

**Econometrics Analysis 2 - Lab**  
**Group Project**  
**Financial Performance by Indian firms**  
**[Group No. - 14]**

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**Introduction**

One aspect of the shifting business models around the world is the Indian banking industry. The industry is transitioning out of a period of intense competition, changing regulations, and poor economic growth in India, all of which have had an impact. Recent occurrences including NPAs, demonetization, digit India, payment wallets, goods and services tax, and payment banks in India have impacted banking-related businesses. Financial performance is the key indicator for any business organization. The profitability is the ratio that supports quantifying the financial performance of a business. We have used Panel Data for 24 Indian Banks and for 10 years (2003-2013) for our estimation. The variables used for the estimation are Profit After Tax, Total Assets, Net Sales, Capital Employed, Interest Expended, Interest Earned, Total Debt.

**Objective:**

The objective of this report is to quantify several measures to examine the determinants of profitability and financial performance for the listed Indian banks namely State Bank of India, Allahabad Bank, Andhra Bank, Bank of Baroda, Bank of India, Bank of Maharashtra, Canara Bank, Central Bank of India, Corporation Bank, Dena Bank, Indian Bank, Indian Overseas Bank, Punjab and Sind Bank, Punjab National Bank, Syndicate Bank, UCO Bank, Union Bank of India, United Bank of India, Vijaya Bank, State Bank of Bikaner & Jaipur, State Bank of Hyderabad, State Bank of Mysore, State Bank of Patiala and State Bank of Travancore.

**Literature Review:**

Over the past few years, the changing environment has presented significant problems for Indian banks. It is crucial to identify the factors that have the greatest impact on the general performance of Indian banks in order to maintain financial stability and withstand negative shock. A panel data regression method is used to investigate the impact of various internal factors on the profitability of banks. In the finance literature performance of banks generally is measured by its profitability. Increasing the profitability of the banks denotes better performance. The quality in the working of the financial sector truly impacts the profitability of

the banks which as a whole impacts the economy and GDP of a country. Profit of an enterprise refers to the total income earned by it during the specified period of time, while profitability refers to the operating efficiency of the enterprise. The profitability of a bank means the ability of banks to get sufficient return on the capital (basically advances) and employees used in the business operation. Reserve bank of India and other regulatory bodies have framed many rules and policies for the smooth functioning of the banks. In recent years the profitability of Indian scheduled commercial banks is gradually decreasing. In order to determine the profitability of banks, we have focused on the internal factor analysis. The basic measure of bank profitability is the return on asset (ROA) which corrects for the size of the bank. Another measure to track the financial information and performance of any firm in order to increase the growth of that firm is the Profit margin that expresses the profit from business operations as a percentage of revenue or net sales. We have examined the profitability which is an important criterion to evaluate the overall efficiency of a bank group. Some suggestions were offered on the basis of empirical results to increase the profitability and measures should be taken to increase the level of spread and curtail the burden.

### **Specification of the model:**

#### **The Fixed Effect (FE) Model:**

The FE model is a specific set of 24 firms, i.e. the public sector banks listed on the website of RBI, and our inference is limited to the behavior of these groups of companies. The inference is conditional on the particular firms that we have observed.

##### Estimated Fixed Effect (FE) Regression Equation Model A:

$$PRMA_{it} = \alpha_{0i} + \beta_0 * CAR_{it} + \beta_1 * TDOF_{it} + \beta_2 * IEIE_{it} + \beta_3 * TICE_{it} + u_{it}$$

##### Estimated Fixed Effect (FE) Regression Equation Model B:

$$ROA_{it} = \alpha_{0i} + \beta_0 * CAR_{it} + \beta_1 * TDOF_{it} + \beta_2 * IEIE_{it} + \beta_3 * TICE_{it} + u_{it}$$

where  $\alpha_{0i}$  is the y-intercept of the company i;  $PM_{it}$  the profit margin of each company i at time t (dependent variable in Model A);  $ROA_{it}$  the return on assets of each company i at time t (dependent variable in Model B);  $CAR_{it}$  the capital adequacy ratio of each company i at time t;  $TDOF_{it}$  the total debt to owners fund of each company i at time t;  $IEIE_{it}$  the interest expended to interest earned of each company i at time t;  $TICE_{it}$  the total income/capital employed of each company i at time t; and  $u_{it}$  the error term of company i at time t or between company's error.

#### **The Random Effect (RE) Model:**

There are unique, time constant attributes of individuals that are the results of random variation and do not correlate with the individual regressors.

##### Estimated Random Effect (RE) Regression Equation Model A:

$$PRMA_{it} = \alpha_{0i} + \beta_0 * CAR_{it} + \beta_1 * TDOF_{it} + \beta_2 * IEIE_{it} + \beta_3 * TICE_{it} + u_{it} + e_{it}$$

##### Estimated Random Effect (RE) Regression Equation Model B:

$$ROA_{it} = \alpha_{0i} + \beta_0 * CAR_{it} + \beta_1 * TDOF_{it} + \beta_2 * IEIE_{it} + \beta_3 * TICE_{it} + u_{it} + e_{it}$$

where  $\alpha_{0i}$  is the y-intercept of the company i;  $PRMA_{it}$  the profit margin of each company i at time t (dependent variable in Model A);  $ROA_{it}$  the return on assets of each company i at time t (dependent variable in Model B);  $CAR_{it}$  the capital adequacy ratio of each company i at time t;  $TDOF_{it}$  the total debt to owners fund of each company i at time t;  $IEIE_{it}$  the interest expended to interest earned of each

company  $i$  at time  $t$ ;  $TICE_{it}$  the total income/capital employed of each company  $i$  at time  $t$ ; and  $u_{it}$  the error term of company  $i$  at time  $t$  or between company's error; and  $e_{it}$  the within company's error.

### **Justification & Possible Impact of Independent variables:**

To quantify several measures to examine the determinants of the profitability of the firms, we took Profit Margin (for the first model) and Return on Assets (for the second model) as a dependent variable, and CAR (Capital Adequacy Ratio), TDOF (Total Debt to Owners Funds), IEIE (Interest expended to Interest Earned), TICE (Total Income to Capital Employed) as independent variables for both the models estimated. Financial performance is a subjective measure of how well a firm can use assets from its primary mode of business and generate revenues. The term is also used as a general measure of a firm's overall financial health over a given period. To grow any business, there is a need to track financial information and measure performance. The metrics that could be used for this are Profit margin and Return on Assets. The net profit margin is a profitability ratio that expresses the profit from business operations as a percentage of revenue or net sales. Return on assets is another profitability ratio that provides how much profit a company is able to generate from its assets. In other words, return on assets (ROA) measures how efficient a company's management is in generating earnings from its economic resources or assets on its balance sheet.

Positive and significant relationship between capital adequacy and a bank's profitability suggests that banks with more equity capital are perceived to have more safety and such advantage can be translated into higher profitability. The higher the capital ratio, the more profitable a bank will be. Debt capital can also have a positive effect on profitability. Debt allows companies to leverage existing funds, hence enables more rapid expansion than would otherwise be possible. The effective use of debt financing results in an increase in revenue that exceeds the expense of interest payments. In the banking sector change in interest rate has a significant impact on the profitability of banks. Moreover, Return on Capital Employed (ROCE) is a financial ratio that measures a company's profitability in terms of all of its capital. There are two components required to calculate return on capital employed: earnings before interest and tax and capital employed. EBIT, also known as operating income, shows how much a company earns from its operations alone without regard to interest or taxes. EBIT is calculated by subtracting the cost of goods sold and operating expenses from revenues. Capital employed is very similar to invested capital, which is used in the ROIC calculation. Capital employed is found by subtracting total assets from current liabilities, which ultimately gives the shareholders' equity plus long-term debts.

**Measurement of the variables:** The Evaluating factors of profitability are defined as:

Variable	Sign	Formula
Profit Margin	$PRMA_{it}$	Profit Margin = (Profit After Tax / Net Sales) x 100
Return on Assets	$ROA_{it}$	ROA = (Profit After Tax / Total Assets) x 100
Capital Adequacy Ratio	$CAR_{it}$	CAR = (Tier 1 capital + Tier 2 capital) / Risk-weighted assets
Total Debt to Owners funds	$TDOF_{it}$	TDOF = Total Debt / Owners funds
Interest Expended to Interest Earned	$IEIE_{it}$	IEIE = Interest Expended / Interest Earned
Total Income to Capital Employed	$TICE_{it}$	TICE = Total Income / Capital Employed

### **Estimation Techniques:**

1. Set the Data as Panel Data with panel variables as firms and time variables as the year.
2. Estimated two models and choose the dependent and independent variables of the models as follows:

#### Model I

**Dependent Variable:-** PRMA (Profit Margin)

**Independent Variables:-** CAR (Capital Adequacy Ratio), TDOF (Total Debt to Owners Funds), IEIE (Interest expended to Interest Earned), TICE (Total Income to Capital Employed)

#### Model II

**Dependent Variable:-** ROA (Return on Assets)

**Independent Variables:-** CAR (Capital Adequacy Ratio), TDOF (Total Debt to Owners Funds), IEIE (Interest expended to Interest Earned), TICE (Total Income to Capital Employed)

3. Performed Restricted F-test to select between Pooled Regression Model and Fixed Effects Model.
4. Performed Breusch and Pagan Lagrangian Multiplier Test for Random effect to select between Pooled Regression Model and Random Effects Model.
5. If we get the Fixed Effects Model from Restricted F-Test and Random Effects Model from LM Test, then perform the Hausman test to select between them.
6. Check whether the model is facing problems of endogeneity, autocorrelation
7. Perform Panel Unit Root Tests like Levin-Lin Chu and Harris-Tzavalis
8. Check the validity of overidentifying restrictions by performing the Sargan test.
9. Repeat steps for Model II.

#### Sources of Data:

The data has been extracted from the Reserve Bank of India. We have estimated a panel data model of twenty-four firms (banks) from the year 2003-04 to 2012-13.

(Link: <https://www.rbi.org.in/Scripts/AnnualPublicatiotns.aspx?head=A%20Profile%20of%20Banks>)

Year	Firms	PM	ROA	CAR	TDOF	IEIE	TICE
2003-04	State Bank of India	0.84062	94	13.53	15.74904849	0.632764281	0.6950616157
2004-05	State Bank of India	0.85569	99	12.45	15.2479229	0.569970396	0.5860091573
2005-06	State Bank of India	0.72519	89	11.88	13.74786572	0.5667037243	0.5216080161
2006-07	State Bank of India	0.66387	84	12.34	13.91485351	0.5934769948	0.4905594936
2007-08	State Bank of India	0.81798	101	12.64	10.96004732	0.6522778345	0.4400213732
2008-09	State Bank of India	0.84532	104	14.25	12.80591119	0.6727759279	0.502336335
2009-10	State Bank of India	0.70755	88	13.39	12.19296368	0.6665713533	0.4135710138
2010-11	State Bank of India	0.55343	71	11.98	14.37129228	0.6003852845	0.4658116955
2011-12	State Bank of India	0.66383	88	13.86	12.43159597	0.5935928428	0.4803142253
2012-13	State Bank of India	0.68863	91	12.92	12.16317351	0.6295138358	0.4191000578
2003-04	Allahabad Bank	1.14419	134	12.52	20.28157216	0.5931060322	1.849107626
2004-05	Allahabad Bank	1.01418	133	12.53	17.50945017	0.5718769617	1.449791588
2005-06	Allahabad Bank	1.09821	142	13.37	13.32783732	0.581364481	1.28952959
2006-07	Allahabad Bank	0.87061	126	12.52	13.29997766	0.6414823915	0.866699621
2007-08	Allahabad Bank	0.81954	132	12.04	13.64894225	0.7164012739	0.8670716889
2008-09	Allahabad Bank	0.53824	90	13.11	14.520378	0.7068991269	0.7572191561
2009-10	Allahabad Bank	0.68639	116	13.62	15.70499037	0.6833030636	0.7443991777
2010-11	Allahabad Bank	0.63029	111	12.96	15.50264476	0.6348062135	0.7484891339
2011-12	Allahabad Bank	0.69022	102	12.83	15.18979499	0.6674225197	0.8364243877

(To see the complete dataset, visit([https://docs.google.com/spreadsheets/d/1Fw-U2VqqZueaXQj\\_OG6NGrQmFSATaLpXJW7mkTJrPYM/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1Fw-U2VqqZueaXQj_OG6NGrQmFSATaLpXJW7mkTJrPYM/edit?usp=sharing)))



Scan this QR to get the data set

## Results and Findings:

### ➤ Model I:- Taking Profit Margin as Dependent Variable

#### • Fixed Effects Model and Random Effects Model

```
1 . xtreg prma car tdof ieie tice, fe
```

Fixed-effects (within) regression  
Group variable: **firmcode**

R-sq: within = **0.2260**  
between = **0.5059**  
overall = **0.2841**

Number of obs = **240**  
Number of groups = **24**

Obs per group: min = **10**  
avg = **10.0**  
max = **10**

corr(u\_i, Xb) = **0.1706**

F(**4,212**) = **15.48**  
Prob > F = **0.0000**

```
7 . xtreg prma car tdof ieie tice, re
```

Random-effects GLS regression  
Group variable: **firmcode**

R-sq: within = **0.2212**  
between = **0.5597**  
overall = **0.2998**

Number of obs = **240**  
Number of groups = **24**

Obs per group: min = **10**  
avg = **10.0**  
max = **10**

corr(u\_i, X) = **0** (assumed)

Wald chi2(**4**) = **84.73**  
Prob > chi2 = **0.0000**

prma	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
car	.0571929	.014788	3.87	0.000	.0282089	.0861768
tdof	-.0132711	.0060711	-2.19	0.029	-.0251703	-.001372
ieie	-1.350166	.2301274	-5.87	0.000	-1.801208	-.8991247
tice	.0148638	.0069093	2.15	0.031	.0013218	.0284058
_cons	1.001125	.2793023	3.58	0.000	.4537031	1.548548
sigma_u	.07625514					
sigma_e	.23843857					
rho	.09278842	(fraction of variance due to u_i)				

- **Selection of Final Model**

```
13 . hausman fixed random
```

	—— Coefficients ——			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
car	.061282	.0571929	.0040891	.0047403
tdof	-.0047626	-.0132711	.0085085	.004152
ieie	-1.284115	-1.350166	.066051	.0533153
tice	.0189708	.0148638	.004107	.002535

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)' [(V\_b-V\_B)^(-1)] (b-B)  
 = 4.80  
 Prob>chi2 = 0.3086

### **Conclusions-**

1. From the restricted F-Test (**Prob > F = 0.0064**) we reject the null hypothesis and choose Fixed Effects Model over Pooled Regression.
2. From the Lagrangian Multiplier Test ( **Prob > F = 0.0103**) we reject the null hypothesis and choose Random Effects Model over Pooled Regression.
3. From the Hausman Test (**Prob>chi2 = 0.3086**) we were not able to reject the null hypothesis hence choosing Random Effects Model over Fixed Effects Model.
4. Our Random Effects model is significant at a 1% significance level, with **R-sq: within = 0.2212, i.e. 22%**, also all our independent variables are significant except Total Debt to Owner Funds.
5. 'Total Debt to Owners funds' and 'Interest Expended to Interest Earned' is showing a negative variation on Profit Margin and Capital Adequacy Ratio, Interest expended to Interest Earned, Total Income to Capital Employed shows a positive variation on Profit Margin.

- **Test for Autocorrelation**

```
. estat abond
```

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-2.8617	0.0042
2	-.00206	0.9984

H0: no autocorrelation

From the Arellano-Bond Test in the **1st order (Prob > z=0.0042)** and in the **2nd order (Prob > z=0.9984)** we fail to reject the null hypothesis hence there may not be any problem of autocorrelation.

- **Test for Multicollinearity**

```
. estat vif
```

Variable	VIF	1/VIF
tdof	1.42	0.705282
car	1.34	0.745272
ieie	1.08	0.929643
tice	1.01	0.986984
Mean VIF	1.21	

VIF is less than 5. Therefore Multicollinearity may not be present in the model.

- **Test for the validity of restrictions**

```
. estat sargan
```

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

```
chi2(35)      =    84.6837
Prob > chi2    =    0.0000
```

From the Sargan test of overidentifying restrictions, **(Prob > chi2 = 0.000)**, we reject the null hypothesis at a 5% significance level, and hence our overidentifying restrictions are not valid.

- **Panel Unit Root Tests**

ADF regressions: 1 lag  
 LR variance: Bartlett kernel, 6.00 lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-22.0723	
Adjusted t*	-13.6847	0.0000

```
. xtunitroot ht prma
```

Harris-Tzavalis unit-root test for **prma**

Ho: Panels contain unit roots	Number of panels =	24
Ha: Panels are stationary	Number of periods =	10
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

	Statistic	z	p-value
rho	0.2591	-8.3209	0.0000

- From the Levin-Lin-Chu test and Harris-Tzavalis test for unit roots, we reject the null hypothesis, hence our model has no unit roots, which means our time series is stationary.

- **Endogeneity**

```
estat endog
```

Tests of endogeneity

Ho: variables are exogenous

Durbin (score) chi2(1)	=	135.577	(p = 0.0000)
Wu-Hausman F(1,234)	=	303.813	(p = 0.0000)

From 2SLS Test for endogeneity for TICE we get (**Durbin score, p=0.000**) and (**Wu-Hausman score, p=0.000**), we reject the null hypothesis, and hence we can say that TICE is an endogenous variable and shows simultaneity with Profit Margin.



➤ **Model II:- Taking Return on Assets as Dependent Variable**

• **Fixed Effects Model and Random Effects Model**

```
. xtreg roa car tdof ieie tice, fe
```

```
Fixed-effects (within) regression      Number of obs      =      240
Group variable: firmcode              Number of groups   =       24

R-sq:  within = 0.2387                Obs per group: min =       10
      between = 0.3771                  avg      =      10.0
      overall  = 0.2665                  max      =       10

                                     F(4,212)      =      16.62
corr(u_i, Xb) = 0.1601                Prob > F       =      0.0000
```

roa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
car	8.385075	1.608929	5.21	0.000	5.213527	11.55662
tdof	-.1832269	.7620376	-0.24	0.810	-1.685368	1.318914
ieie	-100.0136	24.47429	-4.09	0.000	-148.2578	-51.76949
tice	2.58698	.7625102	3.39	0.001	1.083907	4.090053
_cons	54.12732	31.35068	1.73	0.086	-7.671677	115.9263
sigma_u	18.054717					
sigma_e	24.70387					
rho	.34816707	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(23, 212) =      4.26      Prob > F = 0.0000
```

```
. xtreg roa car tdof ieie tice, fe
```

Fixed-effects (within) regression  
Group variable: **firmcode**

Number of obs = **240**  
Number of groups = **24**

R-sq: within = **0.2387**  
between = **0.3771**  
overall = **0.2665**

Obs per group: min = **10**  
avg = **10.0**  
max = **10**

corr(u\_i, Xb) = **0.1601**

F(4,212) = **16.62**  
Prob > F = **0.0000**

roa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
car	<b>8.385075</b>	<b>1.608929</b>	<b>5.21</b>	<b>0.000</b>	<b>5.213527</b>	<b>11.55662</b>
tdof	<b>-.1832269</b>	<b>.7620376</b>	<b>-0.24</b>	<b>0.810</b>	<b>-1.685368</b>	<b>1.318914</b>
ieie	<b>-100.0136</b>	<b>24.47429</b>	<b>-4.09</b>	<b>0.000</b>	<b>-148.2578</b>	<b>-51.76949</b>
tice	<b>2.58698</b>	<b>.7625102</b>	<b>3.39</b>	<b>0.001</b>	<b>1.083907</b>	<b>4.090053</b>
_cons	<b>54.12732</b>	<b>31.35068</b>	<b>1.73</b>	<b>0.086</b>	<b>-7.671677</b>	<b>115.9263</b>
sigma_u	<b>18.054717</b>					
sigma_e	<b>24.70387</b>					
rho	<b>.34816707</b>	(fraction of variance due to u_i)				

F test that all u\_i=0: F(23, 212) = **4.26** Prob > F = **0.0000**

## ● Selection of Final Model

```
. hausman fixed random
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random		
car	<b>8.385075</b>	<b>8.098011</b>	<b>.287064</b>	<b>.2870993</b>
tdof	<b>-.1832269</b>	<b>-1.14517</b>	<b>.9619433</b>	<b>.3251395</b>
ieie	<b>-100.0136</b>	<b>-106.4559</b>	<b>6.442273</b>	<b>2.400727</b>
tice	<b>2.58698</b>	<b>2.131664</b>	<b>.4553152</b>	<b>.1730377</b>

b = consistent under Ho and Ha; obtained from xtreg  
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
= **9.51**  
Prob>chi2 = **0.0496**

## Conclusions-

1. From the restricted F-Test (**Prob > F = 0.000**) we reject the null hypothesis and choose Fixed Effects Model over Pooled Regression.
2. From the Lagrangian Multiplier Test ( **Prob > F = 0.000**) we reject the null hypothesis and choose Random Effects Model over Pooled Regression.
3. From the Hausman Test (**Prob>chi2 = 0.0496**) we are able to reject the null hypothesis hence we choose the Fixed Effects Model over Random Effects Model.

4. Our Fixed Effects model is significant at a 1% significance level, with **R-sq: within = 0.2387, i.e. 23%**, also all our independent variables are significant except Total Debt to Owner Funds.
5. 'Total Debt to Owners funds' and 'Interest Expended to Interest Earned' is showing a negative variation on Return on Assets and Capital Adequacy Ratio, Interest expended to Interest Earned, Total Income to Capital Employed shows a positive variation on Return on Assets.

- **Test for Autocorrelation**

```
. estat abond
```

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	<b>-2.2869</b>	<b>0.0222</b>
2	<b>.14921</b>	<b>0.8814</b>

H0: no autocorrelation

- From the Arellano-Bond Test in **1st order (Prob > z=0.0222)** and in **2nd order (Prob > z = 0.8814)** we fail to reject the null hypothesis hence there may not be any problem of autocorrelation.

- **Test for Multicollinearity**

```
. estat vif
```

Variable	VIF	1/VIF
tdof	1.42	0.705282
car	1.34	0.745272
ieie	1.08	0.929643
tice	1.01	0.986984
Mean VIF	1.21	

VIF is less than 5. Therefore Multicollinearity may not be present in the model.

- **Test for the validity of restrictions**

```
. estat sargan
Sargan test of overidentifying restrictions
H0: overidentifying restrictions are valid

chi2(35)          =    93.4003
Prob > chi2       =    0.0000
```

- From the Sargan test of overidentifying restrictions, (**Prob > chi2 = 0**), we reject the null hypothesis at a 5% significance level, and hence our overidentifying restrictions are not valid.

- **Panel Unit Root Tests**

```
. xtunitroot llc roa

Levin-Lin-Chu unit-root test for roa
-----
Ho: Panels contain unit roots
Ha: Panels are stationary
Number of panels =    24
Number of periods =    10

AR parameter: Common
Panel means: Included
Time trend: Not included
Asymptotics: N/T -> 0

ADF regressions: 1 lag
LR variance: Bartlett kernel, 6.00 lags average (chosen by LLC)
-----
```

	Statistic	p-value
Unadjusted t	-15.2475	
Adjusted t*	-9.7704	0.0000

```
. xtunitroot ht roa
```

Harris-Tzavalis unit-root test for **roa**

Ho: Panels contain unit roots  
Ha: Panels are stationary

Number of panels = **24**  
Number of periods = **10**

AR parameter: **Common**  
Panel means: **Included**  
Time trend: **Not included**

Asymptotics: **N -> Infinity**  
**T Fixed**

	Statistic	z	p-value
rho	0.3858	-6.0695	0.0000

From the Levin-Lin-Chu test and Harris-Tzavalis test for unit roots, we reject the null hypothesis, hence our model has no unit roots, which means our time series is stationary.

- **Endogeneity**

From 2SLS Test for endogeneity for TICE we get (**Durbin score, p=0.000**) and (**Wu-Hausman score, p=0.000**), we reject the null hypothesis and hence we can say that TICE is an endogenous variable and shows simultaneity with Return on Assets.

```
estat endog
```

Tests of endogeneity

Ho: variables are exogenous

Durbin (score) chi2(1) = **135.577** (p = **0.0000**)  
Wu-Hausman F(1,234) = **303.813** (p = **0.0000**)

### **Interpretation:**

1. From the results, we can see that we should choose the random-effects model for estimating profitability and the Fixed Effects Model for estimating ROA.
2. From the regression results we can see that variables 'Total Debt to Owners funds' and 'Interest Expended to Interest Earned' show negative variations on profit margin and ROA as when the debt on a bank increases, it negatively impacts the profitability, similarly expenses also have a negative impact on profitability.
3. Our Arellano Bond Dynamic Panel Data model doesn't show any possible autocorrelation, but from the Sargan test, we observe that our instruments in the dynamic panel data model are not valid.
4. From Panel Unit Roots we are able to reject the null hypothesis, hence our time series doesn't have unit roots and are stationary series.
5. From the 2SLS Test for endogeneity, we confirm a simultaneity between Profit Margin and Total Income by Capital Employed and also ROA and TICE, intuitively also we can say that when

Profit Increases TICE should be increased and with an increase in TICE, the profit margin will increase further.

### **Concluding Remarks/ Recommendations:**

Indian companies should also try different strategies like offering more options to consumers, lenders, and borrowers to try and generate more revenue. We recommend that PSU banks should be competitive and must allocate some funds to improve their image. Banks should try Achieving balance sheet efficiencies, Driving Mergers and Acquisitions, Pursuing growth, Transforming payments, Strengthening compliance management, Managing data, and analytics, and enhancing cybersecurity. We should encourage soft currency, providing attractive incentives to our fellow citizens. Since currency printing its security and logistics involves considerable costs, the banks can introduce incentives of say 1 to 2% of the amount of money spent by every person in soft form. Amounts withdrawn in currency more than a specific amount say Rs 50,000/- need to be released only after the person is identified via his Aadhar card.