Micro Foundations for how Firm Ownership by Consumers can affect Consumer Preferences: The Case of Mutual Bank Deposits

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Abstract

Girotti and Meade (2017) present results from the estimation of Multinomial Logit (MNL) and Random Coefficient Logit (RCL) models of US bank deposit demand. Their specification of indirect utility assumes that bank ownership type – in particular, "mutual", "depositor" or "customer" bank ownership – interacts with deposit rate. Empirically they find that these interaction terms enter depositors' indirect utility functions (IUFs) with a negative sign. This note provides micro foundations for the inclusion of this interaction term, and further derives conditions under which it enters depositors' IUFs negatively. We show that inclusion of an interaction terms arises in the standard, two-period household inter-temporal utility maximisation problem by modifying the household's inter-temporal budget constraint to include "income" from mutual (i.e. consumer – here, bank ownership). Furthermore, using Roy's Identity we show that the interaction term enters depositor's IUFs negatively if depositors' coefficient of absolute risk aversion is sufficiently positive. To our knowledge, this is the first time that firm ownership by consumers has been shown using micro foundations to affect consumer preferences.

1 Introduction

This note uses standard micro foundations to illustrate how a bank's ownership type can affect the sensitivity of its depositors' IUFs to deposit rate. This motivates the inclusion of an interaction term between an ownership type dummy variable and deposit rate in the indirect utility specification adopted in Girotti and Meade (2017) equations (1) and (2). It also enables conditions to be derived under which the coefficient on that term in depositors' IUFs is negative, as they find empirically.

To our knowledge this is the first time it has been demonstrated that a firm's ownership attribute – here, mutual or customer ownership of a deposit-taking bank – can directly affect the specification of consumer preferences.

The next section modifies the standard two-period household inter-temporal utility maximisation problem to show how ownership interacts with deposit rate in depositors' IUFs. Section 3 then derives conditions under which that interaction can enter IUFs negatively, while section 4 concludes.

2 Incorporating Mutual Bank Ownership in the Standard Household Inter-Temporal Utility Maximisation Problem

2.1 Modified Inter-Temporal Budget Constraint

We assume the standard two-period household inter-temporal utility maximisation problem. Exogenous income from sources other than mutual bank ownership is y_t in periods $t \in \{1, 2\}$, while consumption in each period is c_t.

The household makes a deposit $D_1 > 0$ in period 1, earning exogenous deposit rate r^D per period. Abstracting from taxes, risk and differences in household preferences, this means the household's financial resources in period 2 includes the proceeds from that deposit upon maturity.

We modify the standard maximisation problem by allowing for mutual bank ownership to provide an additional source of income. Specifically, assuming the bank has n depositors, each depositor (directly or indirectly) receives the following share S_t in the bank's period t profits π_t:

$$S_t = \begin{cases} \frac{\pi_t}{n} & \text{if the bank is mutually owned; and} \\ 0 & \text{otherwise.} \end{cases} \tag{1}$$

We assume that each depositor is sufficiently small that it treats S_t as exogenous. The household's modified inter-temporal budget constraints there-

fore write as:

$$c_1 + D_1 = y_1 + S_1 \tag{2}$$

$$c_2 = y_2 + D_1\left(1 + r^D\right) + S_2 \tag{3}$$

As usual, we assume $D_2 \equiv 0$, and hence that the household consumes all its available financial resources in period 2.

From (2) we have that:

$$D_1 = y_1 + S_1 - c_1 \tag{4}$$

This allows us to re-write (3) as:

$$c_2 = y_2 + (y_1 + S_1 - c_1)\left(1 + r^D\right) + S_2 \tag{5}$$

Rearrangement of (5) gives our modified household inter-temporal budget constraint:

$$c_1 + \frac{c_2}{1 + r^D} = \underbrace{\left(y_1 + \frac{y_2}{1 + r^D}\right) + \left(S_1 + \frac{S_2}{1 + r^D}\right)}_{\text{wealth } w} \tag{6}$$

The only difference between our setup and the standard utility maximisation problem is due to our inclusion of the S_t terms.

2.2 Solving the Two-Period Utility Maximisation for Optimal Period 1 Consumption

For ease of exposition (i.e. enabling closed-form derivations), and without loss of generality, we assume logarithmic preferences. Thus $u(c) = log(c)$ with $u' > 0$ and $u'' < 0$.

Adopting the modified inter-temporal budget constraint (6), the household's inter-temporal utility maximisation problem writes as:

$$\max_{c_1, c_2} \; [log(c_1) + \beta log(c_2)] \tag{7}$$

$$\text{s.t.} \quad c_1 + \tfrac{c_2}{1+r^D} = \left(y_1 + \tfrac{y_2}{1+r^D}\right) + \left(S_1 + \tfrac{S_2}{1+r^D}\right) \tag{8}$$

As usual, $\beta \in [0, 1)$ is a discount factor reflecting the household's rate of time preference. Solving (8) for c_2 and substituting the result in (7) results in the following univariate and unconstrained problem:

$$\max_{c_1} \; log(c_1) + \beta log\left(\left[\left(y_1 + \frac{y_2}{1 + r^D}\right) + \left(S_1 + \frac{S_2}{1 + r^D}\right) - c_1\right]\left(1 + r^D\right)\right) \tag{9}$$

Taking the first order condition and solving for optimal period 1 consumption yields:

$$c_1^*\left(r^D, w\right) = \frac{1}{1+\beta}\left[\left(y_1 + \frac{y_2}{1+r^D}\right) + \left(S_1 + \frac{S_2}{1+r^D}\right)\right] \tag{10}$$

2.3 Solving for Household Deposit Demand

The household's optimal deposit demand in period 1 is given by:

$$D_1\left(r_D, w\right) = y_1 + S_1 - c_1^*\left(r^D, w\right) \tag{11}$$

Substituting from (10) and rearranging, this is:

$$D_1\left(r^D, w\right) = \frac{1}{1+\beta}\left[\beta\left(y_1 + S_1\right) - \frac{y_2 + S_2}{1+r^D}\right] \tag{12}$$

Notice that S_1 and r^D are unrelated, so any interaction between mutual ownership and deposit rate arises solely in relation to S_2.[1]

3 Using Roy's Identity to show that Mutual Ownership and Deposit Rate Interact Negatively in Depositors' Indirect Utility

Denoting the depositor household's IUF by v and wealth w as in (6), we know from Roy's Identity that:

$$D_1\left(r^D, w\right) = -\frac{\frac{\partial v}{\partial r^D}}{\frac{\partial v}{\partial w}} \tag{13}$$

Rearranging for the derivative of the depositor's IUF with respect to r^D, this means that:

$$\frac{\partial v}{\partial r^D} = -D_1\left(r^D\right)\frac{\partial v}{\partial w} = -D_1\left(r^D\right)\frac{\partial v}{\partial S_2} \tag{14}$$

where the second equality follows from the observation made following (12). By definition of indirect utility, we know that:

$$v = u\left(D_1\left(\cdot\right)\right) \tag{15}$$

[1] Furthermore, without loss of generality, we could have omitted S_1 in any case, and simply allowed for S_2.

and so we have:

$$\frac{\partial v}{\partial S_2} = u'(\cdot)\frac{\partial D_1(\cdot)}{\partial S_2} \tag{16}$$

To show that mutual bank ownership is associated with depositors' IUFs being more negatively related to r^D, we need to show that:

$$\frac{\partial}{\partial S_2}\left(\frac{\partial v}{\partial r^D}\right) < 0 \tag{17}$$

Using (14) and (16), this requires that:

$$\underbrace{-\left(\frac{\partial D_1(\cdot)}{\partial S_2}\right)^2 u'(\cdot)}_{-} + \underbrace{u''(\cdot)\frac{\partial D_1(\cdot)}{\partial S_2}}_{+} + \underbrace{u'(\cdot)\frac{\partial^2 D_1(\cdot)}{\partial S_2^2}}_{0} < 0 \tag{18}$$

where the signs of the latter two parts of (18) follow from using (12), which means that:

$$\frac{\partial D_1(\cdot)}{\partial S_2} = -\frac{1}{(1+\beta)(1+r^D)} < 0 \tag{19}$$

$$\frac{\partial^2 D_1(\cdot)}{\partial S_2^2} = 0 \tag{20}$$

Thus, the required condition is:

$$\frac{\partial}{\partial S_2}\left(\frac{\partial v}{\partial r^D}\right) < 0 \quad \Leftrightarrow \quad u''(\cdot) < u'(\cdot)\frac{\partial D_1(\cdot)}{\partial S_2} \tag{21}$$

In the logarithmic preferences case, this can be rewritten as:

$$\frac{u''(\cdot)}{u'(\cdot)} < -\frac{1}{(1+\beta)(1+r^D)} < 0 \tag{22}$$

or equivalently:

$$-\frac{u''(\cdot)}{u'(\cdot)} > \frac{1}{(1+\beta)(1+r^D)} > 0 \tag{23}$$

The left hand side of (23) is recognisable as depositors' coefficient of absolute risk aversion. Hence we find that mutual bank ownership is associated with depositors' IUFs being more negatively related to r^D when depositors' coefficient of absolute risk aversion is sufficiently positive.

4 Conclusions

In this note we provide micro foundations for why deposit rate interacts with mutual ownership in depositors' IUFs, and derive conditions under which the interaction enters those IUFs negatively. This both motivates the inclusion of such ownership and deposit rate interactions in equations (1) and (2) of Girotti and Meade (2017). It also provides a possible explanation for why they empirically find that the coefficients on these interaction terms are negative.

More generally, to our knowledge this is the first time it has been demonstrated that a firm's ownership attribute – here, mutual or customer ownership – can directly affect the specification of consumer preferences. Furthermore, we have derived feasible conditions under which the attribute interacts with "price" (here, deposit rate) with a particular sign (here, negatively). Finally, we interpret those conditions in terms of a well-known feature of consumer preferences (coefficient of absolute risk aversion).

References

[1] Girotti, M. and R. Meade, 2017, *U.S. Savings Banks' Demutualization and Depositor Welfare*, Banque de France Working Paper #639, August.