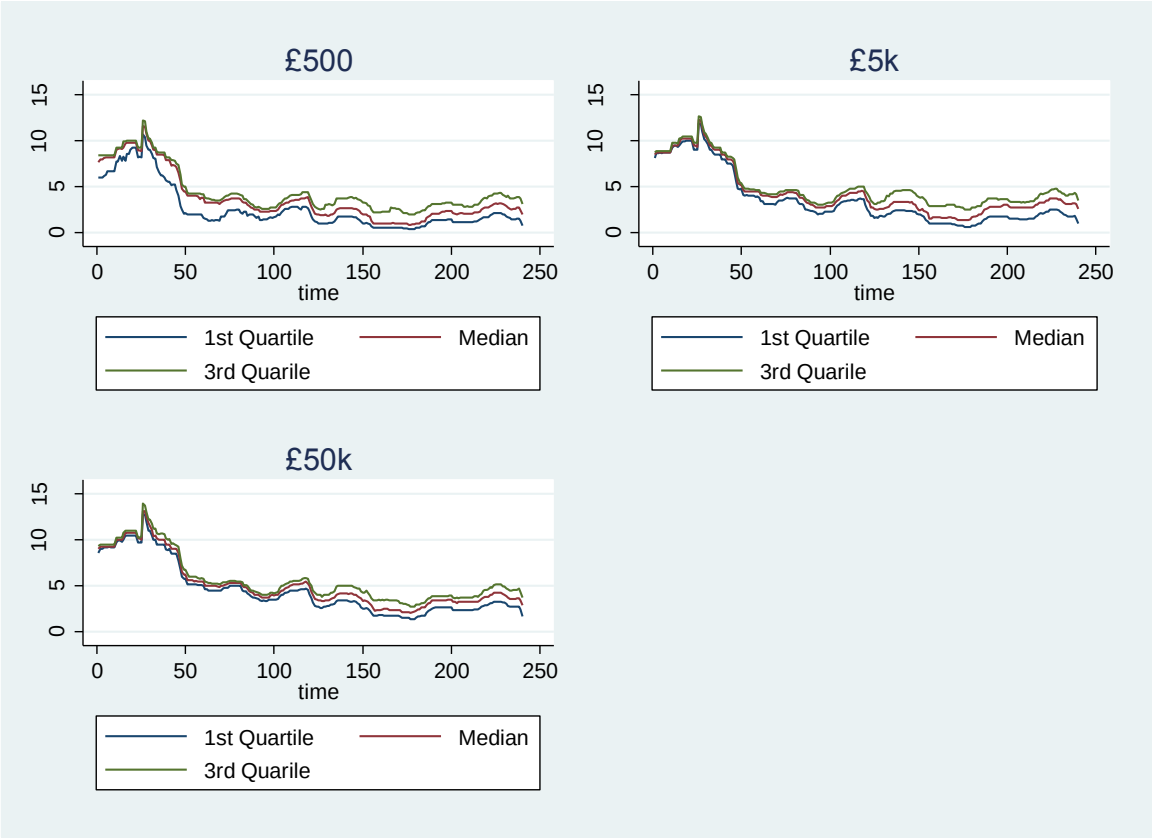
From proposition 1, we will explore where there is a negative relationship between the age of the product and the interest rate. As we can see in row 5 of Table 1 the average age of a product in months has increased in two distinct jumps – between the first and second sub-periods, and between the third and fourth. Firstly the jump between the third and fourth sub-periods has almost certainly been caused by institutions actively marketing older products for a longer time. In terms of the first to second period, the jump from an average of 29 months to an average of 42 months has probably been caused by the left censored due to unobservability of the age variable at the start of our sample. To account for this problem, and given that the second and third sub-periods have a consistent average product age, we will drop the first sample period in the subsequent econometric analysis, focussing instead on the 3 periods starting January 1995, January 2000 and January 2005.

The final collection of rows in the table gives some idea of rate distribution. A graphical representation of this is shown in Figure 1. It is interesting to note that despite the changes

[12] The average of firms includes both parents and subsidiary brands.

in Base Rate over the periods, the inter-quartile range has remained relatively constant at around 2 percent. For most sample periods, there would appear to be slight left skew (the mean account rate is smaller than the median, suggesting there are more accounts in the left tail of the distribution).

Figure 1: Rate Distributions



The general increasing trends explored above for deposit balances of £500 is a feature of the £5,000 and £50,000 initial deposit balances account data too. The main difference is that increases tend to be larger in magnitude (particularly for product age). The other interesting difference is that for balances of £50,000 the inter-quartile range of the rate distribution is significantly smaller – much nearer 1 percent on average.

Finally, comparing across deposit balances, the table suggests that more deposit services are available for larger balances. On average, larger balances also attract higher rates, the rate distribution being shifted to the right for this tier. Overall, this suggests that not only do

agents with more money to invest have more choice of where to invest, including in more mature accounts, but also that on average these accounts offer better returns.

The quartiles of the instant access branch account rate distribution at each point in time can be used to rank products returns. A product with a rate in the bottom quartile (Q1) at a particular time is given a value of 1, while one with a rate in the lower-middle quartile (Q2) is given 2, upper-middle 3 (Q3), and finally top quartile 4 (Q4). Using this ranking, it is possible to examine how the proportion of accounts which fall in to each of these quartiles is correlated with various factors, including product age, number of similar products, firm type and size.

Table 2 shows the proportion of accounts within each quartile dependent upon the number of similar accounts.

Table 2: Product Performance versus Number of Similar Firm Products

	£500											
	1990-94			1995-99			2000-04			2005-08		
	0	1-2	3+	0	1-2	3+	0	1-2	3+	0	1-2	3+
Q1	19.75%	42.47%	100.00%	16.16%	31.56%	28.05%	29.35%	26.61%	14.80%	28.99%	29.43%	15.01%
Q2	22.40%	28.61%	0.00%	20.68%	27.32%	27.44%	35.60%	31.92%	10.50%	43.04%	26.17%	17.75%
Q3	26.49%	14.61%	0.00%	34.38%	17.66%	4.88%	27.68%	23.13%	31.05%	12.97%	22.79%	32.59%
Q4	31.36%	14.31%	0.00%	28.78%	23.46%	39.63%	7.37%	18.34%	43.65%	15.00%	21.60%	34.66%
	£5k											
Q1	18.67%	39.98%	66.67%	17.27%	29.34%	30.43%	24.08%	28.83%	17.76%	31.34%	26.91%	18.11%
Q2	21.49%	25.98%	0.00%	21.53%	25.88%	14.49%	40.97%	32.76%	10.74%	39.47%	28.65%	15.37%
Q3	30.22%	14.12%	0.00%	33.64%	18.04%	16.43%	23.70%	21.39%	26.98%	9.87%	19.26%	36.99%
Q4	29.62%	19.93%	33.33%	27.57%	26.74%	38.65%	11.26%	17.02%	44.52%	19.32%	25.17%	29.53%
	£50k											
Q1	17.82%	35.95%	50.00%	17.11%	28.57%	31.13%	26.88%	27.58%	18.59%	30.84%	27.34%	17.90%
Q2	23.10%	21.18%	0.00%	27.97%	20.01%	30.19%	34.29%	32.63%	11.28%	34.27%	26.45%	16.99%
Q3	32.01%	15.81%	0.00%	29.05%	21.20%	13.68%	22.96%	23.01%	29.38%	12.50%	20.61%	38.68%
Q4	27.07%	27.07%	50.00%	25.87%	30.22%	25.00%	15.87%	16.79%	40.74%	22.39%	25.60%	26.43%

Notes:
Highlighting signifies the largest percentage in each category
Percentages represent the proportion of accounts which fall in to that category – hence columns add to 100%

Although in the first period, for small and medium sized initial balances, there is clear evidence to suggest that extra accounts are negatively correlated with account

performance, this observation is not consistent across other sample periods or balances. Indeed, in later periods, it would seem to be that where there are 3 or more similar products, the account is likely to be in the top quartile. Thus this tabulation would not seem to support proposition 2.

An analysis of product age versus product performance is shown in Table 3. This table measures age of the account in years. Given that the first period only contains 5 years, there is little scope for 'old' accounts, hence the table considers only those accounts of age 1 year, or 2 years and above. Likewise, in the second period, the top category can only be 6 years or over. However, in later periods, we are able to consider accounts over 10 years of age.

Table 3: Product Performance versus Age of Product

	£500												
	1990-94		1995-99			2000-04				2005-08			
	1	2 +	1	2 - 5	6 +	1	2 - 5	6 - 10	11+	1	2 - 5	6 - 10	11+
Q1	25.96%	23.62%	16.97%	21.89%	28.19%	7.33%	12.98%	34.41%	40.06%	6.20%	9.20%	22.66%	46.23%
Q2	17.55%	24.62%	18.19%	21.79%	28.33%	11.81%	17.44%	29.74%	39.81%	9.80%	19.88%	26.57%	39.15%
Q3	20.40%	25.19%	20.51%	25.27%	27.67%	31.96%	33.27%	25.34%	14.25%	38.46%	32.35%	25.78%	10.40%
Q4	36.09%	26.57%	44.32%	31.05%	15.81%	48.90%	36.31%	10.52%	5.88%	45.53%	38.56%	24.99%	4.22%
	£5k												
Q1	25.53%	22.76%	17.83%	21.97%	28.31%	8.79%	14.94%	35.25%	38.44%	6.66%	11.41%	25.68%	47.70%
Q2	18.53%	23.18%	16.75%	22.87%	26.85%	10.98%	17.44%	30.49%	47.75%	13.41%	18.85%	25.38%	36.67%
Q3	19.83%	28.50%	18.82%	22.87%	29.28%	28.41%	29.81%	23.29%	10.09%	26.64%	32.32%	28.99%	11.75%
Q4	36.10%	25.56%	46.60%	32.28%	15.56%	51.82%	37.81%	10.97%	3.71%	53.28%	37.43%	19.95%	3.88%
	£50k												
Q1	24.92%	21.47%	20.97%	22.43%	25.90%	7.98%	17.30%	30.95%	39.45%	6.98%	9.40%	30.13%	47.40%
Q2	19.07%	23.35%	18.74%	21.45%	28.20%	12.56%	16.73%	32.92%	42.07%	10.11%	14.17%	26.87%	38.63%
Q3	21.50%	29.82%	20.39%	22.74%	27.55%	22.54%	32.12%	25.58%	13.98%	29.52%	37.39%	28.61%	9.20%
Q4	34.51%	25.35%	39.90%	33.39%	18.35%	56.91%	33.84%	10.55%	4.50%	53.40%	39.04%	14.39%	4.77%

Notes:
Highlighting signifies the largest percentage in each category
Percentages represent the proportion of accounts which fall in to that category – hence columns add to 100%
Age of product is measured in years

Unlike in Table 2, a clear pattern emerges across all balances in both the third and fourth sub-periods to suggest that where an account is over 6 years old, it is more likely to be a poor performer. There is also evidence that this occurs in the second sub-period, but given the limited scope in terms of age of the first sub-period, no such patter arises. Hence this is further evidence for excluding this sub-period for the subsequent econometric analysis.

Table 4 and Table 5 show similar performance tabulations versus firm type and firm size respectively.

In terms of firm type Table 4 suggests that there are some similarities between the first 3 periods, across all tiers. On average, high-street and small banks tend to have products which fall in to the bottom two quartiles of the rate distribution. Conversely, high-street building societies have a large proportion of their accounts in the top quartile of the distribution. In the last sub-period, although high-street building societies still have the largest proportion of their accounts in the top quartile of the rate distribution, high-street banks and small banks appear to be pricing the largest proportion of their accounts more competitively.

Closely linked with institution type is the size of the institution. Table 5 suggests that in the early part of the sample, smaller institutions had larger proportions of accounts in the higher quartiles, while in the latter part of the sample it is instead larger firms which have a large proportion of account in the high rate distribution quartiles.

To conclude, the simple descriptive analysis of the dataset would suggest that account age, duplicate products, institution type and firm size are correlated to some extent with the performance of the product. As a number of these characteristics could co-vary, we next present a more detailed econometric analysis, which will allow for tests of *ceteris paribus* effects, having controlled for other factors.

Table 4: Product Performance versus Firm Type

	1990-94					1995-99					2000-04					2005-08				
	HSB	SBS	CBS	SB	HSBS	HSB	SBS	CBS	SB	HSBS	HSB	SBS	CBS	SB	HSBS	HSB	SBS	CBS	SB	HSBS
Q1	27.04%	15.22%	30.48%	67.26%	25.20%	7.39%	20.90%	33.76%	44.40%	24.39%	21.21%	19.37%	37.36%	43.05%	14.59%	7.30%	24.03%	39.83%	26.63%	15.90%
Q2	56.60%	24.89%	11.90%	17.04%	16.99%	48.70%	21.49%	27.58%	28.57%	22.75%	29.09%	28.88%	8.01%	22.67%	16.28%	24.12%	28.74%	14.78%	25.43%	21.76%
Q3	10.69%	27.29%	32.71%	3.36%	27.93%	28.70%	27.95%	22.16%	14.29%	20.49%	22.42%	30.75%	12.49%	31.24%	22.52%	47.57%	28.97%	20.70%	9.28%	11.63%
Q4	5.66%	32.60%	24.91%	12.33%	29.88%	15.22%	29.66%	16.49%	12.75%	32.38%	27.27%	21.00%	42.14%	3.05%	46.62%	21.02%	18.26%	24.70%	38.66%	50.71%
£5k																				
Q1	35.22%	13.56%	22.42%	75.89%	16.21%	18.39%	21.27%	37.37%	28.34%	28.06%	41.06%	19.52%	33.89%	32.85%	18.22%	17.90%	21.13%	24.83%	21.82%	11.70%
Q2	31.45%	25.58%	24.56%	8.04%	16.02%	42.53%	19.45%	30.67%	38.38%	20.74%	13.27%	32.66%	6.72%	33.81%	13.24%	24.59%	26.38%	13.15%	18.18%	5.90%
Q3	27.04%	29.92%	39.86%	3.74%	27.07%	19.92%	28.12%	15.55%	19.04%	21.14%	29.56%	27.82%	11.44%	17.51%	20.26%	34.00%	21.09%	12.36%	5.88%	25.18%
Q4	6.29%	30.93%	13.17%	12.34%	40.70%	19.16%	31.16%	16.41%	14.24%	30.05%	16.11%	20.00%	47.95%	15.83%	48.28%	6.15%	17.31%	33.22%	29.63%	26.71%
£50k																				
Q1	42.14%	12.70%	29.76%	65.98%	16.22%	28.74%	18.73%	52.28%	22.94%	29.82%	34.60%	20.31%	39.21%	21.12%	23.53%	21.72%	26.01%	34.19%	10.01%	19.48%
Q2	20.13%	24.26%	23.51%	16.26%	19.61%	33.33%	24.58%	25.73%	18.89%	20.05%	15.65%	32.46%	5.59%	34.16%	5.39%	14.55%	28.51%	13.70%	36.11%	9.63%
Q3	34.59%	31.81%	24.40%	6.92%	30.48%	11.11%	27.84%	7.88%	29.84%	16.79%	18.62%	25.50%	26.03%	22.78%	29.82%	41.60%	24.86%	24.97%	14.95%	35.18%
Q4	3.14%	31.22%	22.32%	10.84%	33.69%	26.82%	28.85%	14.11%	28.34%	33.33%	31.14%	21.73%	29.17%	21.95%	41.26%	22.13%	20.63%	27.14%	38.93%	35.71%

Notes:
Highlighting signifies the largest percentage in each category
Percentages represent the proportion of accounts which fall in to that category – hence columns add to 100%
HSB denotes high-street bank, SBS denotes small building society, CBS denotes converted building society, SB denotes small bank, and HSBS denotes high-street building society

Table 5: Product Performance versus Institution Size

	£500															
	1990-94				1995-99				2000-04				2005-08			
	<£500m	<£5b	<£50b	£50b+	<£500m	<£5b	<£50b	£50b+	<£500m	<£5b	<£50b	£50b+	<£500m	<£5b	<£50b	£50b+
Q1	9.71%	20.77%	38.22%	37.42%	13.54%	30.11%	33.79%	26.27%	20.72%	16.05%	24.43%	32.91%	27.89%	23.39%	17.81%	28.27%
Q2	22.12%	27.99%	14.77%	27.99%	19.40%	21.64%	33.15%	26.69%	28.99%	31.29%	15.81%	16.80%	32.37%	32.31%	16.48%	25.00%
Q3	23.50%	28.79%	25.44%	15.57%	30.01%	29.00%	14.46%	24.44%	30.56%	31.14%	20.09%	23.22%	21.97%	29.51%	23.00%	25.00%
Q4	44.67%	22.45%	21.57%	19.03%	37.06%	19.25%	18.60%	22.60%	19.73%	21.52%	39.67%	27.07%	17.77%	14.78%	42.71%	21.73%
	£5k															
Q1	6.87%	17.62%	34.50%	48.37%	12.61%	24.11%	39.48%	27.80%	16.48%	19.86%	24.76%	35.17%	27.75%	21.46%	20.30%	30.51%
Q2	22.15%	26.42%	19.72%	17.87%	16.09%	23.12%	34.74%	25.34%	35.57%	32.99%	14.88%	15.18%	35.17%	38.11%	6.86%	25.53%
Q3	30.48%	27.94%	26.62%	18.16%	31.04%	28.90%	11.80%	23.09%	33.98%	24.78%	13.84%	21.06%	21.93%	22.01%	32.57%	19.68%
Q4	40.50%	28.02%	19.17%	15.60%	40.26%	23.87%	13.98%	23.77%	13.97%	22.37%	46.52%	28.58%	15.15%	18.42%	40.27%	24.28%
	£50k															
Q1	8.71%	14.07%	33.78%	46.10%	12.37%	14.86%	45.42%	34.30%	20.21%	18.82%	31.59%	29.21%	27.71%	26.33%	20.07%	24.55%
Q2	26.36%	23.80%	18.47%	18.30%	20.95%	31.96%	22.21%	18.61%	36.58%	31.85%	4.37%	19.11%	35.15%	29.59%	11.40%	24.98%
Q3	30.56%	32.26%	23.57%	21.84%	31.72%	24.95%	16.48%	17.15%	31.11%	19.24%	30.50%	24.25%	18.21%	24.66%	36.11%	22.76%
Q4	34.37%	29.87%	24.18%	13.76%	34.96%	28.22%	15.90%	29.93%	12.09%	30.09%	33.54%	27.43%	18.94%	19.41%	32.42%	27.71%

Notes:
Highlighting signifies the largest percentage in each category
Percentages represent the proportion of accounts which fall in to that category – hence columns add to 100%

4.3. Econometric Analysis

For the reasons mentioned previously, the econometric analysis presented will focus on three of the sub-periods, namely January 1995 to December 1999, January 2000 to December 2004 and January 2005 to December 2008. For variables such as the interest rate variable, eg $b500_{it}$, we will add a superscript *m* of the period, where $m = 1,2,3$.

First we investigate the relationship between the account rate and the factors introduced previously, namely the size of the firm, the type of firm, the age of the product and the number of similar products offered by the firm. To allow for the age, number of products and firm size to have a non-linear relationship with the rate of interest, squares of these variables are also included in the model. Finally, to control for changing macroeconomic market rates, a lagged-base rate term is included. In summary, for all time periods the following models are estimated:

$$\begin{aligned} b500_{it} = \alpha_i + \delta_0 + \delta_1 BR_{it-1} + \delta_2 HSBS_{it} + \delta_3 SB_{it} + \delta_4 CBS_{it} + \delta_5 SBS_{it} + \delta_6 size_{it} \\ + \delta_7 sizeSq_{it} + \delta_8 age_{it} + \delta_9 ageSq_{it} + \delta_{10} products_{it} + \delta_{11} productsSq_{it} + u_{it} \end{aligned} \tag{14}$$

$$\begin{aligned} b5000_{it} = \alpha_i + \delta_0 + \delta_1 BR_{it-1} + \delta_2 HSBS_{it} + \delta_3 SB_{it} + \delta_4 CBS_{it} + \delta_5 SBS_{it} + \delta_6 size_{it} \\ + \delta_7 sizeSq_{it} + \delta_8 age_{it} + \delta_9 ageSq_{it} + \delta_{10} products_{it} + \delta_{11} productsSq_{it} + u_{it} \end{aligned} \tag{15}$$

$$\begin{aligned} b50000_{it} = \alpha_i + \delta_0 + \delta_1 BR_{it-1} + \delta_2 HSBS_{it} + \delta_3 SB_{it} + \delta_4 CBS_{it} + \delta_5 SBS_{it} + \delta_6 size_{it} \\ + \delta_7 sizeSq_{it} + \delta_8 age_{it} + \delta_9 ageSq_{it} + \delta_{10} products_{it} + \delta_{11} productsSq_{it} + u_{it} \end{aligned} \tag{16}$$

Note that as a constant term is included, the HSB_{it} dummy variable is excluded to avoid exact multicollinearity with the other firm dummies. As such, high-street banks are base category, captured by the constant term, while the other dummies measure differences from this base category. Both the age and products variables are recentered slightly by subtracting one from both variables. This therefore means that these variables will measure the effect of an 'extra' account or month.

An account specific (individual) effect term is included as it cannot be assumed that all accounts have the same intercept term. Estimating the account specific effect directly would require a full set of account dummies (fixed effects) to be included. Instead, therefore, a

random effect framework is used where by the error terms are corrected for the correlation across time caused by the α_i. The Rogers (1991) methodology is used to control for this correlation (or clustering) during estimation, so correcting estimated standard-errors.

Given the distribution of interest rates over time is non-normal, the use of standard asymptotic inference might be misleading. Accordingly, all estimated statistics are bootstrapped[13] using a cluster robust bootstrap technique, so accommodating the individual account effect in the resampling routine.

The results of estimating models (14), (15) and (16) using the methodology outlined above are presented in Table 6.

For most tiers and most time periods, results suggest a strong *ceteris paribus* role for account age. The effect of an extra month in the life of the product is, as might be expected, negatively correlated with the rate paid on that product. For all except the £50,000 tier in the first sub-period, the age effect is significant at the 1% level. Generally too, the age squared term, capturing the effect of larger increases in account age, is significant. The slightly positive coefficient suggests that the reduction in the rate paid is reduced slightly for higher account ages. This result is supportive of proposition 1, and confirms the descriptive analysis of Table 3.

[13] With 500 replications

Table 6

Panel A: 1995 - 1999	£500			£5,000			£50,000		
	Coefficient	Std. Err.		Coefficient	Std. Err.		Coefficient	Std. Err.	
Base Rate Lagged	0.7119	(0.0496)	***	0.8051	(0.0383)	***	0.8556	(0.0324)	***
Type: Small Building Society	0.5701	(0.4368)		0.0179	(0.4350)		-0.2051	(0.5120)	
Type: Converted BS	-0.1730	(0.3779)		-0.4139	(0.3647)		-0.6122	(0.3980)	
Type: Small Bank	-0.3137	(0.5946)		-0.3165	(0.5582)		-0.2648	(0.7992)	
Type: High-Street Build. Soc.	0.6759	(0.4650)		0.1854	(0.4305)		0.0361	(0.5249)	
Firm Assets	3.91E-06	(0.0000)		-1.43E-05	(0.0000)		-1.46E-05	(0.0000)	
Firm Assets Squared	3.63E-12	(0.0000)		8.71E-11	(0.0000)	*	7.99E-11	(0.0000)	
Extra Prod	-0.5230	(0.2519)	**	-0.3308	(0.1844)	*	-0.2605	(0.1901)	
Extra Prod Squared	0.1250	(0.0811)		0.1017	(0.0602)	*	0.0681	(0.0518)	
Extra Age	-0.0235	(0.0070)	***	-0.0173	(0.0061)	***	-0.0094	(0.0072)	
Extra Age Squared	1.42E-04	(0.0001)	**	8.93E-05	(0.0001)	*	3.95E-05	(0.0001)	
Constant	-1.3922	(0.5613)	**	-0.9163	(0.5487)	*	-0.3828	(0.6475)	

Panel B: 2000 - 2004	£500			£5,000			£50,000		
	Coefficient	Std. Err.		Coefficient	Std. Err.		Coefficient	Std. Err.	
Base Rate Lagged	0.6136	(0.0454)	***	0.6930	(0.0413)	***	0.7695	(0.0350)	***
Type: Small Building Society	0.5788	(0.5143)		0.8915	(0.4777)	*	0.3823	(0.5573)	
Type: Converted BS	0.4786	(0.4120)		0.7012	(0.4122)	*	0.0324	(0.4698)	
Type: Small Bank	-0.0028	(0.4438)		0.5804	(0.4650)		0.3457	(0.5173)	
Type: High-Street Build. Soc.	1.0652	(0.5649)	*	1.3445	(0.5063)	***	0.6601	(0.5875)	
Firm Assets	1.18E-06	(0.0000)		2.26E-06	(0.0000)		7.48E-07	(0.0000)	
Firm Assets Squared	-1.45E-12	(0.0000)		-4.05E-12	(0.0000)		-1.99E-12	(0.0000)	
Extra Prod	0.1720	(0.0637)	***	0.0719	(0.0645)		-0.0220	(0.0641)	
Extra Prod Squared	-0.0081	(0.0047)	*	0.0007	(0.0048)		0.0066	(0.0048)	
Extra Age	-0.0204	(0.0042)	***	-0.0221	(0.0041)	***	-0.0202	(0.0036)	***
Extra Age Squared	6.56E-05	(0.0000)	***	6.57E-05	(0.0000)	***	6.46E-05	(0.0000)	***
Constant	-0.9009	(0.6374)		-0.8928	(0.6195)		-0.1344	(0.6220)	

Panel C: 2005 - 2008	£500			£5,000			£50,000		
	Coefficient	Std. Err.		Coefficient	Std. Err.		Coefficient	Std. Err.	
Base Rate Lagged	0.7625	(0.0437)	***	0.7315	(0.0431)	***	0.7164	(0.0395)	***
Type: Small Building Society	0.2423	(0.4361)		0.4625	(0.4963)		0.2614	(0.5006)	
Type: Converted BS	0.0154	(0.3827)		0.4220	(0.4091)		-0.0253	(0.4039)	
Type: Small Bank	0.8066	(0.5375)		0.7213	(0.5184)		0.4970	(0.5084)	
Type: High-Street Build. Soc.	0.8150	(0.4608)	*	1.1146	(0.5090)	**	0.7586	(0.5051)	
Firm Assets	1.98E-07	(0.0000)		2.97E-07	(0.0000)		2.37E-07	(0.0000)	
Firm Assets Squared	-9.62E-14	(0.0000)		-1.44E-13	(0.0000)		-1.30E-13	(0.0000)	
Extra Prod	0.0851	(0.0716)		0.0180	(0.0616)		-0.0464	(0.0574)	
Extra Prod Squared	-0.0044	(0.0047)		0.0022	(0.0041)		0.0042	(0.0038)	
Extra Age	-0.0158	(0.0045)	***	-0.0196	(0.0039)	***	-0.0188	(0.0036)	***
Extra Age Squared	2.99E-05	(0.0000)		4.44E-05	(0.0000)	**	4.64E-05	(0.0000)	***
Constant	-0.6543	(0.5370)		-0.1596	(0.5807)		0.6724	(0.5811)	

Notes:
*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All statistics are bootstrapped using a cluster robust bootstrap controlling for the individual account effect.

The effect of an extra product is most significant for the £500 tier in the first and second sub-sample periods. Interestingly the sign of this coefficient is different in the two time periods, being negative in the first, and positive in the second. A positive coefficient concurs with proposition 2 that, in that a new high-interest account would pull up the average rate across all products that the firm offers. A negative coefficient in the first period however suggests that new accounts are pulling down the average rate, something which is difficult to explain. There is marginal significance of this coefficient for balances of £5,000 in the first sub-period, again with a negative coefficient. In all other cases this coefficient is insignificant, perhaps suggesting that product age rather than duplicate products is a more relevant factor in product pricing. There is little significance in for the non-linear products term, perhaps due to the generally small number involved.

Firm assets are generally an insignificant factor (perhaps erroneous significance occurring in Panel A at the £5,000 tier). The non-linear terms is always insignificant. There is however, likely to be a strong relationship between size and institution type. Despite this there is only marginal significance in Panel B and Panel C for the high-street building societies, a type which is probably most correlated with the base group, and so least affected by collinearity with size. In the 4 cases where this dummy variable is significant, the term is positive, suggesting that these types of firm set interest rates for products significantly higher than that of high-street banks. The significance being confined to the second and third sub-period is perhaps caused by the need for large mutuals to demonstrate the 'mutual advantage' to members in terms of better product pricing, following the wave of conversions in the preceding period. It is interesting to note that firm type is never significant at the £50,000 tier, suggesting perhaps all types of firm price competitively at this tier to try to attract large funds (perhaps as a result of economies of scale in administration costs for the firm with such deposits).

Finally, the lagged base rate is always significant at the 1% level. This, along with the other factors, appears to capture most of the mean shift effect in terms of product interest rates, since the constant term is only significant for two tiers in Panel A.

The next step of our econometric analysis is to remove the insignificant firm size variables and also the generally insignificant firm type dummies. We wish to see whether the finding regarding the age and the number of similar products is robust to this new specification. Also, in an attempt to explain further the average pricing of the products, we include the LIBOR market interest rates, both lagged and contemporaneous. Unfortunately these aren't always available for the full sample period, so in the first sub-sample the following models are estimated:

$$\begin{aligned} b500_{it}^{1} = {} & \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1M} + \beta_2 LIBOR_{it-1}^{1M} + \beta_3 LIBOR_{it}^{2M} + \beta_4 LIBOR_{it-1}^{2M} + \\ & \beta_5 LIBOR_{it}^{12M} + \beta_6 LIBOR_{it-1}^{12M} + \beta_7 BR_{it} + \beta_8 BR_{it-1} + \\ & \beta_9 age_{it} + \beta_{10} ageSq_{it} + \beta_{11} products_{it} + \beta_{12} productsSq_{it} + u_{it} \end{aligned} \tag{17}$$

$$\begin{aligned} b5000_{it}^{1} = {} & \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1M} + \beta_2 LIBOR_{it-1}^{1M} + \beta_3 LIBOR_{it}^{2M} + \beta_4 LIBOR_{it-1}^{2M} + \\ & \beta_5 LIBOR_{it}^{12M} + \beta_6 LIBOR_{it-1}^{12M} + \beta_7 BR_{it} + \beta_8 BR_{it-1} + \\ & \beta_9 age_{it} + \beta_{10} ageSq_{it} + \beta_{11} products_{it} + \beta_{12} productsSq_{it} + u_{it} \end{aligned} \tag{18}$$

$$\begin{aligned} b50000_{it}^{1} = {} & \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1M} + \beta_2 LIBOR_{it-1}^{1M} + \beta_3 LIBOR_{it}^{2M} + \beta_4 LIBOR_{it-1}^{2M} + \\ & \beta_5 LIBOR_{it}^{12M} + \beta_6 LIBOR_{it-1}^{12M} + \beta_7 BR_{it} + \beta_8 BR_{it-1} + \\ & \beta_9 age_{it} + \beta_{10} ageSq_{it} + \beta_{11} products_{it} + \beta_{12} productsSq_{it} + u_{it} \end{aligned} \tag{19}$$

The results of estimating equations (17), (18) and (19) for the first sub-period, using the cluster robust bootstrapping random-effects methodology outlined previously are shown in Panel A of Table 7.

For the second sub-period the one week LIBOR rate is also available, and so the following models are proposed:

$$\begin{aligned} b500_{it}^{1} = {} & \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1W} + \beta_2 LIBOR_{it-1}^{1W} + \beta_3 LIBOR_{it}^{1M} + \beta_4 LIBOR_{it-1}^{1M} + \\ & \beta_5 LIBOR_{it}^{2M} + \beta_6 LIBOR_{it-1}^{2M} + \beta_7 LIBOR_{it}^{12M} + \beta_8 LIBOR_{it-1}^{12M} + \beta_9 BR_{it} + \\ & \beta_{10} BR_{it-1} + \beta_{11} age_{it} + \beta_{12} ageSq_{it} + \beta_{13} products_{it} + \beta_{14} productsSq_{it} + u_{it} \end{aligned} \tag{20}$$

$$\begin{aligned} b5000_{it}^{1} = {} & \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1W} + \beta_2 LIBOR_{it-1}^{1W} + \beta_3 LIBOR_{it}^{1M} + \beta_4 LIBOR_{it-1}^{1M} + \\ & \beta_5 LIBOR_{it}^{2M} + \beta_6 LIBOR_{it-1}^{2M} + \beta_7 LIBOR_{it}^{12M} + \beta_8 LIBOR_{it-1}^{12M} + \beta_9 BR_{it} + \\ & \beta_{10} BR_{it-1} + \beta_{11} age_{it} + \beta_{12} ageSq_{it} + \beta_{13} products_{it} + \beta_{14} productsSq_{it} + u_{it} \end{aligned} \tag{21}$$

$$b50000_{it}^{1} = \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1W} + \beta_2 LIBOR_{it-1}^{1W} + \beta_3 LIBOR_{it}^{1M} + \beta_4 LIBOR_{it-1}^{1M} + \beta_5 LIBOR_{it}^{2M} + \beta_6 LIBOR_{it-1}^{2M} + \beta_7 LIBOR_{it}^{12M} + \beta_8 LIBOR_{it-1}^{12M} + \beta_9 BR_{it} + \beta_{10} BR_{it-1} + \beta_{11} age_{it} + \beta_{12} ageSq_{it} + \beta_{13} products_{it} + \beta_{14} productsSq_{it} + u_{it} \quad (22)$$

The results of estimating equation (20), (21) and (22) on the second sub-sample are shown in Panel B of Table 7.

Finally in the third sub-period, the overnight LIBOR rate is also available, and so the following models are proposed:

$$b500_{it}^{1} = \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1N} + \beta_2 LIBOR_{it-1}^{1N} + \beta_3 LIBOR_{it}^{1W} + \beta_4 LIBOR_{it-1}^{1W} + \beta_5 LIBOR_{it}^{1M} + \beta_6 LIBOR_{it-1}^{1M} + \beta_7 LIBOR_{it}^{2M} + \beta_8 LIBOR_{it-1}^{2M} + \beta_9 LIBOR_{it}^{12M} + \beta_{10} LIBOR_{it-1}^{12M} + \beta_{11} BR_{it} + \beta_{12} BR_{it-1} + \beta_{13} age_{it} + \beta_{14} ageSq_{it} + \beta_{15} products_{it} + \beta_{16} productsSq_{it} + u_{it} \quad (23)$$

$$b5000_{it}^{1} = \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1N} + \beta_2 LIBOR_{it-1}^{1N} + \beta_3 LIBOR_{it}^{1W} + \beta_4 LIBOR_{it-1}^{1W} + \beta_5 LIBOR_{it}^{1M} + \beta_6 LIBOR_{it-1}^{1M} + \beta_7 LIBOR_{it}^{2M} + \beta_8 LIBOR_{it-1}^{2M} + \beta_9 LIBOR_{it}^{12M} + \beta_{10} LIBOR_{it-1}^{12M} + \beta_{11} BR_{it} + \beta_{12} BR_{it-1} + \beta_{13} age_{it} + \beta_{14} ageSq_{it} + \beta_{15} products_{it} + \beta_{16} productsSq_{it} + u_{it} \quad (24)$$

$$b50000_{it}^{1} = \alpha_i + \beta_0 + \beta_1 LIBOR_{it}^{1N} + \beta_2 LIBOR_{it-1}^{1N} + \beta_3 LIBOR_{it}^{1W} + \beta_4 LIBOR_{it-1}^{1W} + \beta_5 LIBOR_{it}^{1M} + \beta_6 LIBOR_{it-1}^{1M} + \beta_7 LIBOR_{it}^{2M} + \beta_8 LIBOR_{it-1}^{2M} + \beta_9 LIBOR_{it}^{12M} + \beta_{10} LIBOR_{it-1}^{12M} + \beta_{11} BR_{it} + \beta_{12} BR_{it-1} + \beta_{13} age_{it} + \beta_{14} ageSq_{it} + \beta_{15} products_{it} + \beta_{16} productsSq_{it} + u_{it} \quad (25)$$

Panel C of Table 7 shows the results of estimating equations (23), (24) and (25) on the third sub-period using the cluster robust bootstrapped random effects procedure outlined above.

Table 7

Panel A: 1995 - 1999	£500			£5,000			£50,000		
	Coefficient	Std. Err.		Coefficient	Std. Err.		Coefficient	Std. Err.	
LIBOR 1 Month	-0.8135	(0.2185)	***	-0.8493	(0.1769)	***	-0.4423	(0.1676)	***
LIBOR 1 Month Lagged	-0.1692	(0.1197)		-0.2529	(0.0970)	***	-0.0317	(0.0861)	
LIBOR 2 Month	-0.0166	(0.2866)		-0.1750	(0.2076)		-0.6005	(0.2037)	***
LIBOR 2 Month Lagged	-0.0777	(0.1939)		-0.1773	(0.1433)		-0.3680	(0.1426)	***
LIBOR 12 Month	0.0043	(0.0606)		-0.0163	(0.0412)		0.0682	(0.0410)	*
LIBOR 12 Month Lagged	0.0189	(0.1260)		0.1042	(0.0895)		0.2061	(0.0865)	**
Base Rate	0.7788	(0.1292)	***	0.9228	(0.0958)	***	0.8583	(0.0916)	***
Base Rate Lagged	0.9832	(0.1538)	***	1.2632	(0.1105)	***	1.2131	(0.0984)	***
Extra Prod	-0.6087	(0.2136)	***	-0.3842	(0.1784)	**	-0.2711	(0.1683)	
Extra Prod Squared	0.1428	(0.0728)	**	0.1032	(0.0586)	*	0.0611	(0.0520)	
Extra Age	-0.0266	(0.0067)	***	-0.0176	(0.0060)	***	-0.0087	(0.0063)	
Extra Age Squared	1.62E-04	(0.0001)	***	9.14E-05	(0.0001)	*	3.19E-05	(0.0001)	
Constant	-0.5975	(0.4399)		-0.8954	(0.3582)	**	-0.8480	(0.3499)	**

Panel B: 2000 - 2004	£500			£5,000			£50,000		
	Coefficient	Std. Err.		Coefficient	Std. Err.		Coefficient	Std. Err.	
LIBOR 1 Week	0.0155	(0.0225)		-0.0029	(0.0230)		0.0286	(0.0196)	
LIBOR 1 Week Lagged	-0.1065	(0.0242)	***	-0.1118	(0.0287)	***	-0.0569	(0.0228)	**
LIBOR 1 Month	-1.3353	(0.3428)	***	-0.8561	(0.3504)	**	-0.8155	(0.3110)	***
LIBOR 1 Month Lagged	0.8725	(0.2575)	***	0.7643	(0.2333)	***	0.4483	(0.1942)	**
LIBOR 2 Month	2.5906	(0.4833)	***	1.9768	(0.4748)	***	1.5331	(0.4210)	***
LIBOR 2 Month Lagged	-0.1572	(0.2308)		0.0334	(0.1939)		0.0106	(0.1501)	
LIBOR 12 Month	-0.5707	(0.1027)	***	-0.5119	(0.0916)	***	-0.3597	(0.0816)	***
LIBOR 12 Month Lagged	-0.1385	(0.0432)	***	-0.1592	(0.0430)	***	-0.0858	(0.0322)	***
Base Rate	-0.4552	(0.1363)	***	-0.3575	(0.1211)	***	-0.1962	(0.1132)	*
Base Rate Lagged	-0.1019	(0.1497)		-0.0849	(0.1419)		0.2615	(0.1196)	**
Extra Prod	0.2095	(0.0615)	***	0.0901	(0.0637)		-0.0183	(0.0618)	
Extra Prod Squared	-0.0104	(0.0047)	**	-0.0002	(0.0048)		0.0067	(0.0046)	
Extra Age	-0.0213	(0.0041)	***	-0.0233	(0.0040)	***	-0.0206	(0.0037)	***
Extra Age Squared	7.32E-05	(0.0000)	***	7.64E-05	(0.0000)	***	7.04E-05	(0.0000)	***
Constant	-0.3158	(0.3608)		0.0374	(0.3347)		0.2351	(0.3125)	

Panel C: 2005 - 2008	£500			£5,000			£50,000		
	Coefficient	Std. Err.		Coefficient	Std. Err.		Coefficient	Std. Err.	
LIBOR Overnight	-0.2211	(0.0792)	***	-0.1326	(0.0768)	*	-0.0807	(0.0714)	
LIBOR Overnight Lagged	-0.2514	(0.0868)	***	-0.1931	(0.0848)	**	-0.1304	(0.0826)	
LIBOR 1 Week	0.4783	(0.2000)	**	0.1367	(0.2004)		0.0676	(0.1991)	
LIBOR 1 Week Lagged	2.3933	(0.3010)	***	1.9993	(0.2910)	***	1.7092	(0.2808)	***
LIBOR 2 Week	-0.0086	(0.2749)		0.4182	(0.2771)		0.3589	(0.2489)	
LIBOR 2 Week Lagged	-4.0221	(0.4243)	***	-3.4132	(0.4134)	***	-3.0189	(0.3725)	***
LIBOR 1 Month	-0.8694	(0.1801)	***	-0.9210	(0.1786)	***	-0.7713	(0.1461)	***
LIBOR 1 Month Lagged	1.0326	(0.1380)	***	0.8193	(0.1459)	***	0.7617	(0.1292)	***
LIBOR 2 Month	0.6574	(0.0695)	***	0.5741	(0.0702)	***	0.4986	(0.0611)	***
LIBOR 2 Month Lagged	0.6117	(0.0785)	***	0.5456	(0.0804)	***	0.4629	(0.0672)	***
LIBOR 12 Month	0.0245	(0.0719)		-0.0182	(0.0656)		-0.0512	(0.0572)	
LIBOR 12 Month Lagged	0.0356	(0.0437)		0.0544	(0.0441)		0.0331	(0.0419)	
Base Rate	-0.4194	(0.0711)	***	-0.4161	(0.0715)	***	-0.3255	(0.0612)	***
Base Rate Lagged	1.3944	(0.1242)	***	1.3588	(0.1158)	***	1.2675	(0.0998)	***
Extra Prod	0.1044	(0.0735)		0.0490	(0.0618)		-0.0244	(0.0572)	
Extra Prod Squared	-0.0059	(0.0050)		-0.0003	(0.0043)		0.0025	(0.0040)	
Extra Age	-0.0156	(0.0039)	***	-0.0178	(0.0038)	***	-0.0178	(0.0035)	***
Extra Age Squared	2.52E-05	(0.0000)		3.46E-05	(0.0000)	**	4.10E-05	(0.0000)	***
Constant	-0.7623	(0.3606)	**	-0.1340	(0.3372)		0.5887	(0.3096)	*

The results shown Table 7 in general mirror those of the previous analysis, shown in Table 6, in terms of the significance, size, and sign of both the extra product and age terms. In this model, however, the non-linear age terms are generally significant. So this model confirms that adding an extra month to the age of the product generally lowers the interest rate paid by 0.2 percent.

Market rates, both lagged and contemporaneous are generally highly significant, offering information content beyond that held in just the base rate. It is interesting to note that in both the £500 and £5,000 tier in the first sub-period, the longer range LIBOR rates are insignificant, which is quite different to later periods and the £50,000 tier. The constant term, however, is significant in more cases, suggesting that the average rate effect is a product of the firm type too.

From this analysis, we have relatively strong support for the hypothesis that age of the account is negatively correlated with the interest rate. There is some significance for firm effects too, particularly large building societies. Having investigated the issue of market rates, it appears that a number of market rates are highly correlated with movements in the interest rate, and not just the base rate. Finally, with regard to the number of duplicate products, there is rather sporadic evidence that this might be correlated with the rate paid, and so empirically based on the econometric analysis, we don't find strong support for proposition 2.

4.4. Empirical Analysis Summary

Our analysis has taken a two-stage approach. Firstly our descriptive analysis found strong evidence for the influence of product age. This analysis also suggested there may be a role for both firm size, firm type and number of similar products. Our second approach was to use an econometric model to examine *ceteris paribus* effects and these models confirmed the finding with regard to product age. There was also some support for firm type pricing differences, though we were unable to find strong support for the effect of either duplicate products or firm size. As such, our analysis has confirmed that proposition 1 introduced by our model probably holds for UK instant access saving account product pricing.

6. Conclusions

This paper examines why banks offer multiple and duplicate deposit accounts with distinct level of interest. First a model is presented to determine the interest rates employed by banks which are aware that some depositors discount decisions in a time inconsistent manner. Four propositions emerged: Do banks issue duplicate deposit accounts, do underperforming deposit accounts occur, does the addition of extra duplicate accounts increase the proportion of underperforming deposit accounts, and lastly is the age of a deposit account a significant influence on the level of interest provided? In an empirical assessment of the near population of UK retail branch distributed instant access deposit accounts between 1996 and 2008, three of these predictions are borne out by the data. High levels of duplicate deposit accounts are reported, underperforming deposit accounts appear commonplace and the age or length of time a deposit account has been offered for investment is a significant determinant of the level of deposit account interest rate. Further these influences also appear to be robust to the influence of other factors including the bank type and interaction of these terms. The issue of whether an extra deposit account increases the proportion of underperforming accounts is reported for some banks (high street banks), yet not all banks.

Examining why banks issue multiple and similar deposit accounts with distinct interest rates is important for three reasons. Initially, the research contributes to the wider literatures examining interest rate setting in financial services and potential causes of interest rate variability and sluggish interest rate transmission in the deposit market. It can be reported that depositors' time inconsistency when switching accounts is consistent with banks offering a range of duplicate deposit accounts with low and often unchanging levels of interest. This explanation is also consistent with generalised characteristics of interest rate transmission in deposit markets where interest rate rises are often slower than falls in response to external shocks (e.g. De Haan and Sterken 2004, Lim 2001). Further recognising the importance of understanding how the consumer behaves in these markets is critical to improving competition (Waterson 2003, Scitovsky 1950).

Secondly, the last decade has observed a global shift towards individuals taking increasing responsibility and autonomy for their savings decisions (Benartzi, 2001, Benartzi and Thaler, 2002). This movement comes at a time when savings levels in many nations

including the USA and UK have been at historically low levels (Kirsanova and Sefton 2007), and higher savings rates are a policy priority. As it is often more efficient to reduce restraints to an action rather than increasing driving forces of such an action (Kahneman 1992) challenging banks' behaviours which may make saving less attractive should be an efficient policy response to this concern.

Lastly, we report banks have incentives to provide both competitive and underperforming deposit accounts simultaneously, and present empirical evidence consistent with this situation. While this bank behaviour appears to overcome the long standing trade-off faced by firms between lowering prices to attract new customers and raising prices to extract rent from existing customers (Klemperer 1995) these actions also create a substantial moral hazard. If the bank has greater knowledge of the depositors' behaviour, be this individually or on aggregate, the individual depositor may face interest rate setting undertaken in manner which provide substantial benefits to the bank yet, relatively low returns to the depositor. This issue is particularly pertinent as time inconsistent depositors will be unaware they have present state biases and defer decisions due to inconsistent time preferences of which they are not fully aware. Facing such circumstances the bank may adopt a range of strategies to maximise its profits. Initially the bank will attempt to increase the perception of current task costs. This may be achieved through product obfuscation, presenting information in a challenging manner and developing the perception of high switching costs. Secondly the bank will ensure delay cost do not become so large that the depositor moves accounts.

In light of these findings, it is important to offer potential solutions or actions which may remedy or alleviate these adverse outcomes. An important initial challenge is how to de-bias people to be able to resist this behaviour bias. Three potential actions may be important in this context: one, improving the ability and perception of the ease of switching for customers. Currently the perception that switching may be challenging can encourage decision avoidance and customer inertia to form. Clearly this an area were further information provision to the customer may be important and concerns raised in associated deposits (OFT 2010) with delays in switching need to be addressed across the sector.

Secondly, can this behaviour be overcome through greater education? The benefits of financial education can be limited by financial firms as it is important for customers to

remain uniformed to assist firm profitability (Subrahmanyam 2009). While financial education is widely advocated internationally (see Fox 2004, Erturk *et al* 2007) this alone can't resolve incentives for banks to obfuscate and withhold relevant facts in financial services sales (Kozup and Hogarth 2008, Williams 2007). Subsequently it is suggested that a mechanism other than formal education is important for customers, such as increasing repeated market decisions. It is proposed informing customers each year of the interest rates of the deposit accounts that they currently hold and the other interest rates provided on similar deposit accounts provided by the bank, would assist this process. Such information provision allowing a comparative comparison of the banks deposit offerings and associated interest rates would at least encourage switching of financial services within the bank. This approach would be viewed as improving consumer sovereignty; the set of social and economic arrangements that allow a consumer to freely choose the goods and services they wish to consume, rather than be directed in their choices by firms' persuasion (Averitt and Lande 1998, 2007). By improving information provision in a systematic rather than partial manner situations where some consumers cannot make informed choices between products and firms exploit these 'out of head' failures can be limited. As seen in this case, such market failures do occur; challenging these circumstances when they arise should be a regulatory priority.

There are a number of areas for further research. Theoretically the role of excessive choice (Ireland 2007) and market complexity (Carlin 2009) in how both consumers and financial firms make decisions is an important avenue for future work for the UK deposit market. For example the issue of choice in retirement savings has repeatedly been be associated with non-rational behaviours, such as more choice of investment funds being associated with lower participation rates (Choi *et al* 2004); the degree of choice of investment funds observed to have little influence over the funds chosen (Benartzi and Thaler 2002, Choi *et al* 2004, Huberman and Jiang 2006) and a reluctance for many saving plan participants to construct their own portfolio yet employ a median of other participants' decisions (Benartzi and Thaler 2002). Lastly customer inertia has mostly been viewed as a negative behaviour (Steel 2007). It would helpful to observe if this human quality also has some possible positive contributions to financial decision making.

Appendix: Group Constituent Institutions

High Street (Total: 6)
Barclays
HSBC
Lloyds (Lloyds/TSB)
NatWest
Royal Bank of Scotland
TSB

Converted Building Societies (Total: 9)
Abbey National
Alliance and Leicester
Birmingham Midshires
Bradford and Bingley
Bristol and West
Cheltenham and Gloucester
Halifax
Northern Rock
Woolwich

High Street Building Societies (Total: 8)
Britannia BS
Chelsea BS
Coventry BS
Leeds and Holbeck BS
Nationwide BS
Portman BS
Skipton BS
Yorkshire BS

Small Building Societies (Total: 58)
Barnsley BS
Bath BS
Beverley BS
Buckinghamshire BS
Cambridge BS
Catholic BS
Chesham BS
Cheshire BS
Chorley and District BS
City and Metropolitan BS
City of Derry BS
Clay Cross BS
Cumberland BS
Darlington BS
Derbyshire BS
Dudley BS
Dunfermline BS
Earl Shilton BS
Ecology BS
Furness BS
Greenwich BS
Hanley Economic BS
Harpenden BS
Hinckley and Rugby BS
Holmesdale BS
Ipswich BS
Kent Reliance BS
Lambeth BS
Leek United BS
Loughborough BS
Manchester BS
Mansfield BS
Market Harborough BS
Marsden BS
Melton Mowbray BS
Mercantile BS
Monmouthshire BS
National & Provincial BS
National Counties BS
Newbury BS
Newcastle BS
Norwich and Peterborough BS
Nottingham BS
Nottingham Imperial BS
Principality BS
Progressive BS
Saffron Walden Herts and Essex BS
Scarborough BS
Scottish BS
Shepshed BS
Stafford Railway BS
Staffordshire BS
Stroud and Swindon BS
Teachers' BS
Tipton and Coseley BS
Universal BS
Vernon BS
West Bromwich BS

Small Banks (Total: 24)
AIB Bank (GB)
Airdrie Savings Bank
Bank of Cyprus
Bank of Ireland (GB)
Bank of Ireland (NI)
Bank of Scotland
Cater Allen Private Bank
Citibank
Clydesdale
Co-operative Bank
Coutts and Co.
First Trust Bank
Granville
HFC Bank
Hoare and Co.
Julian Hodge Bank
Laiki Bank
National Savings / Giro Bank
Northern Bank
Post Office
Triodos Bank
Ulster Bank
Whiteaway Laidlaw bank
Yorkshire Bank

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