



ASSETS PRICING AND EQUITY DURATION PARADOX

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ABSTRACT

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We used the co-integration approach and panel unit root test to estimate banks' equity duration in Pakistan, India, China, Australia, the UK and the US from 1992 to 2017. The results showed that the highest duration is in the UK and Chinese banks then the US and Indian banks followed by the banks in Pakistan and Australia. These results have important implications for policymakers particularly because banks act as channels for monetary policy. Since duration is a measure of sensitivity to interest rates, these results imply that the UK and Chinese banks would be the most affected by monetary policy changes while those in Pakistan and Australia would be the least affected. Since duration also measures the speed by which cash flows come back, these results indicate that investors in Pakistan and Australia banks recover their investments faster than investors in the Indian, US, Chinese and UK banks. Therefore, banks in Australia and Pakistan are the most profitable while those in the UK and China are the least profitable.

Contribution/Originality: This study is one of few studies to have investigated the asset pricing and equity duration paradox by estimating banks' equity duration in Pakistan, India, China, Australia, the UK and the US. These results have important implications for policymakers particularly because banks act as channels for monetary policy.

1. INTRODUCTION

Over time, different researchers have contributed towards the equity duration analysis in financial institutions especially banks. In this paper we examined the dispute of bank equity duration. Banks being financial institutions lend money to the consumers or borrowers and at the same time accept deposits from customers or clients and in this way they tend to be more sensitive towards interest rates than other non-financial institutions. The gap between lending and borrowing using asset liability management provides a bank's profit. This duration analysis concept helps indicate how fast investments can be recovered and the sensitivity of share prices to changes in interest rates. It is one of the techniques of asset / liability management that is used to measure interest rate risk and liquidity risk. We estimated duration by using the co-integration approach and the unit root test on panel data.

The classical approach based on the McCauley approach and the Leibowitz (1986) approach provide contradictory estimates of duration. It has been suggested that duration should be valued empirically i.e. estimated by observation or experience rather than theory. The empirical information gives indication about the profitability

of shares portfolio to the banker and central bank. It allows us to do compare duration between banks in different countries and examine individual effects within the same model.

Different researchers have shown that the equity market generally responds to interest rate changes (Fama and French, 1989). However, when it comes to bank stocks the case is a little different and unclear. The banks being in the business of lending / borrowing makes them more sensitive to interest rates than other non- financial institutions. Studies showed that banks' stock return are far greater in terms of sensitivity to interest rates than those of non-financial institutions (Lyngne and Zumwalt, 1980; Flannery and James, 1984; Booth and Officer, 1985). Other prior studies on the same issue have been conducted using ARCH based methods and the results have shown that fluctuating interest rates have an impact on bank shares. Some examples are (Flannery *et al.*, 1997; Elyasiani and Mansur, 1998).

Cox *et al.* (1981) found that investors are risk adverse so there is no hope that expected returns on all bonds are the same over all possible time limits. In the beginning of 2000 a perfect storm for defined benefit pension funds was created after there was a decline in the long term interest rates and stock prices. Chance (1990) and Acharya and Carpenter (2002) highlighted the importance of adjusting duration for call risk and default.

When banks can hedge their exposure to changes in interest rates by the matching of assets and liabilities, they are less affected by fluctuation in interest rate. The hypothesis developed by researchers Cornell and French (1983) suggested a direct association between the amount of net nominal assets and bank stock sensitivity and the duration of those assets. So, a mismatch of the assets and liabilities can make banks sensitive to interest rate variations. Peng *et al.* (2003) stated that the impact of the interest rate change affects the incentive of investors to keep their deposits in banks. The impact of changes in interest rates was much higher on depositors than borrowers. The article concluded that the pre-tax profitability of the banks was primarily driven by actions in the interest rate margins.

Ngugi (2001) went a step forward while describing the banks' problem of covering their costs and staying profitable even with different levels of interest rates. The article further discussed the impact of different risks on the differential the banks charged to borrowers. The spread was stated to also be dependent over the perfection of the market. The spread in a perfect market is usually low due to stability and competition with other financial institutions while the spread is high during uncertain conditions. However, the imperfect market is when the legal framework in a given jurisdiction is not strong enough for the repayment. In this case, the bank charges a higher spread in order to cover the risk of loan default by any of its borrowers.

The macro-economic environment also creates a positive or adverse effect on the profitability of the banking sector since banking is a financial intermediary and gets directly affected by changes in the financial market due to macroeconomic factors. The borrower is directly affected by the performance of the market which leads to the decision regarding bank financing or to keep the volume of business steady. The financial decisions are usually made via a rational cost to benefit analysis which is aided by the performance and stability of financial market and economy. The demand for bank borrowing is also dependent on the elasticity of interest rate. Lower elasticity reflects that the spread can be higher and it also reflects an underdeveloped money market. The profitability of the banking sector in the presence of an underdeveloped money market is usually high due to fewer options being available to the borrower. The article explained different aspects of banking risks which were covered through higher premiums charged to the borrower in jurisdiction with lower law enforceability, higher financial instability and interest rate elasticity.

Evrensel (2008) also said that the banks that were unable to cope with the changing macroeconomic factors like inflation, domestic credits and interest rates, were more likely to fail. So, the implementation and forecast of concrete policies on risk mitigation plays an important role when commenting on the risk appetite of a bank in depressed economic conditions. The financial institutions are likely to develop strong risk management frameworks to handle the shocks arising due to significant changes in interest rates. The presence of a regulator's good central policies also plays an important role when analyzing the banks' performance in an economy.

The banks are considered to be risk-free investments by domestic and commercial depositors. The product basket of a bank consists of a few products designed to suit the needs of a depositor. Some depositors are looking for fruitful returns from their deposits held into the bank while some are not interested in interest income and just require good facilities for their day to day transactions. We are more concerned with the depositors who require a risk-free return from bank. The return on their deposit is directly associated with the prevailing interest rate in the market. To cater to the diversified needs of the depositors, banks have long term and short-term deposit solutions available for the clients and offer returns on those deposits according to the tenor of investments. However, banks are considered to be the main source of funding for business and directly aid the economic development of the country. The cost of deposits plus operating costs along with consideration for risk is actually the cost that the bank bears for the purpose to lend which in addition to spread become the offered cost to the businesses. The increasing uncertainty in the market makes the cost of funds higher for the banks and the banks then charge higher interest to their borrowers to stay profitable. Any lag in this chain results in losses for the banks. The articles discussed above identified many factors which affect the profitability of banks and the main cost is the changing interest rate which becomes the benchmark for calculating the cost of borrowed funds and helps the banks decide the minimum interest rate they require to cover all costs.

The articles also discussed the importance of a strong regulator and its unbiased policies to keep the sector strong. The introduction of lending rate ceilings not only cuts the hands of this sector but also directs the bank towards decreasing the cost of funds and ultimately moving to less operations and decreased profitability. The presence of a strong regulator, better law enforcement and uncertain conditions aids in the better performance of the banking sector due to the lower risks associated with it. However, the lending rates are kept higher in volatile, uncertain and comparatively risky economies.

The complication and complexity of the interest rate and share prices relationship and conflicting results by other researchers show the need for reexamining these relationships in both the short term and long term as there can be serious implications caused by the connection between these variables. Therefore, this study tries to determine whether bank equity prices react to the interest rates and assets and liabilities mismatch affects a bank's equity duration in both developed nations (UK, USA and Australia) and developing nations (Pakistan, India and China) using a classical approach based on the McCauley approach and [Leibowitz \(1986\)](#).

2. LITERATURE REVIEW

Many researchers have conducted studies on equity duration analysis in the banking sector and have examined the correlation between banks' share prices and interest rates. The rate of interest is the amount charged by the lender to the borrower to use assets and considered as a principal percentage, annually noted, called APR (annual percentage rate). The assets include both liquid and fixed assets like cash, buildings, and vehicles. Interest is a leasing charge or a rental charge by the lender to the borrower for the assets that are being used and for large assets (like a fixed asset such as land) the interest rate is a lease rate and if the borrower's risk profile is low the bank will charge minimum interest and if the borrower's risk profile is high the bank will charge a higher interest rate to mitigate the risk. The interest rate affects financial market and if there is an increase in interest rates it would eventually drive investing decisions and changes in investment structure.

Studies have shown that the stock returns of banks are far more sensitive towards interest rates than those of non-financial institutions ([Lynge and Zumwalt, 1980](#); [Flannery and James, 1984](#); [Booth and Officer, 1985](#)). Studies conducted have shown significant abnormal returns and the results show a consistently adverse relationship between the rate of interest surprises, bank earnings and also between the rate variability and bank returns ([Aharony et al., 1986](#)). However, researchers have found no impact on bank share prices when there is a change in interest rate in the long term ([Aharony et al., 1986](#); [Akella and Greenbaum, 1992](#)).

With the increase in the interest rate the borrower has to pay more for the money they have borrowed. As the interest rate rises the cost of their loan also rises and it has a negative impact on their profitability, due to which the share prices also decrease. An increase in the interest rate can lead to a decrease in the profitability of corporate bonds. The holder of the bond does not get an attractive profit till the maturity of bond due to the high interest rate (Accaglobal.com). Banks offer different varieties of interest rates for borrowing and saving. The central bank plays a vital role for the economy's growth and financial stability by setting the interest rates. The major source through which commercial banks have a positive gain in their income is the interest income from the interest rate that is above or below the inter bank loan rate. The central bank will sometimes boost up the interest rate in order to correct different issues such as the inflation rate. High interest rates encourage people to deposit money in the bank by giving a good return on savings which directly affects the inflation rate and also the currency revaluation for an increase in the value of money. When the interest rate rises it increases the demand of government securities.

Prior studies show a clear picture that when the interest rate rises it affects the borrowers. However, it doesn't affect the performance of banks. When there is an increase in the interest rate the borrower pays more and the lender enjoys profit or return. In Pakistan, comparatively, the spreads are higher. When the interest rate goes up, people would move towards savings and that results in the increase in banks' profit.

Bourke (1989) and Molyneux and Thornton (1992) found positive relationships among better quality management and overall profitability. Different studies have found out that it is very important for the banks that they hedge their risk with interest rate swaps, with estimation effects stated as non-interest earnings (Gorton and Rosen, 1995). As the liabilities of banks in terms of maturity are shorter than their assets and have a shorter interval for re-pricing, they receive floating rates and pay fixed rates. A higher interest rate would result in valuation gains and also affects the interest margins. Bashir and Hassan (1997) in their research showed the sensitivity of the interest rate to stocks in the UAE and found out that the stocks of the banking sector were negatively impacted by changes or fluctuations in the interest rate.

Dividend growth and earnings have always been slower than net economic growth and related to this during the twentieth century, growth in dividends was two percent slower than basic macroeconomic growth (Bernstein and Arnott, 2003). Bleakley and Cowan (2008) opposed the idea that the cause of financial crises was short term liabilities by pointing out that regions and countries in financial crises or distress would be prone to issuing more short term debts and have maturity mismatches. Later on, they found no difference between the sum of investment by firms with high and low maturity mismatches during reversals (capital reversals) in emerging markets. Vaz *et al.* (2008) from January 1990 to June 2005 by using a market model found out that when the interest rate changes or increases there was no negative change on stock returns in Australian banks as opposed to US banks, where there was a negative impact if there was an increase in the interest rate. There was also a positive abnormal return if there was an increase in cash rate. It was found that Australian banks that work in a less concentrated environment and competitive environment effectively manage the earnings impact when there is a cash rate change.

Nishat and Shaheen (2004) examined the long term relationship between the KSE index and macroeconomic variables and concluded that the largest negative and positive determinants were inflation and industrial production. A causal relationship between the interest rate and stock market was found. There was a significant relationship of the property index and stock index with all variables.

Bredin *et al.* (2007) examined the sensitivity between 33 industry portfolios of stock returns of four European economies to market risk, the interest rate and exchange rate from 1973 to 2004. Banks in the UK were the least profitable while those in the US were most profitable. When it comes to the US banks there was a negative impact by the change of interest rate or the fluctuation in interest rates on the stock returns of banks (Lynge and Zumwalt, 1980; Bae, 1990; Kwan, 1991; Dinienis and Staikouras, 1998; Czaja and Scholz, 2007).

Studies show that there is a differential effect of expected changes in the interest rate and actual changes in the real interest rate on the stock returns of Spanish companies and both financial and non-financial institutions at the

sector level (Jareño, 2008). The two most important factors of the economy that affect common stocks are the foreign exchange rate and interest rate risk (Bredin *et al.*, 2007; Vaz *et al.*, 2008). If there is an increase in the interest rate, there is a change in the investment structure and eventually investing decisions to change from the capital market into fixed income securities. Interest rate variability generates a motion to the market i.e. from capital market to money market. However, the stocks are generally sensitive to the interest rate because there is an inverse relationship between stocks and interest rate changes (Alam and Uddin, 2009).

Past research has shown a negative association between the interest rates and equity returns for highly developed economies (Ioannidis and Kontonikas, 2008; Bredin *et al.*, 2009). Different studies have shown a negative relationship between the short term stock returns and interest rates (Arango *et al.*, 2002; Abugri, 2008). Other studies highlighted the different role of regional (Cooray and Wickremasinghe, 2007) and global factors (Ang and Bekaert, 2002; Fifield *et al.*, 2002; Kundu and Sarkar, 2016) that affect stock returns if there is a change in the interest rate.

The studies in Pakistan show that oil prices, inflation and industrial production are not substantial in defining share prices in the long term whereas the exchange rates, money supply and interest rate have a substantial effect in the long term on share prices. In the short term, changes in oil prices, industrial production and inflation have insignificant influence whereas the interest rate changes, money supply and exchange rates have a significant short-term influence (Hasan and Nasir, 2008). Khawaja and Din (2007) examined the interest rate spreads' determinants in Pakistan by using industry variables and firm variables. They found that one of the major interest rate spreads' determinants is the inelasticity of deposit supply.

In summary, the literature indicates that there is no clear evidence for a study on the asset pricing and equity duration paradox by estimating the banks' equity duration and by comparing developed and developing countries. Therefore, this study contributes to the existing literature by investigating the asset pricing and equation duration paradox by considering the countries of Pakistan, India, China, Australia, the UK and the US.

3. METHODOLOGY

The initial concept by Hicks (1939) on duration states that it is the average numbers of years required recovering the present value of a loan. Their research showed it is the elasticity of the banks' share prices with the interest rate. We can say that duration is the degree of relationship between the interest rate price and also the price of an asset. When we talk about bonds, by using the bond valuation formula we can say that the bond price and yield to maturity are inversely related to each other. But when it comes to equities it is different than bonds because there are many other factors other than the interest rate that impact the equity price. The net present value of a stock is one of the functions of discount factor and its cash flows. In other words, it is used to value stock based on the net present value of the future dividends, this is also termed as Dividend Discount Model (DDM) (Farrell, 1985) in DDM The cash flow can be dependent on the interest rate. The traditional approach to measure duration is based on the DDM which is presented below:

$$D = \frac{(1+k)}{(k-g)} \quad (1)$$

Where Equation 1 explains, g is the dividend growth rate, k is the discount rate and D is the Dividend growth. Leibowitz (1986) projected one of the ways to calculate duration which was based on the grouping of the equations below relating to equity returns and bond returns:

$$R_e - R_f = a_1 + \beta_E(R_B - R_f) + e_1 \quad (2)$$

$$R_B - R_f = a_2 + \beta_B(\delta) + e_2 \quad (3)$$

Consider Equation 2 and 3 where:

R_E = Equity market return.

R_B = Bond market returns.

R_f = Risk free rate.

δ = Change in benchmark long term yield.

β_E = Sensitivity of equity market returns to bond market returns.

β_B = Sensitivity of bond market returns to benchmark long term yield.

This approach of duration uses the price whereas Leibowitz (1986) uses the return and that is why different duration figures are produced by them. The latter shows a lower duration as the price risk is offset by reinvestment risk as showed by Johnson (1989). The DDM (Dividend Discount Model) duration produces a far higher value than Leibowitz (1986) model (Leibowitz and Kogelman, 1993) known as the equity duration paradox. Hurley and Johnson (1995) worked to settle the change between the two duration measures by discovering the DDM model or traditional approach for permitting a non-linear track for the dividends in a Markov sense, by putting the convexity properties of equity duration in their example.

The above models created equity interval levels in between that of the Leibowitz and traditional model. Leibowitz and Kogelman (1993) made a similar attempt but their outcomes again differed significantly from the earlier models. There is still no officially determined method that is best for calculating duration.

That is why still there is scope for literature on banks' sensitivity to the duration measurement and to interest rates. This study offered a different approach for empirically calculating duration in the banking business across six countries. Our result provided proof of banks' sensitivity to share prices in the five countries by using the panel co-integration method for estimating and evaluating duration. This method has the advantage of using more information from both cross section and time series data. This method allows for individual properties or effects and makes it easier to compare duration between different countries.

As stated previously, Hicks (1939) revealed that duration is the elasticity measure which is unit free as we can interpret it in comparative terms. Elasticity is said to be equal to the projected slope parameter in the regression equation if the used variables are in logarithmic form which is proved as follows. Assume that the independent variable (X) and dependent variable (Y) relationship was explained by the given exponential function:

$$Y_t = AX_t^b e^{u_t} \quad (4)$$

Where,

Scale parameter is represented by 'A'.

Exponent is donated by 'b'.

Natural base is represented by 'e'.

u_t = White noise error term.

The elasticity of Y to X and its mathematical formula is then donated by ϵ_{YX} as follows in Equation 5:

$$\epsilon_{YX} = \frac{\delta Y_t}{\delta X_t} \frac{X_t}{Y_t} \quad (5)$$

Giving us the following result:

$$\epsilon_{YX} = \frac{\delta Y_t}{\delta X_t} \frac{X_t}{Y_t} = bAX_t^{b-1} e^{u_t} \frac{X_t}{Y_t} = bAX_t^{b-1} e^{u_t} \frac{X_t}{AX_t^b e^{u_t}} = b \quad (6)$$

Here in Equation 6, capital asset value is the dependent variable whereas the interest rate is the independent variable and b is equal to elasticity. When estimating elasticity, we can estimate our Equation 4 as shown in Equation 7:

$$\ln Y_t = \ln(A X_t^b e^{u_t}) = \ln A + b \ln X_t + u_t \quad (7)$$

OLS can be used to estimate Equation 7 providing the direct measure or degree for elasticity duration in positions of projected value for (b), while we used panel data analysis in our study. For panel data we have used the corresponding regression model as described in Equation 8:

$$\ln Y_{it} = a_i + b_i \ln X_{it} + \varepsilon_{it} \quad (8)$$

Where,

t = 1, ..., T.

i = 1, ..., N.

T = Time series dimension.

N = No. of (cross sectional units).

We applied the method of (GMM) generalized method of moments for estimating Equation 8 that is not sensitive to presence of heteroscedasticity and autocorrelation and these features may be prevailing in panel data set. Before estimation of Equation 8 it was important that we checked the properties of the time series of the fundamental panel data to avoid misleading results.

The data generating method is described by unit roots for numerous economic variables. For unit roots the Dickey-Fuller test statistics is a known test statistic and it is based on Equation 9:

$$\Delta x_t = \gamma x_{t-1} + e_t \quad (9)$$

For one-unit root the null hypothesis is $\gamma = 0$. When it comes to small sample sizes, Dickey-Fuller test statistics has a very low command. If you want to improve the command properties of Lin and Levin (1993) Dickey Fuller test the Im et al. (2003) IPS hereafter presented panel versions of the test. The panel unit root test is built on the below mentioned system:

$$\begin{pmatrix} \Delta x_{1t} \\ \Delta x_{2t} \\ \vdots \\ \Delta x_{Nt} \end{pmatrix} = \begin{pmatrix} \gamma_1 x_{1t-1} \\ \gamma_2 x_{2t-1} \\ \vdots \\ \gamma_N x_{Nt-1} \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \\ \vdots \\ e_{Nt} \end{pmatrix} \quad (10)$$

By combining the cross-section dimensions and time series in Equation 10 there is more freedom in the result. Every error term is supposed to be a random process (white noise). $\gamma_1 = \gamma_2 = \dots = \gamma_N = 0$ is the null hypothesis of the 'one panel unit root'. The developed panel unit root test by Lin and Levin (1993) is shown and built on the Equation 11:

$$\Delta x_{it} = \gamma_i x_{it-1} + e_{it}, \text{ for } i = 1, \dots, N \text{ and } t = 1, \dots, T \quad (11)$$

N = No. of Cross sections.

T = No. of Time series opinions.

When we talk about the above two dimensions and their combinations, it results in N x T (degrees of freedom). According to some of the authors the unit root panel estimator can be defined as follows in Equation 12:

$$\sqrt{NT}(\hat{\gamma}-1) = \frac{\frac{1}{\sqrt{N}} \sum_{i=1}^N \frac{1}{T} \sum_{t=1}^T x_{it-1} e_{it}}{\frac{1}{N} \sum_{i=1}^N \frac{1}{T^2} \sum_{t=1}^T x_{it-1}^2} \quad (12)$$

By applying the t statistics below, we can test the null hypothesis (no panel unit-root) as shown in Equation 13:

$$t_{\gamma} = \frac{(\hat{\gamma}-1) \sqrt{\sum_{i=1}^N \sum_{t=1}^T x_{it-1}^2}}{\sqrt{\frac{1}{NT} \sum_{i=1}^N \sum_{t=1}^T e_{1t}^2}} \quad (13)$$

It was mentioned that we could see in the simulation experiments (Monte Carlo) by Levin *et al.* (2002) that comparatively the panel unit root test has a more superior influence than the simple unit root test.

By allowing a different coefficient of unit root, the flexibility of IPS test is more reliable than the individual Dickey Fuller test which is explained in Equation 14:

$$\bar{t} = \frac{1}{N} \sum_{i=1}^N t_i \quad (14)$$

t_i = Individual t-statistic used to test $H_0: \gamma_i = 0 \forall i, i = 1, \dots, N$ and for $H_1: \gamma_i < 0, i = N_i+1, N_i+2, \dots, N$. Such that:

$$\lim_{N \rightarrow \infty} \frac{N_1}{N} = c, 0 < c \leq 1$$

The test allows for heterogeneity in panel data. The experiment's or "Monte Carlo" approach was used by Karlsson and Löthgren (2000) who demonstrated that the IPS test has more improved power properties.

It was essential to check whether the variables contain panel unit roots or not. If they do contain them, then the panel co-integration test has to be applied to avoid false regression. We used the procedures that were established by Pedroni (2004) for testing the panel co-integration.

1. Equation 15 shows Non-Parametric (Panel t-Statistic):

$$Z_{tN,T} = [\hat{\sigma}_{N,T}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11}^{-2} \hat{e}_{it-1}^2 - 1/2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11}^{-2} (\hat{e}_{i,t-1} \Delta \hat{e}_{it} - \hat{\lambda}_i)] \quad (15)$$

2. Equation 16 shows Parametric (Panel t-statistic):

$$Z_{tN,T}^* = (\tilde{S}_{N,T}^{*2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11}^{-2} \hat{e}_{it-1}^2 - 1/2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11}^{-2} \hat{e}_{i,t-1}^* \Delta \hat{e}_{i,t}^*) \quad (16)$$

3. Equation 17 shows Non-parametric (Group t-statistic):

$$N^{-1/2} \tilde{Z}_{tN,T} = N^{-1/2} \sum_{i=1}^N (\hat{\sigma}_i^{2 \sum_{t=1}^T \hat{L}_{11}^{-2} \hat{e}_{it-1}^2}^{-1/2} \sum_{t=1}^T \hat{e}_{i,t-1} \hat{e}_{i,t} \hat{\lambda}_i) \quad (17)$$

4. Equation 18 shows Parametric (Group t-statistic):

$$N^{-1/2} \tilde{Z}_{tN,T}^* = N^{-1/2} \sum_{i=1}^N \sum_{t=1}^T (\tilde{S}_i^{*2} \hat{e}_{i,t-1}^*)^{-1/2} \sum_{i=1}^N (\sum_{t=1}^T \tilde{S}_i^{*2} \hat{e}_{i,t-1}^*)^{-1/2} \sum_{t=1}^T \hat{e}_{i,t-1}^* \Delta \hat{e}_{i,t}^* \quad (18)$$

Likewise, we have obtained estimated error terms by using the Equation 19 and Equation 20:

$$\hat{\varepsilon}_{it} = \hat{\gamma}_i \hat{\varepsilon}_{it-1} + \hat{\mu}_{it} \quad (19)$$

And

$$\Delta \ln Y_{it} = a_0 + a_1 \Delta \ln X_{it} + \hat{\eta}_{it} \quad (20)$$

Δ is first change operator. $\hat{\varepsilon}_{it}$ signifies the residuals from panel exemplary which has been defined in Equation 8.

For each test the statistics modifications were made as explained by Pedroni, so that each observation was normally distributed. For these statistics the adjusted values that we used in our study could be equated or could be associated to the standard normal distribution values, which were applied for both the unit root and co-integration tests.

We used the quarterly data of treasury bills, MSCI index data (banking index data) for the UK, the US, Australia, China, Pakistan and India from 1992 to 2017. However, all these countries have a central bank which sets the monetary policy. The share price of the banks depends on the variation in the interest rate, which determines the essential information for conducting monetary policy in all of the above mentioned countries, since the banking sector serves and assists as the network for the monetary policy and these judgments are transmitted. Banking is a major sector in portfolio allocation whereby fund managers and investors make decisions on investing in each of the above countries.

4. STATISTICAL ANALYSIS

4.1. Panel Unit Root (Stationarity Test)

In order to check the data stationarity, the table below explains the Augmented Dickey and Fuller Test (ADF), Im, Pesaran and Shin Test (IPS), Levin, Lin and Chu Test and Fisher PP Test.

The panel unit root test in Table 1 for the US, the UK and Australia shows that for the LnMSCI and LnInterest Rate both the P values were above 5 percent which showed that these data were non-stationary at all levels so there was a unit root and we accepted the null hypothesis. However, at the 1st difference level there was stationarity among the variables.

Table-1. Panel unit root test (US, UK and Australia).

Variables	LLC		IPS		ADF		PP	
	Test for I(0): Level		Test for I(0): Level		Test for I(0): Level		Test for I(0): Level	
	P-value	Decision	P-value	Decision	P-value	Decision	P-value	Decision
LnMSCI	0.0843	Non-stationary	0.3005	Non-stationary	0.4076	Non-stationary	0.3953	Non-stationary
LnInterest Rate	0.5495	Non-stationary	0.6831	Non-stationary	0.8329	Non-stationary	0.7915	Non-stationary
Variables	LLC		IPS		ADF		PP	
	Test for I(1): First difference		Test for I(1): First difference		Test for I(1): First difference		Test for I(1): First difference	
	P-value	Decision	P-value	Decision	P-value	Decision	P-value	Decision
LnMSCI	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary
LnInterest Rate	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary

Source: Authors' own elaboration.

For Pakistan, India and China the panel unit root test in Table 2 shows that for the LnMSCI and LnInterest Rate both the P values were above 5 percent meaning that these data were non-stationary at all levels. This

indicated that there was a unit root so the null hypothesis was accepted. Stationarity among the variables was found at the 1st difference level.

4.2. Panel Co-Integration Model

The co-integration method was used to find the long term relationship among the variables. Firstly, we converted the non-stationary data into stationary data and this test provided practical support that variables co-integrated in the panel perspective so interest rates and share prices of banks had a stationary long term relationship. We used Pedroni's co-integration test in this approach.

Table-2. Panel unit root test (Pakistan, India and China).

Variables	LLC		IPS		ADF		PP	
	Test for I(0): Level		Test for I(0): Level		Test for I(0): Level		Test for I(0): Level	
	P-value	Decision	P-value	Decision	P-value	Decision	P-value	Decision
LnMSCI	0.5820	Non-stationary	0.7035	Non-stationary	0.7734	Non-stationary	0.7588	Non-stationary
LnInterest Rate	0.4317	Non-stationary	0.0879	Non-stationary	0.1337	Non-stationary	.0745	Non-stationary
Variables	LLC		IPS		ADF		PP	
	Test for I(1): First difference		Test for I(1): First difference		Test for I(1): First difference		Test for I(1): First difference	
	P-value	Decision	P-value	Decision	P-value	Decision	P-value	Decision
LnMSCI	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary
LnInterest Rate	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary	0.0000	Non-stationary

Source: Authors' own elaboration.

Table-3. Co-integration test (US, UK and Australia).

Alternative hypothesis: common AR coefs. (within-dimension)				
	Statistic	Prob.	Weighted statistic	Prob.
Panel v-statistic	-0.200842	0.0396	0.169694	0.0326
Panel rho-statistic	-0.122549	0.4512	-0.540427	0.2945
Panel PP-statistic	-0.021493	0.0414	-0.376727	0.0332
Panel ADF-statistic	0.097498	0.0038	-0.154602	0.0036
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-statistic	-0.242816	0.4041		
Group PP-statistic	-0.252195	0.0004		
Group ADF-statistic	0.158796	0.0001		

Source: Authors' own elaboration.

Table-4. Co-integration test (Pakistan, India and China).

Alternative hypothesis: common AR coefs. (within-dimension)				
	Statistic	Prob.	Weighted statistic	Prob.
Panel v-statistic	1.257289	0.0104	1.864276	0.0311
Panel rho-statistic	-0.912760	0.0180	-1.342250	0.0198
Panel PP-statistic	-0.939156	0.0173	-1.182379	0.0185
Panel ADF-statistic	-0.630742	0.2641	-0.849452	0.1978
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-statistic	-0.729541	0.0328		
Group PP-statistic	-0.974188	0.0150		
Group ADF-statistic	-0.612031	0.2703		

Source: Authors' own elaboration.

Table 3 and 4 shows that for the Panel v-Statistic, Panel PP-Statistic, Panel ADF-Statistic, Group PP-Statistic and Group ADF-Statistic probabilities the P values were below 5 percent which indicated that the null hypothesis was rejected and the alternative hypothesis was accepted. And though the Panel rho-Statistic and Group rho-Statistic probability P values were greater than 5 percent we accepted the null hypothesis and rejected the alternative hypothesis.

4.3. Elasticity

Table-5. The long term interest rate elasticities (Duration) of bank's share prices (US, UK and Australia).

Country	Elasticity	S.E.	T-statistics	P-value
US	-1.111	0.247	5.324	0.0000
UK	-1.789	0.402	-6.113	0.0000
Australia	-0.890	0.514	-2.941	0.0013

Source: Authors' own elaboration.

As shown in Table 5 there was a negative relationship between the equity prices of banks and interest rates. We analyzed the elasticity of the developed countries in the Table 5 by using the GMM with the t-statistics, standard error, p-values and elasticities. Our result showed a negative relationship between all the coefficients which indicated that the share prices of banks responds in the opposite direction to the interest rates. The highest elasticity as shown in our table was that of the UK (1.789), then the US (1.111) and then Australia (0.890). That means that the UK in terms of bank shares took the longest time to recover any investment while Australia took the shortest time. These results indicated that banks in Australia were leading in terms of making profits and that the UK were lagging and that the shares of banks were the most sensitive to interest rates in the UK and least so in Australia. Banks in the UK were the least profitable while those in the US were the most profitable. The stocks were generally sensitive to interest rates because there was an inverse relationship between stocks and interest rate changes (Alam and Uddin, 2009).

Table-6. The long term interest rate elasticities (Duration) of bank's share prices (Pakistan, India and China).

Country	Elasticity	S.E.	T-statistics	P-value
Pakistan	-0.591	0.303	-3.483	0.0001
India	-0.897	0.200	3.148	0.0000
China	-1.455	.0178	-5.746	0.0030

Source: Authors' own elaboration.

As shown in Table 6 there was a negative relationship between equity prices of banks and interest rates. We analyzed the elasticity of the emerging countries in the Table 6 by using the GMM with the t-statistics, standard error, p-values and elasticities. Our result showed a negative relationship between all the coefficients which indicated that the share prices of banks responds in the opposite direction to the interest rates. The highest elasticity as shown in our table is that of China (1.455), then India (0.897) and then Pakistan (0.591). That means that China in terms of bank shares took the longest time to recover any investment while Pakistan took the shortest time. These results indicated that banks in Pakistan were leading in terms of making profits and banks in China were lagging as shown in the results and that the shares of banks were the most sensitive towards interest rates in China and the least sensitive in Pakistan . When it comes to the US banks there was a negative impact by the change of interest rate or the fluctuation in interest rates on the stock returns of banks (Lyng and Zumwalt, 1980).

5. CONCLUSION

Using the above approach and the unit root test we found that the bank returns and banks share prices are negatively linked to interest rate variations and are also sensitive. In developed countries, the bank shares have the highest duration in the UK then the US and Australia and in emerging countries, bank shares have the highest duration in China, then India and Pakistan. As our research was about how fast investment in shares is recovered, our results showed that banks in Australia and Pakistan are the attractive to investors. This seems supported by the fact that during the 2008 financial crisis, most of the world was affected but Pakistan and Australia were not hugely impacted.

The reason behind this may be that Pakistan invested in its local market. The SBP, Pakistan's regulatory authority and central bank, ruled that all financial institutions could not invest more than 10 percent of equity on foreign investment (SBP-Prudential regulation) which saved Pakistan from financial disaster.

Banks in the UK and China were the least safe because they invested in the derivative market. In the derivative market banks invest in underlying assets and future contracts but in Pakistan and Australia banks invest in current or physically available products. The results indicated that bank shares in the UK and China were the most sensitive towards interest rates and then in India, the US and then Australia and Pakistan. When central banks change the interest rates it will have the highest impact on the banks in China and the UK and the least impact in Pakistan and Australia. Pakistan and Australia have less interest rate risk than the UK and China which means Pakistan and Australia as compared to the UK and China have the lowest need for hedging.

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