Forman Journal of Economic Studies
Vol. 20(1), 2024 (January–June), pp. 69-86 DOI: 10.32368/FJES.20242004

Asymmetric Interest Rate Pass-Through at the Disaggregated Data: The Case of Pakistani Banks

Haniya Fatima[1] Malaika Ayub[2] Farwa Javed[3] Farrukh Mahmood[4]

Abstract

This research analyzed the interest rate pass-through (IRPT) hypothesis from central banks to commercial banks in Pakistan's banking sector. Compared to the literature, this research used disaggregated data (private, public, foreign, specialized, and all banks) with monthly frequency to capture the more appropriate behavior of the data. The data is available on the State Bank of Pakistan's website. Based on the properties of the data, this research used a co-integration estimation method in the presence of the Momentum Threshold Auto Regressive (MTAR) model. This econometric model will help us to capture the symmetric vs asymmetric co-integration and rigidities in empirical models. Empirically, we found different types of IRPT across various types of banks, but the change in the policy rate is the same for all these banks, which ultimately creates the hurdles in achieving the objective of monetary policy. Therefore, we suggest that the State Bank of Pakistan must construct different policies across different types of banks to achieve the objective of the monetary policy.

Keywords: Interest Rates Pass-through, Co-integration, Asymmetric, Rigidities

JEL Classification: E43, C32, D82

1. Introduction

The efficiency of the monetary policy depends upon the rate pass-through from the central bank to the commercial banks. A complete pass-through implies that commercial banks has completely adopted the change in the monetary policy rate and consequently transferred to the consumers. Hence, central bank have a fully efficient monetary policy. It is only possible when the structure of the market is perfectly competitive. Contrary, when the market is not fully competitive, then it tends to be more oligopoly (Wang and Lee, 2009). In the case of oligopoly, the commercial banks are not able to transfer the total cost due to changes in the monetary policy to their consumers. Thus, we have an incomplete IRPT. Other

[1] Research Student, Department of Economics, Information Technology University, Lahore, Pakistan.
[2] Research Student, Department of Economics, Information Technology University, Lahore, Pakistan.
[3] Research Student, Department of Economics, Information Technology University, Lahore, Pakistan..
[4]Assistant Professor, Department of Economics, Information Technology University, Lahore, Pakistan.
Corresponding Author's Email: bseds20003@itu.edu.pk

factors of incomplete pass-through are market segmentations, information asymmetry, funding costs, and the risk considerations.

The available literature in Pakistan indicates incomplete pass-through in the banking sector. For example, Ahmed et al., (2019) discovered that the pass-through to the lending rate was partial and slow, and took almost a year to transfer fully. Qayyum et al., (2005) also discovered slow and incomplete pass-through of interest rate to banks. Similarly, Batool et al., (2021) discovered a limited pass-through, with around 26% of policy rate changes passed to the lending rate. In a recent report by State Bank of Pakistan (2024), the IRPT has been reduced to 20.5%. Table 1 represents the summary of the literature review on the IRPT; almost all researchers claim incomplete and slow IRPT, not only in the case of Pakistan but also in other countries. However, some found that rigid rises in deposit interest rates and decreases in lending-rate might result in system inflexibilities (Wang and Lee, 2009; Mahmood, 2017; Khan and Hanif, 2014). According to Mahmood and Zakaria (2021), there is less volatility in loan rates, and deposit rates are more inflexible to the increasing trend. Meanwhile, Khan (2020) found that loan rates tend to decrease as more banks operate in a market. Sticky interest rates on loans are a significant concern for the financial system. Lending-rate also react to changes in money market rates more rapidly than fresh deposits (Hanif, 2012). Fresh deposits often react more swiftly to changes in money market rates than average rates on open accounts.

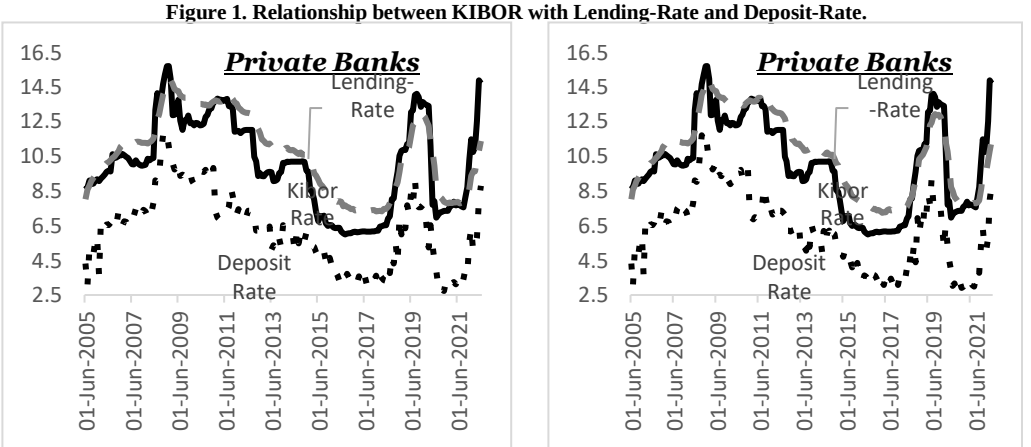
The available literature explains the pass-through to the banking sector as a whole, but hardly focuses on the banking sector consisting of different kinds of banks. State Bank of Pakistan (SBP) has categorized banks into four categories: private, public, specialized, and foreign. As shown in Figure 1, the relationship between the lending rate and the deposit rate with KIBOR significantly varies across different categories of banks. Similarly, the margin also varies across banks. For instance, foreign banks show almost complete IRPT in the case of lending-rate. On the other hand, specialized banks show very low IRPT, public banks represent incomplete and delayed IRPT in the case of lending-rate, and private banks represent incomplete IRPT. Similarly, the margin, mark-up and mark-down level varies across each specialization. Despite this, the prior research focuses only on the banking sector as all banks are homogenous and adapt the policy rate simultaneously, making their claims invalid. This research paper aims to fill this gap by considering the four categories of banks prescribed by the State Bank of Pakistan.

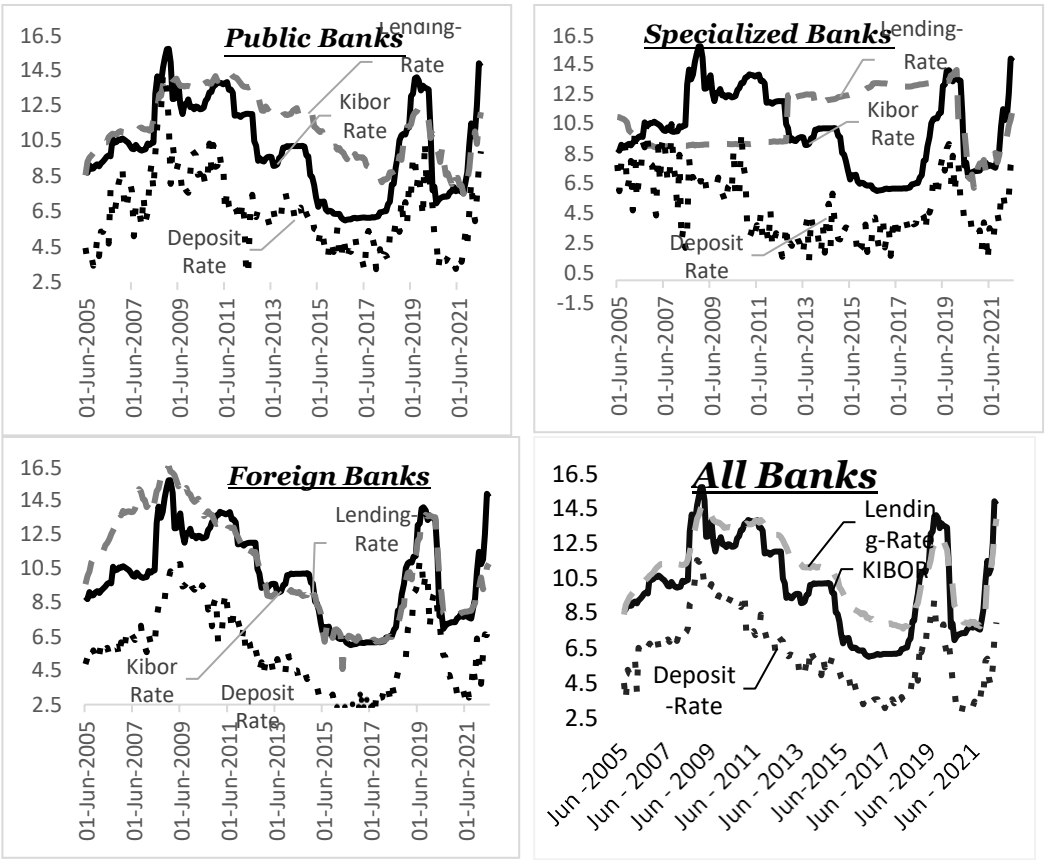
Moreover, the prior research on IRPT relies only on data from a restricted time frame. The results deposit-rate drawn from a few observations are usually unreliable and may not accurately represent the population or phenomenon being studied. This is because small sample sizes are more susceptible to random variation or chance factors, which can lead to biased or skewed results. Furthermore, research needs to be conducted on latest data. This research paper is taking data from 2005 up till 2022, the most updated data available.

To accomplish these goals, the researcher considers the four categories of banks defined by SBP, i.e., private, public, specialized, and foreign. This research uses the asymmetric co-integration between banks and monetary policy. Using the most recent data, the researcher will examine the long and short-term relationships between the KIBOR rate, deposit-rate, and lending-rate of various bank types. The study will analyze time series data on loan, deposit-rates, and policy interest rates using econometric techniques including Engle and Granger method, the Threshold Autoregressive Model (TAR), and the Momentum Threshold Autoregressive Model (MTAR). The study uses the KIBOR rate as a stand-in for the policy rate. The State Bank of Pakistan provided the information. The findings of this research will shed light on the nature and causes of IRPT in Pakistan, with implications for monetary policy efficacy and financial system stability.

This paper consists of six sections. The researcher introduces the study's objectives and purpose in the first section. The second section consists of a literature review of IRPT on disaggregated bank data. The third section covers the methodology, source of data, and model used for the research. Section 4 elaborates on the results. Section 5 analyzes the results. Section 6 concludes the paper.

Figure 1. Relationship between KIBOR with Lending-Rate and Deposit-Rate.





Source: The monthly data is collected from the website of the State Bank of Pakistan.

Table 1. Summary of Literature Review

Researcher	Variables	Sample			Methodology	Results
		Observations	Time Period	Source		
Ahmed et al. (2019)	T-bills rate, weighted average LR, weighted average deposit-rate, half-yearly call money rate, and consumer price index		January 2006 to December 2015	State Bank of Pakistan	VECM and IRF	T-bill rates significantly impact the call money rate, lending-rate and deposit-rate.
Altavilla et al. (2019)	Lending-rate to NFC, lending-rate to HHs, Bank bond yields, deposit-rate, Sovereign debt exposure, Non-performing loans (gross), CET1 capital ratio, Leverage ratio, Credit default swap (CDS), Capital and Reserve, Total Assets	325 Banks	July 2007 to October 2017	ECB Statistical Data	Two-step cross-sectional vector autoregressive (VAR)	The IRPT varies significantly in different banks of the Eurozone, and this heterogeneity is the primary cause of the incomplete pass-through
Bredin, D., Fitzpatrick, T., and Reilly, G. O. (2002).	Money market interest rate and retail LR	Ireland	January 1980 to March 2001	Central Bank of Ireland database	ECM	Between the money market rate and lending rate, significant structural changes occur in the rate of pass-through and the speed of adjustment. The degree of pass-through is significantly lower.
Eleam et al. (2021)	Prime and maximum lending-rates, 7-day, one-month, quarterly, semi-yearly and yearly deposit, standing deposit facility, standing lending facility	Nine different types of retail interest rates.	June 2007 to December 2019	CBN's statistics database	EC-E-GARCH-M model	The IRPT is asymmetric, with banks responding more strongly to lending facility rate hikes than to deposit facility rate cuts; the pass-through in the standing facilities rate varies by bank size.
Fazal and Salam (2013)	Semi-annually T-bills is used as a proxy for the policy rate the weighted average lending-rate and the weighted average deposit-rate.	72	June 2005 to May 2011	SBP	VAR models and impulse response functions (IRFs)	IRPT affects the lending rate more than the deposit rate in the short run and in the long run. The rate of pass-through is higher in the case of the lending rate.
Gigineishvili (2011)	Retail and market interest rates and their volatility, size, geographic region, development level, exchange regime, GDP growth, and inflation.	70 Countries	December 2005 to March 2010	IFS and individual country central bank publications	Co-Integration Analysis	Market IRPT adjustments are limited in developing financial markets and vice versa. Established financial markets demonstrate increased persistence of market interest rates.
Hanif (2012).	Money market rate, deposit-rate and lending-rate	Pakistan	July 2001 to August 2011	State Bank of Pakistan	ARDL model	Immediate pass-through from T-bill rates and overnight rate to the money market rate
Horváth, C., J. Krekó and A. Naszódi (2004).	Corporate lending and deposit-rates	Short-term corporate deposit rates of 23 banks and lending rates of 21 banks	January 2001– January 2004	Hungary	ECM and Non-Linear TAR Model	The corporate lending rate adjusts fully and quickly in response to the money market rate. Deposit rates and household loan rates show incomplete and/or rigidities. The deviations from the long-run equilibrium of the money market rate and the adjustment rates of banks may vary.
Kanwal et al. (2014).	CPI and exchange rates	Pakistan	2005 - 2010 (Monthly)	SBP and SECP	Multiple Linear regression	Inflation and exchange rate fluctuation have a positive impact on interest rates.
Khan (2020).	Lending rate	300 geographical markets across Pakistan	April 2006 - May 2012	Credit Information Bureau	Price-concentration hypothesis	The margin of the banks decreases as the number of banks grows in a geographical market.
Khawaja, M. I., and Khan, S. (2008).	KIBOR, six-month deposit-rate, and weighted average lending-rate	Pakistan	September 2001 to February 2009	State Bank of Pakistan	ACF, PACF, and Taylor Rule	The delayed pass-through limits the efficacy of interest rates as a tool for policymaking to the lending and deposit-rate.
Kwapil and Scharler, 2010		15 European Countries	January 1995 to September 2003	BIS, IFS, Fed	VAR and SVAR model	The pass-through in most nations is incomplete and has deteriorated over time.

Lee, T.H. (1994).	Deposit-rate and lending-rate	1245 observations from the New York Foreign Exchange Market	March 1, 1980, to January 28, 1985.	Baillie and Bollerslev (1989a, 1989b)	A system of error correction models and GARCH	The squared spread may often explain unmolded conditional heteroscedasticity in GARCH models, and larger spreads are associated with more volatile exchange rates.
Mahmood and Zakaria (2021).	Deposit-rate, lending-rate, and T-Bill rate	Pakistan	January 2004 to March 2017	State Bank of Pakistan	EC-E-GARCH-M	The IRPT, as compared to previous studies, is higher for Pakistan.
Mahmood, F. (2018).	KIBOR and Retail Interest Rates	Pakistan	January 2004 to December 2013.	State Bank of Pakistan	EC-EGARCH-M model	Asymmetric relationship among the KIBOR and the lending and deposit-rates.
Mahmood, F., (2023).	Money Market Rate	8 countries	February 1998 - December 2004	Wang and Lee (2009)	Engle and Granger, ARCH	The results suggest that only the US is suitable for the co-integration test, as other countries show high money market rates or co-integration due to structural breaks.
Mohsin, H.M. (2011).	Deposit-rate and lending-rate	Pakistan	November 2001 to March 2011	The SBP	Co-Integration analysis	The rate of pass-through is about only 20% in the first month, showing insufficient pass-through.
Munir, M., Tufail, S., and Ahmed, A. M. (2022).	GDP, inflation, retail and policy interest rate, investment, and co	Pakistan	1980 Quarter 1 to 2018 Quarter 4	Hanif et al. (2013) and IFS	DSGE model	The type of shock determines the nature and magnitude of pass-through. A weak and negative association was found among the cost channel of monetary policy and the degree of pass-through.
Nizamani et al. (2021).	Monetary policy rates	12 private commercial banks	2003:Q2 to 2015:Q4	IFS	Pooled Mean Group	To enhance MP's effectiveness, the SBP should restrict bank capitalization and reduce excess liquidity in the banking sector.
Oyadeyi, O. (2022).	Open buy-back rate, Interbank call money rate, Monetary policy rate, lending-rate, savings deposit-rate, monthly, quarterly, half-yearly and yearly deposit-rate.	Nigeria	Monthly data from December 2006 to 2020	Nigeria's Statistical Bulletin issued by central bank (2021)	ECM and Autoregressive Distributed Lag model	Compared to Lending-rate, deposit-rates react to changes in policy and interbank rates more strongly but more slowly.
Qayyum et al. (2005).	Six-month T-Bill rate, Call money rate, Deposit-rate, half yearly deposit-rate, and lending-rate.		March 1991 to December 2004	Statistical Bulletin published by SBP	Transfer function approach	IRPT in Pakistan is partial, and changes in policy rates take a long time to be transferred entirely to market rates
Sander, H., and Kleimeier, S. (2002).	Money market rates and commercial bank lending-rate.	All EU Countries	January 1985 to December 1998	IFS	ECM with the consideration of structural breaks in analysis	It is discovered that different countries' adjustment processes vary in their character and speed.
Toolsema, L. A., Sturm, J. E., and Haan, J. (2002).	Three-month interbank rate and Lending-rate.	6 European Countries	1980-2000	ECB and IFS	ECM	Empirically, a weak rate of monetary transmission was found, even if there are significant disparities in pass-through.
Wang and Lee (2009).	Money market rate and the retail interest rate	10 countries	January 1994 to December 2004	IFS	EC-EGARCH	Information of the market is important for the effectiveness of the monetary policy.
Batool, S., Asghar, N., and Rasul, F. (2021)	Discount rate and maturity wise deposit rates	Pakistan	December, 1978 to December, 2019		Philips and Loretan methodology	Slow and incomplete pass-through has been observed in the long-run.

2. Data and Methodology:

2.1 The Data

Data for the research has been collected from the State Bank of Pakistan (SBP). The dataset contains monthly interest rate information for several types of banks from June 2005 to June 2022. The Karachi Inter Bank Offered Rate (KIBOR) rate is taken as a proxy for the policy rate set by the central bank due to the lack of available data on the policy rate.[5] Additionally, lending and deposit-rate data from four categories of banks - public, private, foreign, and specialized - have been collected from the SBP. The data from all the banks has been included in the analysis. These variables are crucial for examining the dynamics of IRPT and comprehending how various bank types react to changes in the policy rate.

Figure 1 represents the relationship between KIBOR, deposit-rate, and lending-rate. According to SBP, there are four specialized banks in Pakistan: Zarai Taraqiati Bank Limited, The Punjab Provincial Cooperative Bank, and Industrial Development Bank of Pakistan, SME Bank Ltd. The IRPT for specialized banks in our sample seems lower than the banking sector average. This is most likely due to their reliance on borrowing rather than deposits to support lending and their rigid lending-rate set in cooperation with the government. Regardless of the cause, this implies that specialized banks negatively influence the banking sector's total IRPT.

There are 15 private banks in Pakistan (State Bank of Pakistan, 2022). The lending-rate of private banks is adapting to the KIBOR with more paces compared to the deposit-rate of private banks. The speed of IRPT is higher for private banks' lending-rate. There are five public banks in Pakistan, including First Women Bank Limited, the National Bank of Pakistan, the Bank of Khyber, the Bank of Punjab, and Sindh Bank Limited. Public banks have less IRPT than private banks. We can see that the IRPT to lending and deposit-rates of public banks are incomplete and slow.

Only four foreign banks operate in Pakistan, including Citi Bank N.A., Deutsche Bank AG, Industrial & Commercial Bank of China, and Bank of China Limited. As shown in the figure, The IRPT to the lending-rate of foreign banks is almost complete. However, IRPT to the deposit-rate of foreign banks is incomplete and volatile. The banks' deposit and lending-

[5] The policy rate is announced randomly, contrary, the lending and the deposit rates are issued regularly on monthly bases by the State Bank of Pakistan.

rate collectively have also been observed. The IRPT to the deposit and lending-rate of all banks is partial. The IRPT to lending-rate is almost complete and fast. However, all banks' IRPT to deposit-rate is incomplete and volatile.

2.2. The Methodology

The prerequisite of the time series analysis is to test the existence of the unit root process. Therefore, this research applied ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) tests, and unit root tests are carried out to evaluate the stationarity characteristics of the variables. These evaluations assist in identifying if the variables have a unit root, suggesting non-stationarity. We can guarantee the validity of subsequent econometric analysis by considering the stationarity of the variables.

To measure the IRPT of banks, this research used Momentum Threshold Auto Regression (MTAR). MTAR has been used because the ECM-EG model cannot handle the asymmetries present in the data. This methodology is well explained by Wang & Lee, 2009 and Mahmood, 2017, and is adopted in this research. The results obtained from ECM-EG model are not reliable, and there will be a misspecification problem. TAR is used to tackle this issue. However, TAR cannot handle the momentum present in data (Wang & Lee, 2009). In short, MTAR is the most suitable strategy to capture the complex and dynamic nature of the IRPT process. The MTAR model allows for non-linearities and asymmetries in the relationship between the interest rate of the central bank and the interest rates of various types of banks. This is more realistic and accurate than linear models. As a result, the MTAR model is a good option for studying IRPT at disaggregated data of banks and gaining insights into its dynamics and heterogeneity across various bank types. The MTAR model is specified as:

$$\Delta e_t = M_t \rho_1 e_{t-1} + (1 - M_t)\rho_2 e_{t-1} + e_t \quad (1)$$

where the indicator variable Mt is defined as

$$M_t = \begin{cases} 1 \text{ if } \Delta e_{t-1} \geq \tau \\ 0 \text{ if } \Delta e_{t-1} < \tau \end{cases} \quad (2)$$

Equation (2) indicates that if the change in error term reaches or exceeds the threshold level. (r), then the coefficient of adjustment and margin will be ρ_1 and $\rho_1 e_{t-1}$, respectively. Conversely, if the change in

error term is less than the threshold level (r), then the coefficient of adjustment and margin will be ρ_2 and $\rho_2 e_{t-1}$, respectively. Afterwards, the dataset was analyzed, and Wald tests were run to see if co-integration and asymmetry existed. Two tests were specifically performed: the first tested for the existence of co-integration $(\rho_1 = \rho_2 = 0)$, and the second tested for the existence of asymmetry in the data set $(\rho_1 = \rho_2)$.

After checking the asymmetry and co-integration, the researcher checked the short-run relationship between the KIBOR rate, bank deposit-rate, and lending-rate.

$$\Delta DR = \alpha + \beta\Delta(\text{KIBOR}) + \Delta\text{error}$$

$$\Delta LR = \alpha + \beta\Delta(\text{KIBOR}) + \Delta\text{error}$$

These equations state the ratio of IRPT in a month. If there is a 1 basis point increase in KIBOR in a month, the deposit-rate will increase by β basis points. Similarly, the lending-rate is anticipated to rise by β basis points in response to a monthly increase of one basis point in KIBOR.

3. Empirical results and discussion

The results of the unit root test show that the data series under examination has stationarity characteristics. Stationarity is a prerequisite for statistical inference because non-stationary time series may show spurious relationships and false conclusions.

Table 2: Empirical results of Unit-Root Tests

Banks	Variables	At Level		At First Difference	
		ADF	PP	ADF	PP
Public Banks	Lending	0.0927	0.2307	0.000	0.000
	Deposit	0.0474	0.0149	0.000	0.000
Private Banks	Lending	0.0763	0.2981	0.002	0.000
	Deposit	0.4492	0.2228	0.000	0.000
Foreign Banks	Lending	0.5297	0.5216	0.000	0.000
	Deposit	0.4532	0.3611	0.000	0.0001
Specialized Banks	Lending	0.5242	0.3444	0.000	0.000
	Deposit	0.0150	0.0000	0.000	0.000
All Banks	Lending	0.1163	0.2835	0.093	0.000
	Deposit	0.3960	0.2721	0.000	0.000
	KIBOR	0.3559	0.3011	0.000	0.000

Note: The table displays the ADF and PP unit root test results for variables of various bank types. The tests were conducted at the original data level and on the data's first differences. The null hypothesis of a unit root is weighed against the alternative

hypothesis of stationarity in the ADF and PP tests. If the p-value in an ADF test at the level is more significant than 5% (0.05), it typically suggests insufficient evidence to reject the null hypothesis of a unit root. In other words, the data is not stationary. The reported p-values are denoted as follows: ">0.000" denotes that the p-value is less than the most minor level of significance evaluated (0.001), and "0.0001" denotes that the p-value is less than the least attainable within the parameters of the testing technique.

Augmented Dicky Fuller (ADF) and Philips-Perron (PP) are the tests used to stationarity of the time series data. The null hypothesis of these unit root is that the time series is stationary. Table 2 represents the empirical results of the ADF and PP, which implies that all the series are non-stationary, by rejecting the null hypothesis at level. However, all the series are stationary at first difference. Hence, co-integration estimation method will be more reliable.

Regression analysis is used to analyze the relationship between variables and to determine the statistical significance and magnitude of that relationship. The direction and amplitude of the relationship are shown by the regression coefficient corresponding to the independent variable. If the coefficient is positive, there is a direct link between the independent and dependent variables, meaning that when the independent variable rises, the dependent variable also rises. A negative coefficient, on the other hand, implies a negative connection in which a rise in the independent variable relates to a decline in the dependent variable. The value of the coefficient

Table 3: Empirical Results based on Engle and Granger Regression Model.

		Lending-Rate Model	**Deposit-Rate Model**
Public Banks	Constant	5.673	-0.44
	KIBOR	0.562***	0.6904***
Private Banks	Constant	2.6244	-1.255
	KIBOR	0.80019***	0.7415***
Foreign Banks	Constant	0.426	0.809***
	KIBOR	1.016***	-2.359
Specialized Banks	Constant	13.409	1.137
	KIBOR	-0.2707***	0.3707***
All Banks	Constant	3.407	-1.143
	KIBOR	0.742***	0.725***

Note: The table shows the calculated coefficients for various bank types' lending-rate and deposit-rate models. The models are calculated using a regression framework, with the lending and deposit-rates as dependent variables. KIBOR is the independent variable. The calculated coefficients for the constant term and the KIBOR variable are presented for each bank type. The coefficients' significance levels are also indicated. Statistical significance is indicated by the symbols "*", "**", and "***" at 1%, 5%, and 10%, respectively.

represents the intensity of the relationship, the bigger the coefficient, the greater the influence is. The coefficient is the predicted change in the dependent variable, for a one-unit change in the independent variable.

The results show that all the regressions are significant at 1%, meaning that the independent variable has a statistically substantial influence on the dependent variable. In private banks, if KIBOR increases by 1 basis point, the deposit-rate will increase by 0.74 basis points, and the lending-rate will increase by 0.8 basis points. This indicates that private banks' deposits and lending-rate adapt to the KIBOR faster, and IRPT is high. In public banks, if KIBOR increases by 1 basis point, the deposit-rate increases by 0.69 basis points, and the lending-rate rises by 0.56 basis points. This shows that the IRPT from KIBOR to public banks is partial. In the case of specialized banks, if KIBOR increases by 1 basis point, the deposit-rate increases by 0.37 basis points, while the lending-rate decreases by 0.27 basis points. This ratio indicates that the IRPT of specialized banks is slow and incomplete. Hence, the IRPT is very low in specialized banks. In foreign banks, if KIBOR increases by 1 basis point, the deposit-rate will increase by 0.8 basis points, and the lending-rate will increase by 1.06 basis points, which shows that the IRPT is high. In all banks, if KIBOR increases by 1 basis point, the deposit-rate will increase by 0.72 basis points, and the lending-rate will increase by 0.74 basis points. This indicates a partial IRPT.

Table 4: Unit Root testing of error term of the long run relationship

Banks	Model	At Level	
		ADF	PP
Public Banks	Lending	0.1183	0.187
	Deposit	0.0000	0.000
Private Banks	Lending	0.1352	0.2162
	Deposit	0.0042	0.0001
Foreign Banks	Lending	0.5611	0.7093
	Deposit	0.0091	0.0000
Specialized Banks	Lending	0.0065	0.1265
	Deposit	0.0027	0.0000
All Banks	Lending	0.0073	0.0101
	Deposit	0.0210	0.0014

Note: Table 4 shows the results of unit root tests on the error terms of long-run relationship models for various bank types. The tests were run using the ADF and PP methodologies to determine the stationarity features of the error terms at the level. The null hypothesis of a unit root in the error term is weighed against the alternative hypothesis of stationarity in the ADF and PP tests.

The regression analysis results suggest that banks adapt the KIBOR at different levels, speeds, and magnitudes. A significant difference is

observed if we compare all the banks' speed of adapting the KIBOR with other banks. Therefore, it is important to study different banks separately.

Following a regression analysis to investigate the long-run connection between the variables. The stationarity of the residuals was evaluated to detect the existence or absence of a short-run relationship. This step was conducted to see if there are any short-term departures from the long-run equilibrium, and to examine the dynamics of the variables over time. Following are the results of unit root tests that are applied to check the stationarity of residuals.

Table 4 represents the p-values of ADF and PP, to test the existence of the long-run relationship between KIBOR and lending and deposit rates. In the case of public, private, foreign banks, the lending rate is non-stationary, which implies that there is not a long-run relationship exist with KIBOR. Contrary, in all other cases, the long-run relationship exists with KIBOR. Hence, in some cases change in KIBOR could help to achieve the objective of SBP (where long-run relationship exist), while in other cases it would not helpful.

Table 5: Testing long-run and asymmetric co-integration.

Banks	**Variables**	**Co-integration** $H_0: \rho_1 = \rho_2 = 0$		**Asymmetric** $H_0: \rho_1 = \rho_2$		**Summary**
		F Statistics	Chi-Square	F Statistics	Chi-Square	
Public Banks	Lending	128.8	0.000	4.6124	0.0329	Co-integration and Asymmetric
	Deposit	207.9	0.000	0.9818	0.3229	Co-integration and Symmetric
Private Banks	Lending	99.35	0.000	2.5708	0.1104	Co-integration and Asymmetric
	Deposit	215.9	0.000	0.9669	0.3254	Co-integration and Symmetric
Foreign Banks	Lending	117.6	0.000	3.0064	0.0825	Co-integration and Asymmetric
	Deposit	202.8	0.000	5.0056	0.0253	Co-integration and Asymmetric
Specialized Banks	Lending	74.28	0.000	0.8867	0.3464	Cointegration and Symmetric
	Deposit	98.14	0.000	28.383	0.0000	Co-integration and Asymmetric
All Banks	Lending	107.4	0.000	1.0925	0.2959	Co-integration and asymmetric
	Deposit	202.3	0.000	0.0567	0.8119	Co-integration and asymmetric

Note: Table 5 displays several bank categories' long-run and asymmetric co-integration test results.

Table 5 represents the results derived from Wald tests, applied to data to check the existence of co-integration and asymmetry in the data.

Two Wald tests have been applied. Firstly, a co-integration test has been applied. The null hypothesis (Ho: $\rho_1 = \rho_2 = 0$) is to test the existence of co-integration. If the F statistics of the Wald test is less than 5%, we will reject the null hypothesis. Furthermore, the existence of asymmetric co-integration will be examined using the null hypothesis of (Ho: $\rho_1 = \rho_2$). If the F statistics of the Wald test is less than 5%, we will reject the null hypothesis.

As shown in Table 5, for all the banks, co-integration exists for both lending and deposit-rates. The data for private and all banks, the lending and deposit-rates is symmetric. For specialized banks' deposit-rates, the data is asymmetric. For foreign banks' deposit-rate, public banks' lending-rate data is symmetric at a 10% significance level. The data for public banks' lending and deposit-rates, specialized banks' lending-rates, and foreign banks' lending-rate is symmetric.

For specialized banks, the results illustrate that the lending-rate is symmetrical. However, the deposit-rate data is asymmetrical, which means that the IRPT from the central bank to specialized banks' deposit-rates is complete. The lending-rate for specialized banks is symmetrical; it suggests that the interest rates imposed on loans are the same regardless of transaction direction. In other words, whether they borrow or lend money from a specialized bank, borrowers get the same interest rate on their loans. On the other hand, the asymmetry of deposit-rate data suggests that the interest rates given by specialized banks for deposits are not identical in both directions. This implies that specialized banks may provide different rates to consumers who deposit money vs. customers who borrow money.

Afterward, the short-run relation was tested via regression analysis. To estimate the short-run relationship, the threshold values are calculated first. Regression analysis estimates the short-run relation after calculating the threshold values through trial and error. The short-run relation between the lending and deposit-rate and KIBOR has been tested to check the IRPT in short periods.

The results show that the deposit and lending-rate have a short-term relation with KIBOR at a 10% significance level in almost all banks. A deposit and lending-rate threshold exists for each kind of bank (private, public, foreign, specialized, and all banks). Values above these thresholds represent positive shocks, whereas values below represent negative ones.

Suppose the coefficients of positive shock are near to one and statistically significant. This implies that positive shocks are primarily absorbed in the residuals on deposit and lending-rates across institutions and vice versa. Similarly, suppose the coefficients of adverse shocks are close to one. This case suggests negative shocks are almost completely absorbed in the residuals on deposit and lending-rate for various institutions and vice versa.

Table 6: Short-term positive and negative shocks

		Lending-Rate Model	Deposit-Rate Model
Public Banks	Constant	0.00000484	-0.0000315
	KIBOR	0.271***	0.690***
	$I - e_{t-1}$	1.000***	1.000***
	$(1 - I) - e_{t-1}$	1.000***	1.000***
Private Banks	Constant	-0.00000218	-0.0000363
	KIBOR	0.799***	0.741***
	$I - e_{t-1}$	0.999***	0.999***
	$(1 - I) - e_{t-1}$	0.999***	1.000***
Foreign Banks	Constant	-0.00000655	-0.0001
	KIBOR	1.016***	0.808***
	$I - e_{t-1}$	1.000***	0.999***
	$(1 - I) - e_{t-1}$	1.000***	1.000***
Specialized Banks	Constant	0.00000484	-0.014
	KIBOR	(0.271)***	0.341
	$I - e_{t-1}$	1.000***	-0.182
	$(1 - I) - e_{t-1}$	1.000***	-0.042
All Banks	Constant	0.00000276	0.0005
	KIBOR	0.743***	0.440***
	$I - e_{t-1}$	1.001***	0.025*
	$(1 - I) - e_{t-1}$	1.001***	0.496***

Note: Table 6 represents positive and negative shocks in the short run. The asterisks with the values represent the significance of the values. "*", "**", "***" illustrate 1%, 5%, and 10% significance, respectively.

Overall, the data indicates that banks of all types display high absorption for positive and negative shocks in deposits and lending-rate. This indicates that banks are sensitive to short-term volatility and have structures to modify their rates appropriately, guaranteeing financial system stability and equilibrium. However, for deposit-rate specialized banks, the coefficient of KIBOR, positive shocks, and adverse shocks are far from 1 and are statistically insignificant. This implies that the deposit-rate of specialized banks does not absorb the positive and negative shocks in KIBOR. Moreover, the deposit-rate of all banks displays that the positive and negative shocks are partially absorbed in the short run.

The independent variable of ΔKIBOR (change in KIBOR) indicates a change in the deposit and lending-rate of different types of banks due to a

change in KIBOR in the short run. For instance, if there is a 1 basis point increase in KIBOR in the short-run, suppose in one month, the deposit-rate of private banks will increase by 0.741 basis points. If KIBOR increases by 1 basis point, the lending-rate of private banks will increase by 0.799 basis points, indicating a solid short-run, positive relation between KIBOR and the lending-rate of private banks. Except for specialized banks, the deposits and lending-rate of all types of banks have positive and statistically significant short-run relationships with KIBOR.

4. Conclusion

This research used the asymmetric co-integration estimation method MTAR to evaluate the impact of changes in the KIBOR rate on the deposit-rate and lending-rate using disaggregated banks' data. The empirical results of this research are generally consistent with the literature, i.e., incomplete pass-through. However, empirical findings indicate that market information is vital in helping the asymmetric impact of the KIBOR on lending and deposit rates. Furthermore, our empirical results also suggest heterogeneous IRPT for each bank is different in Pakistan. When the central bank implements the monetary policy, it must consider that there should be different policies for each type of bank depending on their pass-through rate. In summary, separate monetary policies for complete, incomplete, and partial pass-through and for different types of banks, should be adopted. Each scenario's specific challenges, risks, and objectives should be recognized. Such tailored approaches help deposit-rates market dynamics, ensure financial stability and align with different banks' diverse mandates and risk profiles.

References:

Abdul Qayyum, Idrees Khawaja, & Sajawal Khan (2005). Interest Rate Pass-Through in Pakistan: Evidence from Transfer Function Approach. *The Pakistan Development Review*, 44(4), 975-1001.

Ahmed, F., Ali, K., & Kashif, M. (2019). Interest rate pass-through effect using VECM: Evidence from Pakistan. *Global Business Review*, 19(2), 336–347. doi: 10.1177/0972150917695399

Altavilla, C., Canova, F., & Ciccarelli, M. (2019). Mending the broken link: Heterogeneous bank Lending-rate and monetary policy pass-through. *Journal of Monetary Economics*, 75, 73-89. doi: 10.1016/j.jmoneco.2015.06.002

Batool, S., Asghar, N., & Rasul, F. (2021). Analyzing the maturity wise interest rate pass through in Pakistan. Review of Applied Management and Social Sciences, 4(1), 93-104.

Bredin, D., Fitzpatrick, T., & Reilly, G. O. (2002). Retail interest rate pass-through: The Irish experience. *Economic and Social Review*, 33(2), 223–246.

Eleam, V. E., Ekwom, C. G., Ariolu, C. C., Umebali, C. J., & Balogun, A. T. (2021). Pass-Through Effects of Standing Facilities on Bank Interest Rates in Nigeria. *Journal of Risk and Financial Management*, 14(3), 125. https://doi.org/10.3390/jrfm14030125

Fazal, S. K., & Salam, M. A. (2013). Interest Rate Pass-Through: Empirical Evidence from Pakistan. *The Lahore Journal of Economics*, 18(1), 39–62.

Gigineishvili N. (2011). Determinants of Interest Rate Pass-Through: Do Macroeconomic Conditions and Financial Market Structure Matter? *IMF Working Papers*, 11(176), 1–35. https://doi.org/10.5089/9781462339545.001

Hanif, M. N. (2012). Pass-through of SBP policy rate to market interest rates: An empirical investigation. *JISR management and social sciences & economics*, *10*(1), 97-112.

Horváth, C., J. Krekó and A. Naszódi (2004). Interest Rate Pass-through: The Case of Hungary. *National Bank of Hungary Working Paper*, 8.

Kanwal, K., Ahmed, M., Burney, A. I., & Mubeen, M. (2014). Determinants of Interest Rate: Empirical Evidence from Pakistan. *Journal of Economics and Sustainable Development*, 5(13), 25–30.

Khan, A. J. (2020). Competitive Structure and Bank Loan Rate in Pakistan's Banking Industry. *Pakistan Development Review*, 59(3).

Khan, M. H., & Hanif, M. N. (2014). Pass-Through of SBP Policy Rate to Market Interest Rates: An Empirical Investigation. *State Bank of Pakistan Working Paper*, No. 59.

Khawaja, M. I., & Khan, S. (2008). Pass-through of change in policy interest rate to market rates. *The Pakistan Development Review*, 47(4), 661–674.

Kwapil, C., & Scharler, J. (2010). Interest rate pass-through, monetary policy rules, and macroeconomic stability. *Journal of International Money and Finance*, 29(2), 236-251. doi: 10.1016/j.jimonfin.2009.09.005

Lee, T.H. (1994). Spread and Volatility in the Spot and Forward Exchange Rates. *Journal of International Money and Finance*, 13:3,375-383.

Mahmood, F. (2017). Model specification and data problems: A case study of market volatility and retail interest rate pass-through (No. 7934). *MPRA Working Paper*.

Mahmood, F. (2018). Interest rate pass-through in Pakistan: Evidence from the asymmetric co-integration approach. *NUST Journal of Social Sciences and Humanities*, 4(2), 168–183.

Mahmood, F. (2023). Commentary on "Market Volatility and Retail Interest Rate Pass-Through by K. M. Wang and Y. M. Lee." *IIIE Journal of Economics and Finance*, 2(1), 55–73.

Mahmood, F., & Zakaria, M. (2021). Testing the Threshold Asymmetric Co-Integration Interest Rate Pass-Through in the Presence of

Stylised Properties: Evidence from Pakistan. *The Pakistan Development Review*, 17-26.

Mohsin, H.M. (2011). The Impact of Monetary Policy on Lending and DEPOSIT-RATEs in Pakistan: Panel Data Analysis. *The Lahore Journal of Economics*, pp. 16, 199.

Munir, M., Tufail, S., & Ahmed, A. M. (2022). Interest rate pass-through and cost channel of monetary policy: Evidence from minimum distance estimation of DSGE model for Pakistan. *Cogent Economics & Finance*, *10*(1), 2127487.

Nizamani, A. R., Abdul Karim, Z., Zaidi, M. A. S., & Khalid, N. (2021). Bank Heterogeneity in Interest Rate Pass-Through: A Panel Evidence from Pakistan. Asian Academy of Management *Journal of Accounting and Finance*, 17(2), 107-132.

Oyadeyi, O. (2022). Interest Rate Pass-Through in Nigeria. *Journal of Economics*, *10*(1), 49–62.

Sander, H., & Kleimeier, S. (2002). Asymmetric adjustment of commercial bank interest rates in the euro area: an empirical investigation into interest rate pass-through. *Credit and Capital Markets-Kredit und Kapital*, *35*(2), 161-192.

State Bank of Pakistan. (2024). https://www.sbp.org.pk/m_policy/index.asp

Toolsema, L. A., Sturm, J. E., & Haan, J. (2002). Convergence of pass-through from money market to Lending-rate in EMU countries: New evidence. *University of Groningen*.

Wang, K., & Lee, Y. (2009). Market volatility and retail interest rate pass-through. *Economic Modelling*, *26*(6), 1270–1282. https://doi.org/10.1016/j.econmod.2009.06.002