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Portfolio Maturity Choice of Australian Cash Management Trusts

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Abstract:

Money Market Mutual Funds, known in Australia as Cash Management Trusts (CMTs), provide potential benefits for retail investors from pooling of funds and superior portfolio (maturity) management skills. The average maturity of CMT assets exhibits significant variation both cross sectionally and over time, but there is significant correlation between the asset maturities of different CMTs. These variations could reflect decisions about optimal asset maturity by CMT management, given their expectations of future interest rate movements. This paper examines (and rejects) the hypothesis that CMT management has superior interest rate forecasting ability by testing whether asset maturity of CMTs provides any information about future interest rate movements. The correlation between CMT maturity decisions appears to reflect the tendency of some CMTs to adjust maturity in response to current changes in market interest rates.

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Introduction

Cash Management Trusts (CMTs), similar to US money market mutual funds (MMMFs), were introduced to Australia in 1980, and are a simple, transparent, form of financial instititution. They invest funds subscribed on an at–call basis by retail investors (the unit holders) in short term gilt edge money market securities. This enables retail investors to obtain a return closely linked to wholesale money market rates. In addition to this "pooling" benefit, CMTs may also generate benefits to investors from their portfolio management activities based on superior interest rate forecasting ability[1].

This paper addresses the question of whether managers of CMTs have superior interest rate forecasting ability by examining the relationship between asset maturity choices made by CMTs and money market interest rates. If CMTs have, and act upon, superior interest rate forecasting ability, we should expect to see asset maturity changes prior to, and in an inverse direction to, interest rate movements.[2] It is the first such study using Australian data, and extends approaches used in earlier studies using US data on money market mutual funds (MMMFs).

[1] Because unit holders can withdraw funds on demand without penalty, CMT management is faced with a potential loss of funds under management if the returns they generate for investors are expected to be below those of other CMTs or assets available to investors. Generating superior returns for investors can therefore be expected to be a goal of CMT management, since fee income is linked to the size of funds under management.

[2] Such a view is reflected in the Reserve Bank of Australia's (1989) comment that "expectations of interest rate movements, …. may have led them to adjust their maturity profiles…" (page 18).

The paper is structured as follows. Section 1 provides background on CMT characteristics and the relevance of maturity choice. Section 2 provides an overview and critique of the relevant previous literature which focuses on whether maturity decisions of US MMMF managers provide evidence of interest rate forecasting ability. Section 3 describes the Australian CMT market, sources of data, and examines whether there is any evidence of common factors influencing maturity choices made by individual CMTs over time which might shed light on CMT maturity choice. Section 4 develops the hypotheses to be tested about relationships between CMT asset maturity and interest rates. Section 5 describes the methods used in, and the results of, the empirical work undertaken to test those hypotheses. Section 6 provides some concluding comments.

1. Maturity Choice at Cash Management Trusts

The return paid to CMT investors is directly linked to the return achieved on the asset portfolio of the CMT, after a specified management fee is deducted. Interest is calculated daily and credited to accounts on a quarterly basis. Retail investors may benefit from improved returns, relative to other opportunities, for two possible reasons. First, CMTs, by pooling and investing contributed funds, provide returns near to wholesale rates. Second, CMT managers may have superior interest rate forecasting ability which enables them to achieve superior returns by actively adjusting the maturity of their asset portfolio.

This paper provides a test of the relevance of that second possible function of CMTs, and in so doing provides an indirect test of the Efficient Markets Hypothesis. If CMTs have superior interest rate forecasting ability, portfolio maturity changes should be a good predictor of subsequent market interest rate movements. As can be seen from Figure 1, there is considerable fluctuation in average maturity of CMT's and in money market interest rates over the time period under study[3]. In essence, this paper examines whether the fluctuations in the average maturity shown there and, more importantly, at the level of the individual CMT, indicate any forecasting ability of interest rates by CMT managers.[4]

Portfolio choice in CMTs has three main dimensions. One dimension is that of asset quality choice involving the share of the portfolio to be invested in different money market instruments such as Treasury Notes, Bank Accepted Bills and CDs, and Commercial Paper.[5] A second is that of liquidity management, since CMTs must be able to meet investors' withdrawal requirements.

The third dimension, which is the focus of this paper, is that of asset portfolio maturity. CMT management may undertake asset maturity decisions on the basis of expectations of changes in both the level of interest rates and in the shape of the (short end of the) yield curve. However, fluctuations in average maturity may reflect other

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[3] Figure 1 uses data for four large "survivor" CMTs to illustrate the variability in and range of maturity choices. It also illustrates the change in January 1990, coinciding with a shift to a lower interest rate environment, when the Reserve Bank of Australia began announcing targets for the short term interest rates.

[4] Alternatively, maturity variation may be random, determined by other institutional features of CMT portfolio behaviour, or reflect maturity decisions based on expectations of interest rate movements which themselves have no information content.

[5] Typically, around 80 per cent of the portfolio is in bank paper (bank accepted bills and CDs) and most of the remainder in commercial paper.

factors. For example, CMTs receive funds at the discretion of investors, and are thus faced with continual net inflows or outflows of funds requiring investment or disinvestment. Maturity fluctuations, such as those shown in Figure 1, may reflect changes in CMT size, arising primarily from institutional habits of investing new funds in particular maturity securities, rather than being the result of active portfolio management. If, for example, new funds are invested in longer maturity assets, there would tend to be an increasing average maturity in high growth periods. This does not however appear to be the case.[6]

At any point in time, differences between individual CMT average maturity can be quite large, although there is correlation over time between individual CMT average maturities. This paper thus examines portfolio maturity behavior at the individual CMT level. Aggregate data may hide individual instances of superior interest rate forecasting ability, or may appear random even when all individual CMT maturities are responding to some unobserved common factor (albeit one which has no interest rate forecasting power).

2. Prior Research

[6] There is no obvious evidence of a consistent relationship between growth and changes in maturity across the population of CMTs. Correlation coefficients were calculated between change in size and change in maturity for each CMT. Of 39 CMTs for which sufficient data was available, the correlation coefficient was greater than 0.2 in 3 cases, between 0.2 and 0 in 18 cases, between 0 and -0.2 in 14, and below -0.2 in 4. The mean of the correlation coefficients was -0.015 and the standard error of the mean was 0.025. For the group of 9 "survivors" examined in detail in this paper, the correlation coefficient was negative in 6 cases.

There are five published studies of the relationship between US MMMF portfolio maturity choice and interest rates. The objective of all studies is to determine whether maturity changes precede changes in market interest rates as would be expected if MMMF managers have superior ability to forecast interest rate movements. In particular, maturity would be lengthened (shortened) if managers expected a sufficiently large future decline (rise) in interest rates (although, as explained subsequently, none of the studies deals adequately with what constitutes a sufficiently large change).

The earliest, by Ferri and Oberhelman (1981) utilised aggregate data on the average maturity of MMMF portfolios for the period 1975 to 1980. One-way Analysis of Variance was used to examine whether, on average, maturity changes in the last week(s) of a month occurring prior to months when interest rates increased, differed from that prior to months of interest rate decreases. Some evidence of statistically significant differences was observed, and the sign of average maturity change was consistently inversely related to subsequent interest rate changes for the different specifications studied. They also apply contingency analysis to determine whether the signs of maturity changes and subsequent interest rate movements were inversely related. "Correct" changes in maturity were made around two thirds of the time, although the level of significance (at which this ratio differed from 50%) for different specifications was on average in the 5 -10% range.

Kane and Marks (1987) use weekly data on US MMMFs for 1978-1981 in their study, which emphasises the fact that individual MMMFs may make different predictions of interest rates, and may only adjust their maturity partially on the basis of their predictions. They calculate predictive ability as $P = P_1 + P_2 - 1$ where P_1 (P_2) is the proportion of the immediate weeks prior to weeks in which 30 day bills outperformed (underperformed) 90 day bills in which maturity decreased (increased). Perfect predictive ability generates a value for P of 1, while random perfomance generates a value of 0. Adverse predictive ability generates a negative value. The average value of P for their sample of 34 funds was 0.11, with nine showing P values significantly in excess of zero (at a 5 per cent significance level). However, the sizes of changes in maturity were well below those which might have been made to take full advantage of predictive ability. Compared to their estimate of a 230 basis point gain from acting on perfect predictive ability, they found gains in the range of only 2.5 to 7.5 basis points.

Domian (1992) studied the relationship between portfolio maturity choice of US money market mutual funds in aggregate and interest rate movements. Using weekly data on the average maturity of assets for the period January 1982 till December 1990, he finds that "MMMF average maturity does not Granger - cause interest rates... [but]... interest rates Granger - cause fund maturity" (page 526). This, he argues is consistent with the efficient markets hypothesis, since it suggests that maturity choices by fund managers exhibit no superior ability to forecast interest rate movements. Bahmani-Oskooee (1996) however argues that once co-integration of the maturity and interest rate series is allowed for, there is some evidence that maturity Granger-causes interest rates through the significance of the error-correction term.

DeGennaro and Domian (1996) estimate a partial adjustment model for maturity choice by US MMMF using aggregate weekly data from January 1983 to December 1991. Desired maturity is hypothesised to reflect some target risk level and modelled as being negatively related to the expected change in interest rates. It is also hypothesised to be positively related to changes in the size of the fund (reflecting investment and redemption practices). They find that adjustment is very slow and that maturity changes are negatively related to past interest rate changes (which proxy for expected interest rate changes). Since their survey data indicates that fund managers believe expected future interest rate changes are a very important determinant of maturity choice, they also include the actual future interest rate change as an explanatory variable, in an attempt to capture any apparent forecasting ability. The positive coefficient estimated on this variable appears inconsistent with managerial forecasting ability, but the simultaneous inclusion of lagged interest rate changes as a proxy for expected interest rate changes confounds the interpretation of this result. Farinella and Jorgensen (1999) undertake a similar analysis to DeGennaro and Domain, but using aggregate data for tax-exempt MMMFs. Their approach and results are broadly similar.

Drawing on the analysis of the preceding discussion, it can be seen that there are a number of shortcomings in the previous studies. One issue relates to the possibility of twists in the yield curve (where over the range of maturities relevant to the MMMF, shorter and longer rates move in different directions) as well as changes in the level of interest rates. This possibility, which dominates the analysis of Kane and Marks, is largely ignored in the other studies which focus on changes in the level of key market interest rates. A second, and related, issue is that maturity decisions will be made by comparison of expectations of interest rate movements with the existing yield curve slope, and this needs to be reflected in tests of interest rate forecasting ability using maturity changes. The approach adopted in this paper overcomes these problems.

A second problem is that all of the studies (other than Kane and Marks) examine only the information contained in aggregate MMMF maturity choice. It is possible that some MMMFs are able to predict interest rate movements (as Kane and Marks suggest), but that this predictive ability gets lost in the aggregation process. It is thus useful to examine whether maturity choices of individual managers are correlated, since this is suggestive of common response to shared information about future interest rate movements (or other factors).

A final concern is the degree of quantitative a priori specification imposed by some approaches. The bivariate autoregressions estimated by Domian, for example, examine whether a stable quantitative relationship exists between maturity changes and interest rate changes. As the analysis of Kane and Marks illustrates, CMT managers may have views on the direction of interest rate changes and may respond to those views to greater or lesser degree by changing maturity. To assume that a stable linear relationship will exist imposes a strong restriction, although such an approach does allow for the possibility of differing leads or lags, which is not easily catered for in alternative approaches.

For these reasons, a number of alternative statistical techniques to examine the relationship between maturity choices and interest rates are used in this paper. However, before examining that relationship, it is appropriate to determine whether there is any systematic element in maturity choices (perhaps indicative of similar views on interest rate movements) of individual CMTs.

3. Australian CMTs and their Maturity Behaviour

The first CMT commenced operations in Australia in December 1980 and by mid 1983 (when weekly data became available) there were 15 CMTs operating. There have been many entries, exits, and name changes (reflecting mergers among institutions acting as managers of trusts), and there were 25 CMTs in existence at the end of 2000.

For the time period under study in this paper, the average maturity of assets for CMTs in aggregate ranged between 34 and 81 days, with an average value of 50 days. At any point in time there are significant variations in average maturity across individual CMTs, although there is significant correlation through time.

Data on individual CMT average maturity is published weekly in the Australian Financial Review, but has occasional missing observations due to non-reporting.[7] There are also many names changes of individual CMTs. After linking data for CMTs with known name changes, 39 separate CMTs were identified, of which 9 (the survivor group) operated continuously from near the start till the end of the sample period. Another 9 CMTs operated for at least 6 years during the period.[8].

This study differs from most of the previous (US) work by focusing on maturity choice at the level of the individual manager. Even if the industry, on average, displays no superior interest rate forecasting ability, it may be that individual CMTs do so. Even if the industry average appears to follow a random walk, correlation between the individual series would suggest some common factor giving rise to those fluctuations.

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[7] The tests reported here use data with missing observations. Linear interpolation of missing values was also undertaken. Preliminary tests using interpolated data showed little difference to the results involving missing observations.

[8] The data was hand collected and various checks made to identify and rectify coding errors.

A difficulty here from different life spans of CMTs and survivorship bias, since there have been many entrants and exits from the industry, and ownership changes. A restricted sample of the 9 CMTs which operated for this entire period is chosen for more detailed analysis. These CMTs were "survivors" and, if anything, would be expected to have exhibited superior interest rate forecasting ability to others. Use of this sample of survivor CMTs (with over 800 observations each) should, if anything, bias the tests in favour of finding interest rate predictive ability. Where appropriate, results for the larger sample of CMTs which have survived for more than 6 years (18 in number) is also given.

Table 1 provides information on the maturity choices of the 9 survivor CMTs. It is apparent that there is some tendency for some CMT's to generally choose longer or shorter maturity than others, as can be seen from the ranking statistics. However, with the exception of CMT number 8 which persistently has a lower maturity, the average maturities over the entire sample do not differ markedly.

The behavior of CMT maturity was examined in more detail as follows. First, the group of 18 CMT maturity series were tested for stationarity, both individually (using augmented Dickey Fuller tests) and jointly (using the Im, Pesaran, and Shin (2003) test for unit roots in panel data[9]). Allowing for intercepts and trends for each cross section, the hypothesis of a unit root was clearly rejected in all cases. A high degree of persistence could, however, be noted, with first order autoregressive coefficients ranging from 0.71 to 0.94 with an average of 0.87.

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[9] This involves a test of the null hypothesis that all the series have a unit root against an alternative that some of the series are stationary.

Second, the existence of positive correlation between the individual CMT maturity series, indicative of common response to some as yet undetermined factor, was examined. This is an important step for two reasons. First, tests of predictive ability based on aggregate (industry wide) maturity (as conducted in the previous literature) must implicitly assume some degree of common behavior by individual managers. Second, even if aggregate CMT average maturity appears random and has no interest rate forecasting power, individual CMTs may be responding to some common unobserved factor such as a particular interest rate view.

A variety of techniques were used to examine correlation between CMT maturities. First, the correlation matrix for the survivor group was calculated.[10] Of the 36 pairwise correlations, all were positive and significantly different from zero at the 5 per cent level,[11] 25 exceeded 0.2 and 4 exceeded 0.4. Second, correlations of each survivor CMT maturity with the average for the rest of the group (excluding itself) were calculated. These ranged from 0.25 to 0.61 with an average of 0.47. With a minimum sample size of 811 observations (allowing for missing values), these are all highly significant. Third, principal components analysis was used. The first principal component explained 35 per cent of the total variation in the maturity series for the 9 survivors (and the second principal component explained a further 18.6 per cent. All individual maturity series had significant negative correlation with the first principal component.

[10] Using the group of 18 would involve a significant number of cases where there were few observations in common, due to different time periods of operation.

[11] The distribution of r for two random variables is given as a t distribution with n-2 degrees of freedom: $t = r.[(n-2)/(1-r2)]^{0.5}$ (Ben-Horim and Levy (1984, p 631)

Based on this analysis of the CMT maturity data, it is apparent that maturity decisions of individual CMTs, although having a large idiosyncratic element, are affected by some common factor. Whether those maturity decisions provide evidence of superior interest rate forecasting ability of CMT managers is the subject of the following sections.

4. CMT Maturity and Interest Rates

In this section the relationship between maturity choice and interest rate expectations is examined in order to determine the appropriate specification for tests of interest rate predictive ability of CMT managers.

CMTs invest in money market securities which are, generally, pure discount securities. Consequently, the average maturity of the CMTs asset portfolio will be a satisfactory proxy for its duration.[12]

Denote average maturity (in weeks)[13] at date (week) t by m_t, and let $r_{t,m}$ represent the continuously compounded interest rate (yield to maturity) per week at time t on a money market instrument of maturity m (weeks). The price at time t of a discount security paying $1 with maturity of m_t is

$$P_t = \exp(-r_{t,m}.m)$$

The (one week holding period) return over the week t to t+1 is given by:

$$r_{t,m}^{hp} = \ln(P_{t+1} / P_t) = -r_{t+1,m-1}(m-1) + r_{t,m}.m \quad (1)$$

[12] Provided that the portfolio weights used are the market values of the assets. Even if asset values are not continually marked to market, their short term nature means that average maturity should remain a reasonable proxy for portfolio duration.

[13] Since data used in this study is available at weekly intervals, the following analysis uses a week as the unit of measurement.

The forward rate at time t for an *m*-1week security one week hence is given by

$$(m-1)_t f_{t+1}^{m-1} = r_{t,m}.m - r_{t,1} \tag{2}$$

Hence the excess return on a *m* week security over a *1* week security is:

$$r_{t,m}^{hp} - r_{t,1} = (m-1)({}_t f_{t+1}^{m-1} - r_{t+1,m-1}) \tag{3}$$

Under the expectations hypothesis of the yield curve, expected returns are unaffected by maturity choice. For, example, in an upward sloping yield curve environment, the greater "running yield" on a longer maturity security is exactly offset by higher expected capital losses from interest rate increases. However, if the CMT management (on the basis of its expertise in money markets – or otherwise) expects an increase in market interest rates which is greater (less) than implied by the current yield curve slope, it should shorten (lengthen) its average maturity to reflect this view. As can be seen from equation 3 above, if the expected (maturity *m-1* week) interest rate in one week ($E_t(r_{t+1,m-1})$) is below the one week forward rate (for maturity *m-1*), the expected excess return between week t and t+1 is increasing in *m*. For example, if the yield curve is upward sloping, and the CMT manager does not expect interest rates to increase to as much as the forward rates implied by the yield curve, an increase in maturity will increase the expected excess return.

In practice, management risk aversion can be expected to limit the range over which the CMT adjusts its average maturity in response to its interest rate view. (Kane and Marks (1987) discuss how US MMMF's make only a partial adjustment of maturity to their interest rate forecasts). This also suggests that it is appropriate to focus upon CMT's ability to predict interest rate changes only for the maturities near to that of its current portfolio. Consequently, we have proposition 1.

Proposition 1: For a CMT with a portfolio of average maturity m at time t, if $E_t(r_{t+1,m-1}) < (>) \, {}_t f_{t+1}^{m-1}$ then m will be increased (decreased).

This proposition leads to the following testable hypothesis, based on the assumptions that CMT managers adjust their average maturity in response to their interest rate expectations and that their interest rate expectations have predictive power.

$H1_0$: Changes in CMT maturity should precede movements in interest rate levels (after adjusting for the current yield curve slope) with an inverse relationship. Specifically, there should be a negative relationship between the change in maturity (Δm) at date t and the forward rate forecast error ($r_{t+1,m-1} - {}_t f_{t+1}^{m-1}$) observed at date t+1.

Testing this hypothesis is complicated by lack of data of greater frequency than weekly. For example, a change in maturity between date t and t+1 ($\Delta m_{t,t+1}$) observed at date t+1 could occur near (soon after) date t or (just before) date t+1. In the former case, it should be negatively related to ($r_{t+1,m-1} - {}_t f_{t+1,m-1}$). In the latter case it should be negatively related to ($r_{t+2,m-1} - {}_{t+1} f_{t+2,m-1}$). It is also possible that changes in maturity are made more than one week in advance of interest rate changes expected by CMT managers due to risk aversion and uncertainty about their predictive ability. Hence, it is appropriate to examine both contemporaneous and (short term) lagged relationships between maturity and interest rate changes.

In concluding this discussion, it is worth noting the implicit assumption made, that CMT management operates with a very short term investment horizon of days or weeks. Consequently, the concern of management is with the impact of possible movements in interest rates in the immediate future on portfolio value. Since CMTs report returns daily and all liabilities are at call, this assumption seems justified.

5. Method and Results

Interest rate data for the benchmark rates of the unofficial cash rate and 30, 90 and 180 day bank bills was obtained from the Reserve Bank of Australia Daily Interest Rate Data Base and converted into weekly interest rate data by a filtering process to obtain data for Fridays (the date of CMT maturity data) or where Friday was a holiday, the nearest preceding business day. Interest rates were converted to a continuous compounding basis. The one week interest rate was proxied by the unofficial cash rate data using the 24 hour call rate up until February 1996 and the 11 am call rate thereafter. While 11 am call rate data was available prior to that time, the mechanics of the Australian overnight cash market made it an unreliable proxy for a one week rate which is needed for current purposes. One week forward rates were calculated (using equation 2) for maturities of 23, 83 and 173 days using the cash rate (as a proxy for the 7 day rate), 30, 90, and 180 day bank bill rates.

For each CMT, a test of hypothesis 1 requires comparison of changes in maturity in week t (Δmat_t) with the difference between the interest rate ($r_{t+1,m-1}$) for maturity (m-1) weeks at week t+1 and the one week forward rate (${}_tf_{t+1,m-1}$) for maturity (m-1), observed at week t, where m is the current maturity of the CMT. A time series of $r_{t+1,m-1}$ and ${}_tf_{t+1,m-1}$ corresponding to the maturity (m) observed at time t was constructed for each CMT, by linear interpolation between the benchmark interest and forward rates. The forward rate forecast error for the one week forward rate observed at time t is defined by:

$$e_{t,t+1} = (r_{t+1,m-1} - {}_tf_{t+1}^{m-1})$$

Because the size of maturity change cannot be assumed to have a stable quantitative link to interest rate expectations, it is appropriate to initially test for the existence of any relationship using approaches which do not impose such strong restrictions. The testing approach adopted involves three steps. First, a contingency table approach was adopted to examine whether there is any evidence of changes in maturity predicting the sign of the forward rate forecast error. If CMT managers have predictive ability, there should be a disproportionately large number of maturity increases (decreases) in weeks prior to those in which the forecast error is negative (positive). For each CMT (using the group of 18) maturity changes (Δmat_t) and forward rate forecast error ($e_{t,t+1}$) are classified according to sign, and a 2x2 contingency table constructed.[14] Test statistics, based on the difference between actual and expected cell frequencies[15] were calculated for each CMT. Under the null hypothesis of no relationship between maturity change and forward rate forecast error, the test statistics are distributed as a Chi Squared distribution with 1 degree of freedom. Table 2 provides a summary of the results of those tests. It is clear that none of the test statistics are significantly different from zero at the 5 per cent level. We cannot reject the null hypothesis that there is no relationship between the direction of maturity changes and forward rate forecast errors.

To confirm these results, two other tests were performed. First, the average size of change in maturity (Δmat_t) associated with $e_{t,t+1}>0$ was compared with that associated with $e_{t,t+1}<0$. P-values for the t-test of a difference in means are also shown in Table 2 and

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[14] Cases where the forecast error was zero were excluded

[15] The test statistic is given by $\Sigma(e_{ij} - o_{ij})^2/e_{ij}$ where e_{ij} is the expected frequency in cell ij and o_{ij} is the observed frequency in cell ij.

they support the results of the contingency table analysis. Finally, a Granger causality test was run for each CMT, using the following regression[16]:

$$e_{t,t+1} = c_1 + c_2.e_{t-1,t} + c_3.e_{t-2,t-1} + c_4.dmat_t + c_5.dmat_{t-1} + u_t \qquad (4)$$

The p-values for the F-test of the null hypothesis that $c_4 = c_5 = 0$ are also shown in Table 2 and generally confirm the results of the previous tests (although for 2 of the 18 CMTs the null hypothesis that maturity changes Granger cause forward rate forecast errors, consistent with predictive ability, cannot be rejected at the 5 per cent level of significance).

Based on these results, there is no evidence of superior interest rate predictive ability of CMT managers. However, as noted earlier, the use of weekly data does raise the possibility that a relationship might exist between $e_{t-1,t}$ and $dmat_t$, which is not considered in those tests. For example, maturity might be adjusted during the week which ends at date t because of expectations that interest rates will change before the end of that week. Alternatively, maturity might be adjusted during the week in response to changes in interest rates which have already occurred during the week. Interest rates might Granger-cause maturity as found by Domian (1992) using aggregate data for US MMMFs.

For this reason, the preceding tests were repeated using forward rate forecast errors contemporaneous with changes in maturity (ie using $e_{t-1,t}$ and $dmat_t$ as endogenous variables). Table 3 presents the results, and it is apparent that, for approximately half of the CMTs there is evidence of contemporaneous correlation between maturity changes and forward rate forecast errors. For many of the CMTs the average maturity change is

[16] Use of different lag lengths had little effect on the results.

positive (negative) in weeks when the forward rate forecast error is negative (positive) and the difference in means is statistically significant in around half of the cases. Likewise, Granger causality type[17] tests shown in Table 3 confirm that for approximately half of the 18 CMTs), week t maturity changes (Δmat_t) contain information about the contemporaneous forward rate forecast error $e_{t-1,t}$.

This result is consistent with the hypothesis of interest rate predictive ability for a very short horizon of a few days and with very rapid adjustment of maturity. However, it is also consistent with the hypothesis that CMTs adjust maturity in response to contemporaneous interest rate changes. Estimating,

$$dmat_t = c_1 + c_2.e_{t-1,t} + c_3.e_{t-2,t-1} + c_4.dmat_{t-1} + c_5.dmat_{t-2} + u_t \tag{5}$$

and testing H_0: c_2=c_3 confirms (as expected, and shown in the last column of Table 3) that maturity changes are "caused" by contemporaneous and lagged forward rate forecast errors. Virtually no explanatory power exists if the contemporaneous forecast error ($e_{t-1,t}$) is omitted and greater lags of the forecast error included. (Using two lags of the forecast error commencing with $e_{t-2,t-1}$ generates significance at the 5% level for prior forward rate forecast errors in 3 of 18 cases, with none of the other cases significant at the 10% level).

There is clearly some contemporaneous correlation between maturity changes for a significant number of CMTs and interest rate movements, although the use of the forward rate forecast error in the preceding tests makes the relationship somewhat opaque. If the change in market interest rates ($\Delta r_{t,m}$) is used in place of $e_{t-1,t}$ in equation 5, the test results are little affected. Interest rate changes "granger-cause" maturity changes in 8 cases (7 of

[17] Because the contemporaneous maturity change is included as an explanatory, this is not strictly a test of Granger causality.

which are the same cases as when $e_{t-1,t}$ and its lagged values are used). For a significant number of CMTs contemporaneous changes in maturity and interest rates are inversely related.

Given the available data, it is not possible, on a statistical basis to discriminate between the alternative explanations for the contemporaneous negative association between maturity changes by some CMTs and interest rate changes. Changes in maturity occurring in the same week as interest rate changes could be indicative of CMTs adjusting maturity in response to current interest rate movements, or could reflect some ability to predict interest rates by CMT managers.

Closer consideration of the implications of analysis based on weekly data suggests that the hypothesis of interest rate predictive ability is unlikely to be supported. Maturity changes reported at each date t (a Friday) could have occurred at any time during that week. Similarly changes in interest rate expectations prompting such maturity changes could have occurred at any time during the week. If interest rate expectations are for a horizon of even a few days hence, some maturity changes (such as those made late in the week) reported in week t will be based on expectations about interest rates for the subsequent week. Consequently, some evidence of predictive ability would be found based on tests using Δmat_t and $e_{t,t+1}$.

It is also relevant to consider the identity and fortunes of those CMTs for which a negative association between contemporaneous changes in maturity and interest rates is observed. Of the 8 CMTs for which such a relationship exists, 4 have exited the industry, suggesting that it is unlikely that the relationship reflects predictive ability.

Conclusion

This paper has examined the extent to which portfolio maturity choice by CMTs indicates ability to predict future interest rate movements. Compared to previous literature examining interest rate predictive ability of US MMMFs, this study examines data for individual CMTs rather than aggregate data, specifies the type of the relationship which might be expected, and uses a range of statistical tests which do not impose overly strong restrictions on the nature of the relationship.

CMTs may add value for retail investors by providing indirect access to wholesale market interest rates, but there is little evidence of any superior interest rate predictive ability which might add value for investors. CMTs appear to be responding to some common influences in their maturity choices, and while these might include commonly held expectations of future interest rate movements, the evidence presented here indicates that confidence in the accuracy of such expectations is unfounded. Instead, it appears to be the case that many CMTs adjust their maturity partially in response to current movements in interest rates.

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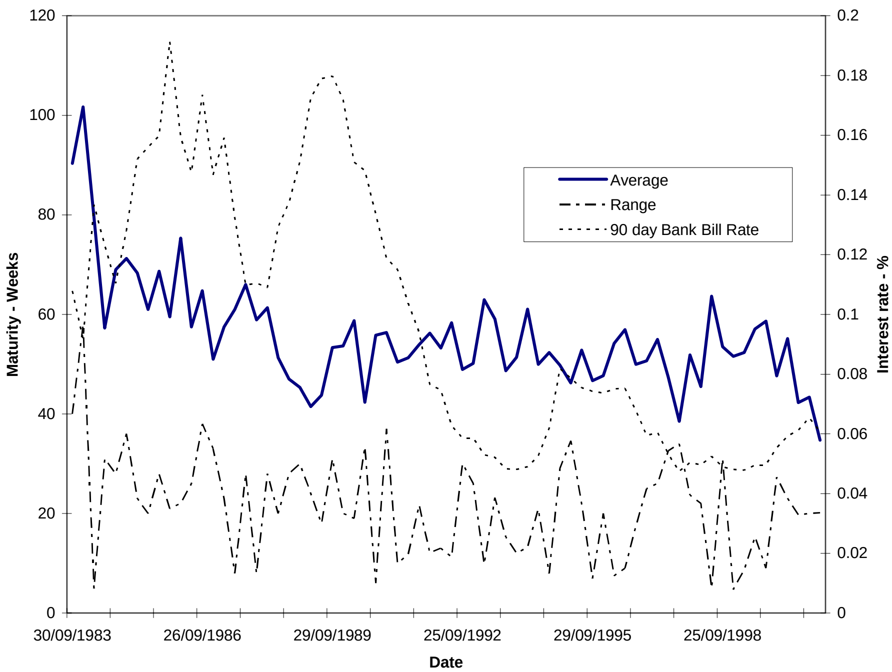
Figure 1: CMT Average Maturity and Market Interest Rates

This figures shows the average and range of maturity for four of the large "survivor" CMTs, together with the 90 day bank bill interest rate, at quarterly intervals.



Sources: 90 day bank bill rate - Reserve Bank Statistical Bulletin
CMT maturity – Australian Financial Review

Table 1: CMT Maturity Choice: Group of 9 "Survivors"

CMT Number	1	2	3	4	5	6	7	8	9
% of times CMT had the maximum maturity	9.0%	8.6%	20.3%	5.8%	19.2%	7.7%	5.4%	1.9%	22.2%
% of times CMT had the minimum maturity	6.3%	10.1%	0.6%	4.7%	6.5%	14.5%	3.9%	51.4%	1.8%
Mean maturity	51.6	49.5	56.9	50.7	54.3	48.4	51.2	33.5	57.3

Table 2:
Test Results for CMT Maturity Choice as a predictor of future interest rates

This table presents p-values for several tests of whether CMT maturity change between date t-1 and t ($dmat_t$) is related to the one week forward rate forecast error ($e_{t,t+1}$, using the forward rate observed at date t). The forward rate is for maturity (m-1) weeks where m is the CMT maturity at date t. The chi-square test compares the number of actual and expected increases and decreases in maturity for cases of positive and negative forecast errors. The t-test compares the difference in mean change in maturity for cases of positive and negative forecast errors. The F-test is a test of the hypothesis that $c_4=c_5=0$ in the regression $e_{t,t+1} = c_1 + c_2.e_{t-1,t} + c_3.e_{t-2,t-1} + c_4.\Delta mat_t + c_5.\Delta mat_{t-1} + u_t$.

	Chi-square test for difference in number of observations	t-test for difference in mean change in maturity			F-test for Granger causality
CMT No.	p-value	Mean difference	p-value	Number of observations	p-value
1	0.33	-0.03	0.98	326	0.21
2	0.82	-0.98	0.33	300	0.28
3	0.61	0.63	0.53	755	0.37
4	0.51	0.50	0.62	325	0.26
5	0.06	-0.71	0.48	775	0.22
6	0.13	1.55	0.12	541	0.03
7	0.39	0.46	0.64	335	0.33
8	0.20	0.09	0.92	341	0.27
9	0.34	-0.76	0.45	815	0.42
10	0.40	-0.13	0.90	328	0.59
11	0.25	-0.51	0.61	803	0.03
12	0.22	-0.64	0.52	764	0.73
13	0.68	0.73	0.47	451	0.36
14	0.85	-0.21	0.83	789	0.41
15	0.20	-0.23	0.82	776	0.56
16	0.94	0.83	0.41	775	0.91
17	0.71	-0.12	0.91	730	0.49
18	0.77	-0.79	0.43	513	0.76

Table 3:
Test Results for CMT Maturity Choice as a predictor of future interest rates

This table presents p-values for several tests of whether CMT maturity change between date t-1 and t (Δmat_t) is related to the one week forward rate forecast error ($e_{t-1,t}$, using the forward rate observed at date t-1). The forward rate is for maturity (m-1) weeks where m is the CMT maturity at date t. The chi-square test compares the number of actual and expected increases and decreases in maturity for cases of positive and negative forecast errors. The t-test compares the difference in mean change in maturity for cases of positive and negative forecast errors. The F-tests are tests of the hypothesis that $c_4=c_5=0$ in the regressions:

$$e_{t-1,t} = c_1 + c_2.e_{t-2,t-1} + c_3.e_{t-3,t-2} + c_4.\Delta mat_t + c_5.\Delta mat_{t-1} + u_t \text{ and}$$
$$\Delta mat_t = c_1 + c_2.\Delta mat_{t-1} + c_3.\Delta mat_{t-2} + c_4.e_{t-1,t} + c_5.e_{t-2,t-1} + u_t$$

	Chi-square test for difference in number of observations	t-test for difference in mean change in maturity			F-tests for Granger causality	
CMT No.	p-value	Mean difference	p-value	Number of observations	*"Δmat"* Granger causes "*e*" p-value	*"e"* Granger causes "*Δmat*" p-value
1	0.00	-4.01	0.00	326	0.00	0.00
2	0.00	-2.81	0.01	300	0.00	0.00
3	0.21	-0.76	0.45	755	0.43	0.35
4	0.08	-2.21	0.03	325	0.04	0.08
5	0.00	-2.60	0.01	775	0.06	0.14
6	0.56	-0.68	0.50	541	0.36	0.04
7	0.27	0.59	0.55	335	0.93	0.43
8	0.02	-2.75	0.01	341	0.00	0.00
9	0.00	-3.16	0.00	815	0.05	0.04
10	0.72	-1.90	0.06	328	0.92	0.39
11	0.01	-2.59	0.01	803	0.01	0.05
12	0.03	-1.98	0.05	764	0.17	0.18
13	0.65	0.48	0.63	451	0.19	0.27
14	0.99	-1.17	0.24	789	0.02	0.00
15	0.21	-1.82	0.07	776	0.16	0.10
16	0.79	0.23	0.82	775	0.93	0.97
17	0.48	0.77	0.44	730	0.80	0.59
18	0.08	-2.22	0.03	513	0.01	0.01