International Review of Business Research Papers
Vol. 5 No. 5 September 2009 Pp. 169-181

Relevance of Duration Analysis To Term Finance Certificates

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Aim: *The research paper examines the Duration Analysis on Term finance certificates (TFCs) a replica of bond. Term finance certificate (TFC) is a corporate debt instrument issued by companies In Pakistan to generate long and medium term funds (DAWN, May, 2003). These certificates have been issued as corporate bond since the year 1994-95 (Mahmud, July 2002). Ninety four issues of TFCs having aggregate value of Rs.69.974 billion have been floated up till 2007.* ***Methodology****: The study considers eighty five TFCs issues worth Rs.66.327 billion listed between the Fiscal years 1999 to 2007. TFC issues have been analyzed using Macaulay duration and Modified duration models. The term to maturity of the selected TFCs is one, three, four to eight years.* ***Results:*** *The Duration analysis of the eighty five TFCs reveals Macaulay duration < (less than) stated term to maturity Modified duration < (less than) corresponding Macaulay duration.* ***Conclusion:*** *The results are consistent with the bond portfolio, TFCs have the characteristics of bonds. TFC is a corporate bond & redeemable capital instrument*. ***3,188 words***

Field of Research: Finance – Corporate Bonds (Term Finance Certificates)

1. Introduction

The islamization of the financial system in Pakistan since 1985 necessitated introduction of new sharia based instruments for the investors. Preferred stocks and debentures have been phased out and replaced with the Participation Term Certificates (PTCs) and Term Finance Certificates (TFCs). TFCs are considered as quasi equity, redeemable capital instrument. Experiencing the workability and potentials of this instrument, to reduce heavy reliance on bank borrowing and also to develop the corporate bond market the government of Pakistan allowed the use of TFCs as corporate debt instrument. Kevin (2007) defines bonds as long-term fixed income securities or debt instruments used for borrowing by the government, public sector units and private companies. Term finance certificate

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(TFC) is regarded as corporate bond in Pakistan (Yousfani & Hussain 2004). It is a means for raising extensive resources for financing and mobilizing them into productive investment to promote economic growth and development. In this paper we are investigating and testing the Duration Analysis by applying Macaulay duration and Modified duration models on the TFC issues.

1.1 Scope of Research

The paper applies Macaulay duration and Modified duration models on term finance certificates issued during the years FY1999 to FY2007 both by the financial and non-financial entities.

1.2 Plan Of The Paper

The paper proceeds as follows: Section 2 gives the Objective of research. Section 3 presents Background information. Section 4 is the Conceptual coverage. Section 5 contains Review of the Literature on the models. Section 6 pertains to the Statement of Problem. Section 7 describes Research Methodology. Section 8 reports Computational analysis and Results derived from the respective models. Section 9 provides the Limitations. Section 10 presents the Conclusion.

2. Objective

The purpose of the research paper is to examine the application of duration analysis on the Term Finance Certificates – corporate bond in Pakistan.

3. Background

3.1 Term Finance Certificates (TFC)

Corporate bond market in Pakistan exists in the form of Term Finance Certificates (TFCs) – differs from traditional corporate bond firstly, it is sharia based secondly, it substitutes the word interest rate by the expected profit rate (Leonardo, 2000). Dawn newspaper's investor guide (May, 2003) defines Term Finance Certificates as a corporate debt instrument issued by companies to generate medium and long-term funds. TFC's are instruments of redeemable capital under section 120 of the Companies Ordinance 1984. An amendment in this section through the Finance Act 1994 enabled the Term Finance Certificate to be issued by various financial and non - financial entities in Pakistan, with a fixed term to maturity having a tenure of five to ten years (Khan, 1996). As part of overall financial sector reforms private companies have been allowed to issue TFC's from 1995 onwards (SBP-Financial Stability Review, 2006). The Companies Ordinance of 1984 gives the name "Term Finance Certificates" to those debt securities whose promised return by the issuer is built into the repurchase price at maturity. The difference between the original price and the repurchase price is referred to as fixed return

rather than “expected profit.” The certificates are regulated by the Securities & Exchange Commission of Pakistan (SECP) and their public issues are subject to credit rating. WAPDA – a public sector corporation launched the first bond in Pakistan in 1985 (Yousfani & Hussain 2004).

3.2 Size Of The TFC Market

The aggregate issue of TFCs since inception (1994) to 2007 amounts to Rs.69.974 billion (US $1.13 billion) while during the year 2007 TFCs worth Rs.14.2 billion (US $0.23 billion) have been issued. (SBP: Annual report 2006-7). Details presented at **Appendix: 1 & 2**.

4. Conceptual Framework

4.1 Duration

Kevin (2007) explains duration as a time period at which the price risk and the reinvestment risk are equal but in opposite direction. During this holding period the two effects exactly balance each other resulting in zero interest rate risk. Because what is lost on reinvestment is compensated by a capital gain on sale of TFC (bond) and vice versa. The holding period at which the interest rate risk disappears is called duration of TFC (bond). Duration indicates the length of time it takes a bond to be repaid by its internal cash flows. Bonds with longer durations are risky as such they have a higher price volatility compared to those with lower durations. (www.schaeffersresearch.com).

There are four types of durations - Macaulay duration, modified duration, effective duration and key-rate duration. Their calculations differ in the way they account for interest rate changes and the bond's embedded options or redemption features. These factors affect the degree to which bond price will change in the face of a change in prevailing interest rates the two variables work together and against each other. (www.regentschoolpress.comBondDuration.pdf). Fischer & Jordan (2006) state duration is the weighted average measure of a TFC’s (bond’s) life where various time periods in which the bond generates cash flows are weighted according to the relative size of the present value of those flows. Faboozi, Modigliani, Jones & Ferri (2002) state that duration is a measure of price sensitivity that incorporates maturity, coupon and level of yield and provides an approximation of the percentage price change for small changes in yield. Place, (2000); Reilly and Brown (2003) state that if duration is calculated under the assumption that the cash flows do not change when interest rates change it is Modified Duration. Modified Duration describes the sensitivity of a price of a bond to small changes in its yield. It indicates price volatility of the bond in response to interest rate changes and is derived by making a small adjustment to the Macaulay duration value.

4.2 Models

In a book written for the National Bureau of Economic Research in 1938, Frederick Macaulay first developed the concept of bond duration (Heck, Zivney & Modani, 1995).

4.2.1 Macaulay Model

Frederick Macaulay model has been used to analyze the duration of the TFC issues. In the formula numerator is the weighted present value of the cash receipts and denominator is the sum of all these present values equal to the total present value or price of the bond. (www.schaeffersresearch.com)

$$\text{Macaulay Duration} = \frac{\sum_{t=1}^{n} \frac{t * C}{(1+i)^t} + \frac{n * M}{(1+i)^n}}{C * \frac{\left[1 - \left[\frac{1}{(1+i)^n}\right]\right]}{i} + \frac{M}{(1+i)^n}}$$

n = number of cash flows
t = time to maturity
C = cash flow
i = required yield
M = maturity (par) value

This model enables us to examine the relationship of duration analysis with the term-to-maturity of the respective TFCs.

4.2.2 Modified Duration Model

Macaulay derived Modified Duration to approximate the percent change in bond value for a given percent change in yield using the following formula (www.regentschoolpress.com).

$$\text{Modified Duration} = \left[\frac{\text{Macaulay Duration}}{\left(1 + \frac{\text{yield - to - maturity}}{\text{number of coupon periods per year}}\right)}\right]$$

This model indicates how much the duration calculated for the TFC changes for each percentage change in yield.

5. Literature Review

The literature review covers empirical research on different approaches towards the calculation of duration vis-à-vis Macaulay and Modified duration analysis on bonds since TFCs replicates bonds. Duration is a powerful tool that determines the impact of interest rate changes on the price of a TFC /bond (www.news.morningstar.com). Macaulay defined duration as the total weighted average time for recovery of the interest payments and the final return of principal in relation to the current market price of the bond (www.regentschoolpress.com). McEnally (1977) views duration as a measure of the average time prior to the receipt of payment. Carreiro (1998) in his article reviews the duration measure as an invention that allows bonds of different maturities and coupon rates to be compared directly. In the long- term bonds the price swings is more violent to changes in interest rates. In this article Duration is referred as weighted average of the times that interest payments and the final return of principal are received. The weights are the present values of the payments, using the bond's yield-to-maturity as the discount rate.

According to ezine article duration is stated to be the weighted average term to maturity of bonds cash flows and a valuable tool in assessing bond price sensitivity to interest rate shocks. It is regarded as the most common technique for quantifying the price sensitivity and is generally used to approximate changes in the price of the bond for every 100 basis point change in yields (modified duration). The lower the yield the greater will be the duration on the bond. A bond having a longer duration is far more volatile than corresponding shorter duration. Duration is an effective means for determining interest rate risk for the individual investor. (www.ezinearticles.com/?Bond-Duration-Explained&id=1078337).

Heck, Zivney and Modani (1995) cite the number of papers written to simplify the Macaulay's duration measure – Chau (1984) derived a closed-form formula enabling faster computation of duration; Caks, Lane, Greenleaf and Joules (1985) also referred as CLGJ utilized the linearity of duration as a combination of the interest and maturity payments to calculate duration for a coupon bond; Moser and Lindley (1989) adapted CLGJ formula on multiple coupons per year; Benesh and Celec (1984) simplified formula by compounding periodic yields rather than multiplying the periodic yield by the number of periods per year. Duration increases on the day a coupon is paid otherwise it continuously decreases as time to the bond's maturity approaches redemption date and removed from the series of future cash flows - all this occurs until duration, eventually converges with the bond's maturity.

(http://www.investopedia.com/university/advancedbond/advancedbond5.asp).

Heck, Zivney & Modani (1995) in their article developed a simplified alternative duration & convexity calculations they have identified several valuable uses of

Duration for investors namely it is a measure of interest rate risk, provides a benchmark for comparing risk of alternative bonds, if it matches the investment planning horizons then it minimizes interest rate risk, investors can compute total interest rate risk exposure on their portfolio. HZM method yields accurate results, estimates associated interest rate risk and quickly calculates the expected change in bond price corresponding to change in yield to maturity. Villazon (1991) in the study on the behavior of duration of bonds states duration is used for taking decisions for investing capital in specific projects. He concludes duration to be a decreasing function of the coupon rate and yield to maturity (YTM). According to Winfried (1987) there are two interpretations of duration, first it measures long, average or weighted time period of a bond; second duration measures the price sensitivity of a bond relative to change in interest rate. He has observed that term-to-maturity is inappropriate for measuring the life of the coupon bond because coupon payments are made before the repayment of the principal amount.

5.1 Variables

The variables identified are Coupon payment, Yield-to-Maturity, Term-to-Maturity (price) and Interest rate

6. Statement Of Problem

Investigating the duration analysis on listed TFCs, gives the result as that on corporate bonds because the TFCs have been structured to resemble bonds.

7. Methodology

7.1 Research Design

The study is both exploratory and descriptive. The exploratory approach supports the application of models for analyzing the duration on TFC issues. The descriptive approach provides background and conceptual information. Computation for deriving result is based on the present value of cash flows from a bond.

7.2 Sample

The sample consists of eighty five term finance certificates floated, listed between the fiscal years 1999-00 to 2006-07. These TFCs have different maturity dates ranging from one, three and four to eight years.

7.3 Sources of Data

7.3.1 Secondary Source

Sources of secondary data are:

- Prospectus for Floatation of public issue of Term Finance Certificates.
- Annual Reports of company.
- Books on bond and portfolio management.
- Journals and Magazines.
- Web sites: google Scholar, wikipedia, investopedia etc.

8. Result Of The Analysis

The result of the Duration analysis of the eighty five TFCs having varying coupon payments, term to maturity and price is summarized below:

- Macaulay Duration < (less than) stated term to maturity.
- Modified duration < (less than) corresponding Macaulay duration.

Table: 1
One Year Maturity

No. of Term Finance Certificates floated	**3**
Term to Maturity	**1 year**
Macaulay Duration years	**0.96**
Modified Duration years	**0.89**

Table: 2
Three Year Maturity

No. of Term Finance Certificates floated	**6**
Term to Maturity	**3 year**
Macaulay Duration years	**2.53**
Modified Duration years	**2.35**

Table: 3
Four Year Maturity

No. of Term Finance Certificates floated	**12**
Term to Maturity **Macaulay Duration years**	**4 year** **3.11**
Modified Duration years	**2.88**

Table: 4
Five Year Maturity

No. of Term Finance Certificates floated	**42**
Term to Maturity	**5 year**
Macaulay Duration years	**3.69**
Modified Duration years	**3.43**

Table: 5
Six Year Maturity

No. of Term Finance Certificates floated	**3**
Term to Maturity	**6 year**
Macaulay Duration years	**4.21**
Modified Duration years	**3.92**

Table: 6
Seven Year Maturity

No. of Term Finance Certificates floated	**5**
Term to Maturity	**7 year**
Macaulay Duration years	**4.60**
Modified Duration years	**4.29**

Table: 7
Eight Year Maturity

No. of Term Finance Certificates floated	**14**
Term to Maturity	**8 year**
Macaulay Duration years	**5.39**
Modified Duration years	**5.09**

According to the characteristics of bond measurement duration is always shorter than its term-to-maturity (Reilly 1994). Likewise Duration measure of the above TFCs computed using the two models is less than their respective term-to-maturity.

9. Limitations Of Research

Following are the limitations of the research study:

- Insufficient data for analysis pertaining to TFC issues.
- Working is on firm based information.
- Few empirical research available on different approaches towards the calculation of duration using models namely Macaulay and Modified duration.

- The paper has formed basis for further analyses in the context of other models.

10. Conclusion

The result of Term Finance Certificate conforms to the following characteristics of bond duration:

- The duration of a coupon bond is always be less than its term-to-maturity (Reilly, 1994). Likewise Duration of the TFCs computed from the two models is less than their respective term-to-maturity.

- For a bond Modified duration is always less than the corresponding Macaulay duration the same is true for TFC.

- There is an inverse relationship between yield-to-maturity (YTM) and duration. Duration measure of the TFC decreased when YTM increased and vice versa.

The research concludes Term Finance Certificates (TFC) is a replica of corporate bond it exhibits the general characteristics of bonds.

11. References

Advanced Bond Concepts: Duration,
http://www.investopedia.com/university/advancedbond/advancedbond5.asp

Advanced Bonds Duration,
(http://www.schaeffersresearch.com/schaeffersu/education.aspx?id-17112/3/2009

Benesh, G.A., & Celec, S.E. 1984, A Simplified Approach for Calculating Bond Duration, Financial Review, vol.19, no. 4, pp. 394-396.

Bodie, Zvi, Alex, Kane & Marcus, Alan J., 2004, Essentials of Investments 4th edition, McGraw-Hill.

Bond Duration Explained.
http://ezinearticles.com/?bond-duration-explained&id=1078337

Caks, J., Lane, W.R., Greenleaf, R.W. & Joules, R.G. 1985, A Simple Formula for Duration, Journal of Financial Research, vol. 8, no. 3, pp.245-249.

Chau, J. 1984, A Closed-form Formula for Calculating Bond Duration, Financial Analysts Journal, vol. 40, no. 3, pp. 76-78.

Companies Ordinance, 1984, www.pakistanlawyer.com

Dawn, May 11, 2003, The Investor's guide to personal investment.

Faboozi, Frank J., 2007, Modigliani, Franco, Jones, Frank, J. & Ferri, Michael, G., Foundation of Financial Markets and Institutions, 3rd edition, Pearson Education, India.

Fischer, Donald E. & Jordan, Ronald J., 2006 Security Analysis and Portfolio Management, Pearson Prentice Hall, New Delhi.

Heck, J.L., Zivney, T.L. & Modani, N.K.,1995 A Simplified Approach to Measuring Bond Duration, Financial Services Review, vol. 4, no. 1, pp. 31-40.

Kevin, S., 2007, Security Analysis and Portfolio Management, Prentice-Hall of India, New Delhi.

Khan, S.A., September 1996, Recent Developments in the Regulatory Framework of Capital Market in Pakistan, The Journal of the institute of Bankers in Pakistan, pp.11-18.

Leonardo, J., 2000, Pakistan Survey: Issues in Local Bond Market Development, in Building Local Bond Markets An Asian Perspective, ed. Alison Harwood Ed. International Finance Corporation, World Bank Group, Washington DC, pp. 167-206. www.worldbank.org

Macaulay, F. R., 1938, Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States Since 1865, National Bureau of Economic Research, New York.

Mahmud, Dr. Mohammad, July 2002, Development of Corporate Bond Market in Pakistan: Challenges and Prospects, The Journal of the institute of Bankers in Pakistan, pp. 59.

McEnally, R.W., 1977, Duration as a Practical Tool for Bond Management, Journal of Portfolio Management, pp. 53-56.

Moser, J.T. & Lindley, J.T., 1989, A Simple Formula for Duration: An Extension, Financial Review, vol. 2, no. 43, pp. 611-615.

Place, J., December 2000, Basic Bond Analysis, Bank of England. www.bankofengland.co.uk

Reilly, Frank K., & Keith, C. Brown, 2003, Investment Analysis and Portfolio Management, 7th edition, South-western Publishing, USA.

Reilly, Frank. K., 1994, Investment Analysis and Portfolio Management. 4th edition, The Dryden Press, USA.

Rich Carreiro, 1998 Bonds Duration.
http://invest-faq.com/cbc/bonds-duration.19 Feb.1998

Robert J Donohue. Introduction to Cash Flow Analysis, CCIM Regent School Press. http://www.regentschoolpress.comBondDuration.pdf

SBP – Annual Reports various issues.

SBP - Financial Stability Review, 2006.

Villazon, C., 1991, Bond Duration, Yield to Maturity and Bifurcation Analysis, 2nd AFIR Colloquium, Barcelona Spain, Vol.1, pp.201-223.

Winfried, H. October 1987, A Simple Closed-form Formula for bond's Duration, Centre for Research in Business Economics, Department of Business Finance and Portfolio Investment, Eramus University Rotterdam, Report 8716/F.

Yousfani, A. M. & Hussain, S. A., July 27, 2004, Development of TFC Market in Pakistan: Challenges and Prospects, Journal of Independent Studies and Research (JISR), Szabist Karachi. Vol. 2, no. 2.

Appendix: 1

Table-1:

Pakistan TFC Market Size

Rs. in Million

Date of Issue	# of TFC Issues	Year-wise TFC Amount	Cumulative TFC Amount
1994-95	1	210	210
1995-96	2	750	960
1996-97	1	1000	1960
1997-98	1	274	2234
1998-99	3	1413	3647
1999-00	3	937.5	4584.5
2000-01	10	5390	9974.5
2001-02	17	9500	19475
2002-03	21	10399	29874
2003-04	6	3300	33174
2004-05	12	15600	48774
2005-06	7	7000	55774
2006-07	9	14200	69974
TOTAL	99	69974	

Source: State Bank Annual Reports

Appendix: 2

Table-2

Yearwise Selected TFC Issues

Rs. in Million

Date	# of TFC Issues	Yearwise Amount
1999-00	3	937.5
2000-01	10	5390
2001-02	17	9500
2002-03	21	10399
2003-04	6	3300
2004-05	12	15600
2005-06	7	7000
2006-07	9	14200
	85	66326.5
Source: State Bank Annual Reports		