“Modelling the effects of capital adequacy, credit losses, and efficiency ratio on return on assets and return on equity of banks during COVID-19 pandemic”

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MODELLING THE EFFECTS OF CAPITAL ADEQUACY, CREDIT LOSSES, AND EFFICIENCY RATIO ON RETURN ON ASSETS AND RETURN ON EQUITY OF BANKS DURING COVID-19 PANDEMIC

Abstract

The study aims to determine the impact of Capital Adequacy Ratio, Credit Losses Ratio and Efficiency Ratio on the two significant profitability ratios, namely Return on Assets (ROA) and Return on Equity (ROE), during the pandemic. Panel Data Regression is used to model the effects of Capital Adequacy, Credit Losses and Efficiency Ratio on Return on Assets and Return on Equity of Indian banks. A suitable model has been developed by analyzing the results of the Hausman test and the p-values. It has been found that Capital Adequacy Ratio (CAR) with coefficient value of –0.664, CET1 with coefficient value of 1.83 and efficiency ratio with coefficient value of 1.825 have significantly affected the return on assets as their p-values are less than 0.05. However, the accepted relationship between CAR and ROA, efficiency ratio and ROA were inverse, but their coefficients were significant. The provision for credit losses (PCL) was not affecting the ROA significantly during the pandemic and hence was not considered while framing the model. Again, the dependent variable is the return on equity, except CAR. Other ratios, i.e., CET1, efficiency ratio, and PCL ratio have unacceptable correlations and are even non-significant as their p-values are less than 0.05.

Keywords panel regression, COVID-19, CAR, return on assets (ROA), return on equity (ROE), credit losses

JEL Classification C32, C33, C34, C30

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INTRODUCTION

To restrict the impact of the coronavirus outbreak, the Indian government has taken several measures, including limiting the movement of the whole population, a nationwide lockdown, urging the public to stay indoors, shutting down public places, transport and maintaining social distance and work from home (Sohrabi et al., 2020). The resulting economic disintegration is enormous and has a short-term downfall in business activities (Perwej, 2020). The governments enacted mitigation strategies to alleviate the elaboration of the novel COVID-19 (Demirgüç-Kunt et al., 2020). This kind of situation has also affected the businesses of banking in India. Even World Health Organization has advised people to avoid handling banking notes and use contactless payment as much as possible. It was found that coronavirus can also be transmitted through Banking Notes (Bobade & Alex, 2020).

Due to the pandemic, most economic activities were hindered because the Indian Banking System has been turned from stable to negative (Bobade & Alex, 2020). Reduction in productivity and lockdowns had started to take a toll on the corporate sector's financials because cor-

porates could not repay the loans. During the pandemic, many people lost their jobs, failed to repay their loans as scheduled, affected banks' efficiency and profitability, and shot up the NPAs. Hence, the moratorium is one of the efforts by the RBI, announced on March 27, 2020. RBI has permitted all lending institutions to allow a moratorium of three months (later extended to six months) on payment of instalments in respect of all term loans outstanding as of March 1, 2020. This implies that COVID-19 has hit many elements of the income statement and financial state of the banking sector, which led to changes in various ratios like capital adequacy ratio, CET1, efficiency ratio, provision for credit losses and profitability ratios. The ratios related to capital adequacy, provision of credit losses and efficiency ratio affect profitability ratios, namely Return on Assets and Return on Equity.

1. LITERATURE REVIEW AND HYPOTHESES

The literature review of this study's literature section is divided into two sections. The first section highlights a few important research works that focus on various ratios and their relationship with profitability. The first section of the literature review aims to cover existing works and reveal the correlation and significance between capital adequacy, efficiency, and credit losses with profitability. The second section discusses some studies related to COVID-19 and banking.

Many existing studies are available in various ratios related to banking (Hawaldar et al., 2016a, 2017b). Conventional and Islamic banks follow different approaches to measure financial performance (Hawaldar et al., 2017c, 2016b). Different events affect different banks differently (Hawaldar et al., 2017a; Iqbal & Joseph, 2011). A study examined the effect of capital adequacy requirements on the performance of commercial banks of Nigeria by using secondary data from the Annual and Bank Supervision Reports of the Central Bank of Nigeria (CBN) and Nigeria Deposit Insurance Corporation (NDIC). The results revealed that Available Stable Funding, Capital to Risk-Weighted Assets Ratio, and Total Quality Control have a significant effect on the return on assets, and capital adequacy positively affects the financial performance of Nigerian commercial banks (Udom & Eze, 2018). The researchers used a sample size of 14 Deposit Money Banks listed on the Nigerian Stock Exchange from 2000 to 2013 to analyze the impact of credit risk management on Nigerian bank performance. They found that credit risk management positively affects bank performance in Nigeria (Abubakar et al., 2016). A recent paper reveals that Capital Adequacy Ratio and Banks' Performance have a statistically significant relationship (Dao & Nguyen, 2020). A paper analyzes financial reports of several banks to evaluate the impact of different ratios, i.e., Asset turnover Ratio, interest margin, Tax ratio, non-interest margin and Asset/Equity ratio on Return on Equity (ROE). The study revealed that the PBT/Revenue ratio has a maximum positive effect on Return on Equity; Tax ratio has significant effects on Return on Equity; interest margin and Asset turnover have a positive effect on ROE. However, the study revealed that the non-interest margin, Asset and Asset/Equity ratio have no significant effect on ROE (Faisal et al., 2018). A study shows a positive and significant correlation between capital adequacy ratio and ROE (Sebayang, 2020). The researcher studied nine Saudi banks listed on the stock exchange market of Saudi for 2007–2011 to find out the relationship between Capital adequacy and profitability using linear regression. The study results showed a positive relationship of bank size, capital adequacy and cost-income ratio with the profitability of a Saudi bank (Almazari, 2013). Some studies also show a positive impact of CET1 on ROA and ROE (FDIC, 2018; Klepczarek, 2015; Li & Zou, 2014).

Similarly, a study examined the effect of credit risk on the performance of banks using the data of privately owned banks, state-owned banks, and foreign banks throughout 2005–2017 from the statistical reports of the Banks Association of Turkey. The authors found that credit risk is negatively related to both ROA and ROE (Ekinci & Poyraz, 2019; Sheeba, 2017; Ahmad et al., 2014; Peterson & Erick, 2017). Again, a study showing the association between efficiency ratio and ROA signals that the higher the efficiency ratio, the lower the ROA (Sari & Sulistyo, 2011). A minute diversion

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of the above studies, a paper focused on investigating the effect of capital requirements regulation on Tanzania's bank operating efficiency by obtaining data from Tanzania's banks throughout 2009–2015. It was found that capital ratio and bank operating are positively related (Lotto, 2018).

On the other hand, many studies have also been done on the recent COVID-19 pandemic. A study found that all banks are likely to decline their risk-weighted asset values, capital adequacy ratios, and interest incomes (B. Barua & S. Barua, 2021). Demirgüç-Kunt et al. (2020) examined the effect of the COVID-19 pandemic on the banking sector around the world by considering the balance sheets, stock prices and ownership of 16 developed and 28 developing countries throughout May 2, 2018 – May 1, 2020. The study included 896 commercial banks, 3,043 firms, and 2,147 corresponded to non-bank financials and attempted to search out the impact of policy announcements on bank stocks' performance. Similarly, a researcher tries to demonstrate the effect of COVID-19 on the banking sector and financial sector and found that almost every industry, including financial services and the banking sector, are facing various challenges from the ongoing effect of the pandemic COVID-19. The author suggested that banks build flexibility and continue to leverage technology in their infrastructure to navigate these challenges (Perwej, 2020). A recent study investigates the impact of the COVID-19 pandemic on banking sector profitability using ROA in Uganda for the period spanning quarter 1 2000 to quarter 1 2021, using the autoregressive distributed lag testing approach to co-integration while controlling for bank-specific and macroeconomic determinants of bank profitability. The study results revealed that COVID-19 has negatively affected profitability (Katusiime, 2021).

The existing literature was insufficient to shed light on capital adequacy ratios, credit losses ratios, and efficiency ratios on profitability during the recent pandemic. Hence, this paper could contribute a new dimension of research by regressing the effects of Capital Adequacy, Credit Losses, and Efficiency Ratio on the profitability ratios, i.e., ROA and ROE of Indian Banks during this COVID-19 pandemic.

By analyzing the studies stated in the existing research, the following alternative hypotheses can be developed:

H_1: *Capital Adequacy Ratio of Indian Banks has a Positive Relationship with ROA of Indian Banks during COVID-19.*

H_2: *Capital Adequacy Ratio of Indian Banks has a Positive Relationship with ROE of Indian Banks during COVID-19.*

H_3: *Common Equity Tier 1 of Indian Banks has a Positive Relationship with ROA of Indian Banks during COVID-19.*

H_4: *Common Equity Tier 1 of Indian Banks has a Positive Relationship with ROE of Indian Banks during COVID-19.*

H_5: *Efficiency Ratio of Indian Banks has an Inverse Relationship with ROA of Indian Banks during COVID-19.*

H_6: *Efficiency Ratio of Indian Banks has an Inverse Relationship with ROE of Indian Banks during COVID-19.*

H_7: *PCL Ratio of Indian Banks has an Inverse Relationship with ROE of Indian Banks during COVID-19.*

H_8: *PCL Ratio of Indian Banks has an Inverse Relationship with ROE of Indian Banks during COVID-19.*

The above hypotheses are tested by the methodology stated in the method section. Two models are framed where in the first model, Capital Adequacy Ratio, CET1, Provision for Credit Losses (PCL) Ratio and Efficiency Ratio are considered independent variables. In contrast, Return on Assets (ROA) is considered a dependent variable. In the second model, the Capital Adequacy Ratio, CET1, Provision for Credit Losses (PCL), and Efficiency Ratio are considered independent variables. In contrast, Return on Equity (ROE) is considered a dependent variable. The impact of the selected regressors on ROA and ROE is discussed in the Results and Discussion Section.

2. METHOD

The study considers all Indian Banks under NIFTY 100, where 13 are public sector banks and 10 are private sector banks. The data used in the study are secondary, where various ratios are calculated every quarter using the six quarterly reports of all these 23 Indian Banks from January 2020 to June 2021. The study has considered a period from January 2020 to June 2021 because, during this period, the whole world was affected by the COVID-19 pandemic. Therefore, it is interesting to know the impact of Capital Adequacy, Credit Losses, and Efficiency ratios on profitability ratios in that pandemic duration. Even most of the businesses were closed due to lockdown. After extracting and calculating these ratios, two models have been framed. The first model, Return on Assets, is the dependent variable, and Capital Adequacy, Credit Losses, and Efficiency ratios are the independent variables.

Similarly, in the second model Return on Equity is the dependent variable and Capital Adequacy, Credit Losses and Efficiency ratios are considered independent. The secondary data used for calculating the ratios of Indian banks are taken from the quarterly balance sheets and quarterly income statement from a few websites, i.e. www.in.investing.com, www.moneycontrol.com, and www.screener.in. All the variables considered for the study should be stationary. For stationary check, the unit root test, i.e., Augmented Dickey-Fuller Test with the inclusion of test equations as Intercept, Trend, and Intercept and None, has been applied. The relevant number of differentiations have been done if the data were non-stationary. To test the hypotheses, the Ordinary Least Square (OLS) model has been framed, and the coefficients are observed to examine the direct or inverse relationship between the independent and dependent variables. Again, for modelling, panel regression has been used. To decide between the fixed or random effect models, the Hausman test has been used. The significance of the coefficients of independent variables of formulated models has been verified by comparing the p-value with the significance level. The formulated models are further modified by dropping those ratios as independent variables with non-significant coefficients.

3. RESULTS AND DISCUSSION

As the data are a balanced panel, i.e., six quarters of 23 banks, panel data must be applied to measure the impact of Capital Adequacy Ratio, CET1, Provision for Credit Losses (PCL) Ratio and Efficiency Ratio on Return of Assets and Return on Equity.

While applying the panel regression, it is also necessary to examine which kind of panel regression is applicable, i.e., pooled regression, panel with the random effect model or panel with the fixed-effect model. In the case of pooled regression, the regression will be applied as if the data are cross-sectional, i.e., non-panel in nature. Similarly, in a random-effect model, the model considers these individual variations and time-dependent variations. To select the suitable panel regression model, Hausman test is applied for both models. The results of the Hausman test and statistical elements of the framed models are mentioned below.

3.1. Formulation of Model-1

In the first model, the regressors are Capital Adequacy Ratio, CET1, Provision for Credit Losses (PCL) Ratio and Efficiency Ratio, whereas the dependent variable is the Return of Assets. The results of the Hausman test of the model are shown in Table 1.

Table 1. Results of the Hausman test for Model-1

Source: Authors' computation using EViews 10.

Correlated Random Effects – Hausman Test
Equation: Regressing Capital Adequacy, CET1, Efficiency Ratio and Provision for Credit Losses on Return on Equity
Test cross-section and period random effects

Test Summary	Chi-Sq. statistic	Chi-Sq. d.f.	Prob.
Cross-section random	17.617151	4	0.0015
Period random	0.000000	4	1.0000
Cross-section and period random	8.082585	4	0.0886

Note: * Period test variance is invalid. Hausman statistic set to zero; ** WARNING: estimated period random effects variance is zero.

Table 1 shows the results of the Hausman test for Model-1 to decide which panel regression model would be suitable to apply. The chi-square value of cross-section random is 17.62 approx. A probability value less than 0.05 is considered significant,

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Table 2. Results of OLS model for Model-1

Source: Authors' computation using EViews 10.

Dependent Variable: ROA
Method: Panel Least Squares
Sample: 2020Q1-2021Q2
Periods included: 6
Cross-sections included: 23
Total panel (balanced) observations: 138

Variable	Coefficient	Std. error	t-statistic	Prob.
C	2.316898	3.420224	0.677411	0.4993
CAR	–0.839952	0.501480	–1.674947	0.0463
CET1	0.912907	0.439247	2.078347	0.0396
EFFICIENCY RATIO	1.244660	0.371814	3.347533	0.0011
PCL	–0.945185	5.993657	–0.157698	0.8749
R-squared	0.320493	Mean dependent variable		–0.213500
Adjusted R-squared	0.213440	S.D. dependent variable		7.976734
S.E. of regression	7.678243	Akaike info criterion		6.950218
Sum squared resid	7841.070	Schwarz criterion		7.056278
Log-likelihood	–474.5650	Hannan-Quinn criteria.		6.993318
F-statistic	5.714695	Durbin-Watson stat		1.419937
Prob. (F-statistic)	0.000329	–		

implying that a fixed-effect panel regression model is applicable. Before applying the fixed-effect panel regression model, significant coefficients are to be decided by framing an ordinary least square (OLS) model, which is shown in Table 2.

Table 2 represents a negative relationship between Capital Adequacy Ratio (CAR) and Return on Assets, implying that the alternative hypothesis H_1 is rejected as the coefficient is negative. However, the coefficient is significant as the p-value is less than 0.05. Similarly, the alternative hypothesis H_3 is accepted as the coefficient of CET1 is positive and the p-value is less than 0.05. Again, the alternative hypothesis H_5 is also rejected as the relationship between the efficiency ratio and ROA should be adverse, but the results show its coefficient as positive. Furthermore, the alternative hypothesis H_7 is accepted as the coefficient of PCL is negative, but its coefficient is not significant due to a higher p-value; hence, PCL should be dropped while framing the model with a fixed effect in the next step.

Table 3. Formulation of fixed effect panel regression model for Model-1

Source: Authors' computation using EViews 10.

Dependent variable: ROA
Method: Panel Least Squares
Sample: 2020Q1-2021Q2
Periods included: 6
Cross-sections included: 23
Total panel (balanced) observations: 138

Variable	Coefficient	Std. error	t-statistic	Prob.
C	–11.45539	8.349126	–1.372047	0.1729
CAR	–0.663292	1.081138	–0.613513	0.0440
CET1	1.830876	1.247868	1.467203	0.0145
EFFICIENCY RATIO	1.825125	0.396310	4.605301	0.0000
Effects specification				
Cross-section fixed (dummy variables)				
The period fixed (dummy variables)				
R-squared	0.375773	Mean dependent variable		–0.213500
Adjusted R-squared	0.293216	S.D. dependent variable		7.976734
S.E. of regression	7.164795	Akaike info criterion		6.976190
Sum squared resid	5441.435	Schwarz criterion		7.654973
Log-likelihood	–449.3571	Hannan-Quinn criteria		7.252030
F-statistic	2.058387	Durbin-Watson stat		2.094256
Prob. (F-statistic)	0.003536	–		

Table 3 shows the Fixed Effect Panel Regression Model for Model-1 by considering those variables whose coefficients are significant in the OLS model. PCL has been dropped while the other variables, CAR, CET1 and Efficiency Ratio, are considered. All the variables are significant as the p-values of the coefficients are less than 0.05. Moreover, the value of R-squared is 0.375773, which implies that the regressors can explain 37.57% of the dependent variable, i.e., ROA. The fixed-effect panel regression model can be represented as mentioned below.

$$ROA = -11.4554 - 0.6633 \cdot CAR + \\ +1.8309 \cdot CET1 + \\ +1.8251 \cdot EFFICIENCY\ RATIO + \\ +\left[CX = F, PER = F\right]. \quad (1)$$

3.2. Formulation of Model-2

In the second model, the regressors are Capital Adequacy Ratio, CET1, Provision for Credit Losses (PCL) Ratio and Efficiency Ratio, whereas the dependent variable is Return on Assets. The Hausman test was applied to decide the appropriate panel regression model, and the results are presented in Table 4.

Table 4 shows the results of the Hausman test for Model-2 to decide which panel regression model would be suitable to apply. The chi-square value of cross-section random is 1.56 approx. with a probability value of 0.8158, more than 0.05. The null hypothesis of applying random effect panel regression is accepted. It is also to be noted that the probability values of all the variables are non-significant. The hypotheses should be tested before applying the random effect panel regression model. Significant coefficients are to be decided by framing an ordinary least square (OLS) model; the results are shown Table 5.

Table 5 represents a positive relationship between Capital Adequacy Ratio (CAR) and Return on Assets, implying that the alternative hypothesis H_2 is accepted. However, as the p-value is more than 0.05, it should be dropped. The alternative hypothesis H_{1D} is rejected as the coefficient of CET1 is negative, and it should also be dropped as the p-value is more than 0.05. Again, the alternative hypothesis H_{1F} is also rejected as the relationship between efficiency ratio, and ROA should be adverse, but the results show its coefficient as positive. The efficiency ratio should also be dropped due to the higher p-value.

Furthermore, the alternative hypothesis H_8 is rejected as the PCL coefficient is positive. However, its coefficient is not significant due to a higher p-value, so PCL should also be dropped. An appropriate model cannot be framed as all the independent variables are non-significant, and even the R-squared is too low.

The results of the Fixed Effect Panel Regression Model for Model-1 show that CAR with the coefficient value –0.664, CET1 with the coefficient value 1.832 and Efficiency Ratio with the coefficient value 1.825 have a significant impact on Return on Assets as their p-value were less than 0.05. The PCL has been dropped as its

Table 4. Results of Hausman test for Model-2

Source: Authors' computation using EViews 10.

Correlated Random Effects – Hausman Test
Equation: Regressing Capital Adequacy, CET1, Efficiency Ratio and Provision for Credit Losses on Return on Equity

Test cross-section and period random effects			
Test Summary	**Chi-Sq. statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	1.560993	4	0.8158
Period random	0.791790	4	0.9395
Cross-section and period random	0.779540	4	0.9412

Cross-section random effects test comparisons:				
Variable	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
CAR	–0.008818	0.005608	0.000333	0.4293
CET1	0.019195	–0.003965	0.000464	0.2824
EFFICIENCY RATIO	0.001886	0.002144	0.000011	0.9393
PCL	–0.025644	–0.003306	0.002822	0.6741

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Table 5. OLS model results for Model-2

Source: Authors' computation using EViews 10.

Dependent variable: ROE
Method: Panel Least Squares
Sample: 2020Q1-2021Q2
Periods included: 6
Cross-sections included: 23
Total panel (balanced) observations: 138

Variable	Coefficient	Std. error	t-statistic	Prob.
C	–0.012724	0.060885	–0.208981	0.8348
CAR	0.005975	0.008927	0.669264	0.5045
CET1	–0.004166	0.007819	–0.532799	0.5951
EFFICIENCY RATIO	0.001853	0.006619	0.279916	0.7800
PCL	0.001752	0.106695	0.016420	0.9869
R-squared	0.004619	Mean dependent var		0.025428
Adjusted R-squared	–0.025317	S.D. dependent var		0.134985
S.E. of regression	0.136683	Akaike info criterion		–1.106739
Sum squared resid	2.484755	Schwarz criterion		–1.000679
Log-likelihood	81.36496	Hannan-Quinn criteria.		–1.063638
F-statistic	0.154303	Durbin-Watson stat		2.388154
Prob(F-statistic)	0.960770	–		

coefficient is non-significant with a p-value of 0.87, which means the provision for credit losses during COVID-19 were not significantly affecting ROA. Moreover, the value of R-squared is 0.375773, which implies that the regressors can explain 37.57% of ROA. Though CAR and Efficiency Ratio have significant p-values, their relationship to ROA does not agree with the accepted relationship shown by the existing literature. In this study, CAR is negatively correlated to the ROA, representing that, even though CAR has been increased during COVID-19, ROA has declined. In the same manner, the accepted relationship, as per existing researchers, between the efficiency ratio and ROA should be inversely related, but this study found that there is a direct relationship between the efficiency ratio and ROA. This implies that COVID-19 has impacted the return on assets.

Similarly, the results of the OLS model for Model-2 show that none of the independent variables, i.e., CAR, CET1, Efficiency ratio and Provision for Credit Losses, regressed on the dependent variable Return on Equity, significantly affect their p-values that are more than 0.05. This results in a suitable model that cannot be developed. A few points that should also be focused on, during the COVID-19 pandemic, the correlation of CET1 with coefficient -0.004, efficiency ratio with coefficient 0.0018 and PCL 0.0017, to Return on Equity are not agreed with the accepted relationship mentioned in the existing literature.

CONCLUSION

The study aims to regress the effects of capital adequacy, credit losses and efficiency ratio on return on assets and return on equity of Indian banks during the COVID-19 pandemic. By observing the results of the Fixed Effect Panel Regression Model mentioned in Table 3, it can be inferred that CAR, CET1 and Efficiency Ratio significantly affect ROA. But on the other hand, PCL has been excluded as its coefficient was not significant. However, the accepted relationship between CAR and ROA should be positive, but in this study, an inverse relationship between CAR and ROA was found. This might be because if bank loans are not high, more deposits may decrease profits and result in low profitability. Moreover, during the COVID-19 pandemic, banks might not be able to recover the instalment of loans, including profits for the banks in the form of interest.

Similarly, the accepted or universal relationship between the efficiency ratio and ROA is not shown in the results, but their coefficients were significant. This infers that more non-interest banks' expenses were incurred during the pandemic and are directly correlated with the return of assets of banks. The provision for credit losses was not affecting the ROA significantly during the pandemic as its p-value is more than 0.05 and hence was not considered while framing the model. Though the banks have reported many defaults in payment of instalments of loans, the creation of provision for credit losses was not significant. Again, for the formulation of Model-2, where the dependent variable is the return on equity, except CAR, the other ratios, i.e., CET1, efficiency ratio and PCL ratio, did not have the accepted or universal correlation as discussed in the existing literature. The results mentioned in Table 5 show that the coefficients of independent variables are not significant as the p-values are more than 0.05, which hindered formulating an appropriate model using the ratios to predict the return on equity during the pandemic. Though the study considers those elements associated with credit risks, future researchers can also consider other ratios such as liquidity and solvency ratios to investigate the impact of COVID-19 on such ratios and how they affect profitability. Moreover, a comparative study between the models framed during the pre- and post-pandemic can also be done.

AUTHOR CONTRIBUTIONS

Conceptualization: Iqbal Thonse Hawaldar, Puja Kumari, Santosh Kumar.
Data curation: Bharat Kumar Meher, Santosh Kumar.
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Writing – original draft: Bharat Kumar Meher, Puja Kumari.
Writing – reviewing & editing: Bharat Kumar Meher, Iqbal Thonse Hawaldar.

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