

# A COMPARATIVE STUDY ON TOTAL FACTORS PRODUCTIVITY PERFORMANCE OF CELLULAR FIRMS IN PAKISTAN

**Shumaila Hashim<sup>1</sup> and Khair-Uz-Zaman<sup>2</sup>**

*<sup>1</sup>Department of Business Administration and <sup>2</sup>Department of Economics, Gomal University, D.I.Khan, KPK, Pakistan*

## **ABSTRACT**

This study empirically measures the total factors productivity (TFP) of three cellular firms i.e. Paktel, Pakcom and Mobilink operating in Pakistan. For the purpose of analysis, time series data (2000q1-2006q2) has been taken. For all three firms TFP is taken as dependent variable while output, teledensity, geographical areas covered and competition were taken as independent variables. By using the multiple regression models in log-linear form we obtained the positive and significant impact of all variables in all cases except competition that showed its impact negative in case of Paktel and Pakcom and geographical area that was insignificant in case of Mobilink.

---

## **INTRODUCTION**

Advancement in infrastructure especially in telecommunication sector is very important for any economy. At the time of independence Pakistan telecommunication sector was not well developed. Telecommunication sector reforms were started in 1962 and with the passage of time key telecom institutional bodies like Pakistan Telecommunication Authority (PTA), National Telecommunication Corporation (NTC) and Frequency Allocation Board (FAB) were established. Telecom Sector Reorganization Act 1996, Telecom Deregulation Policy 2003, privatization of Pakistan Telecommunication Company Limited (PTCL) in 2006 and

entrance of multinational cellular firms since 1990 till 2007 served as stepping stones in the growth of Pakistan telecommunication sector.

Main purpose of this study is to measure the total factors productivity (TFP) of three pioneer multinational cellular firms working in Pakistan i.e Paktel, Pakcom (Instaphone) and Mobilink. Since their inception of operation in Pakistan they have seen many ups and downs. This study tries to examine the impact of those variables that are responsible for growth of total factors productivity in these three cellular firms. Let us study the profile of these firms:

### **Paktel & Pakcom (Instaphone)**

Luxembourg based Millicom International Cellular (MIC) Group Company which operates Advanced Mobile Phone System (AMPS) and Global System for Mobile (GSM) cellular services M/S PakCom (Instaphone) and Paktel in Pakistan, is a global telecommunications operator with ventures in 16 countries worldwide including countries in Latin America, Asia and Africa. Paktel was the first cellular mobile service operator in Pakistan and for a long time the word Paktel was commonly used as another word for mobile phone. It started its operation in Pakistan since 1990. Ministry of Communication issued both licenses, free of cost. As per license requirement both companies started their operation from Karachi in December 1990, after it Paktel started its services in Lahore and Instaphone in Islamabad in late 1991 (<http://www.millicom.com>).

Paktel has entered the digital mobile network market with the launch of its GSM and AMPS services and formed strategic alliances with mobile giants Samsung and Nokia. In 2006, Millicom decided to exist from its business in Pakistan and as a result Paktel and

Instaphone were classified as discontinued operation. Total telecom, a part of Arfeen group finally acquired Instaphone and thus its sale was finally completed in June 2006, Millicom was actively selling Paktel as of Dec31, 2006. Millicom international signed for the sale of 88.86% shareholdings in Paktel limited to China Mobile Communication Corporation. The transaction implies an enterprise valuation for Paktel Ltd of US\$460 million. The total cash received by Millicom as a result of this transaction was approximately US\$284 million. The sale of Paktel was completed on 13<sup>th</sup> February, 2007. Later on it has acquired 100% stock of Paktel. Current subscribers' base of Paktel and Instaphone are 1,024,563 and 333,081 respectively [Millicom, 2006)]. Table 1 and 2 show the details of revenue, earnings before interest and taxes (EBIT) and net income (loss) of Paktel and Instaphone respectively.

**Table 1 review of paktel performance**

Items	2004	2005	2006
Revenue	34,349	51,862	55,430
EBIT	(1,839)	(37,877)	(43,492)
Net Income (Loss)	(2,412)	(54,450)	(74,927)

Source: Millicom International Cellular SA, (Annual Reports & Accounts, 2006)

**Table 2 review of instaphone performance (US\$, 000)**

Items	2004	2005	2006
Revenue	54,337	34,640	10,948
EBIT	7218	(36,324)	7,866
Net Income (Loss)	(5,435)	(45,581)	(281)

Source: Millicom International Cellular SA, (Annual Reports & Accounts, 2006)

### **Pakistan Mobiles Communication Limited (Mobilink)**

Mobilink launched its operation in August 1994 after it was founded in 1990 as a joint venture between Motorola and Saif group. Mobilink is the most expensive network in Pakistan captures 56% of the total population and 95% of the urban population as of 31<sup>st</sup> December, 2006. Mobilink has invested more than US\$2.0 billion in its mobile communication network and has approximately 5,250 cell sites and 50 switches, Mobilink served over 22 million subscribers as of 31<sup>st</sup> December, 2006, representing a market share of approximately 46.3% of total mobile subscribers in Pakistan. Mobilink has coverage area of more than 10,000 cities, towns and villages and providing international roaming services in 130 countries (<http://www.mobilinkgsm.com/coverage/index.php>).

Mobilink was awarded a license for mobile communication system and services in July 1992, and commenced its operation in 1994, becoming the first company in Pakistan to setup and operate a digital mobile network based on GSM 900 technology. Mobilink was awarded a license for 15 years in July 1992 to establish and operate. In July 2000, PTA indicated that Mobilink license would be renewed on 5<sup>th</sup> July, 2007 for the further period of 15 years. PTA confirmed the following payment schedule: US\$ 14.55 million will be payable in each of July 2007, January 2008, July 2008 and January 2009; US\$ 29.1 million to be payable in each of July 2009, January 2010 and July 2010 and the balance of the fee will be paid in ten equal installments of US\$14.55 million with first installment payable in July 2011 (<http://www.orascomtelecom.com>). On 26<sup>th</sup> June, 2006, Mobilink was granted another Azad Jamu & Kashmir and Northern areas license for a period of 15 years (Orascom telecom, Annual Report, 2008).

Mobilink markets its prepaid services using the Jazz trade name and its post-paid services using the brand name

Indigo. In addition to the basic voice services, Mobilink also provide its subscribers other services like voice mail, closed user group, SMS, call waiting/holding, call forwarding, caller's line identification presentation, free minutes services such as MMS through its GPRS platform (<http://www.mobilinkgsm.com>).

Motorola entered in an agreement with Mobilink to deploy a WiMAX 802.16e-2005 access network for the operator in the country. According to an agreement, Motorola will design, plan, deploy and optimize a WiMAX network for Mobilink, deliver integration and support services as well as indoor and outdoor customer premises equipments (CPE) units to enable faster adaptation of the operator's WiMAX offerings. This network will enable Mobilink to extend its current services beyond data and cellular offering to high speed broadband and VoIP services for fixed line residential and business subscribers (The NEWS, Dec6, 2007). Table 3 shows the details Mobilink Pakistan's revenue, earnings before interest and taxes (EBIT), operating income, average revenue per user (ARPU) and minutes of use.

**Table 3 review of mobilink performance**

Items	2004	2005	2006
Revenue (US\$, 000)	379,484	732,594	1,017,239
EBITDA (US\$, 000)	212,410	292,928	406,537
EBITDA margin (%)	56.0	40.0	40.0
ARPU US\$ (3 months)	9.7	6.7	4.1
MOU (YTD)	173	156	130

Source: Orascom Limited (Annual report 2004-2006)

This study is organized as follows:

- Review of literature by including the theoretical and empirical findings.
- Description of research methodology and about dependent and independent variables.
- Limitations of the study.
- Interpretation of regression results and analysis.
- Conclusion.
- Results are given in appendix.

### LITERATURE REVIEW

Madden *et.al.* (2003), studied the growth in total factor productivity (TFP) of 12 Asia –Pacific telecommunication firms for the period from 1987-1990. They used following model:

$$TFP_{it} = \delta_0 + \delta_1 Q_{it} + \delta_2 MIX_{it} + \delta_3 COMP_{it} + \delta_4 PRIV_{it} + ut$$

Where

TFP = Total Factor Productivity

Q = Output

MIX = Output Mix

COMP = Competition

PRIV = Privatization

Ut = Error term, with zero mean and no variance.

They measured output growth as the log difference of aggregate

telecommunication output, where telecommunication output is measured by minutes of local exchanges, long distance and out-going international traffic. Technology is the log change of the telecommunication technology index and the proxy for telecommunication change is based on a network-switching indicator. Oum and Zhang (1995), defined the index is annually as the log of one plus the percentage of main lines served by digital switches. Output Mix was measured by the log change in domestic output divided by the log change in aggregate output. Competition was the dummy variable. That is equal to 1 when there is more than one firms operating in the market. Privatization was measured by the privatization index, defined by one plus the private ownership share of the dominant firm. Joint impact of competition and privatization was also studied. Results indicate that all variables had significant impact with positive sign. However joint impact of privatization and competition showed negative relation with TFP. Empirical results show that competition, private ownership, technology change and increase in output improve firms' TFP growth.

Madden and Savage (2001), employed a Malmquist index to calculate telecommunications TFP growth of 74 countries for the period from 1991-1995. They used a model relating TFP growth to output growth, network digitization, telecommunications development, output mix, business cycle and market structure. He empirically found the positive impact of advance technology, competition and privatization on TFP.

Gort and Sung (1999), studied the effect of competition on the efficiency of the United States domestic telephone industry. They found that efficiency improved significantly in competitive markets and telephone company production exhibited constant returns to scale. They also observed that technological changes are best for productivity growth and cost reduction.

Oum and Zhang (1995), studied the performance of telecommunication firms in United States after the introduction of competition in 1984. They proved the positive impact of competition on firms' performance.

Petrazzini and Clark (1996), examined the effect of competition in Latin America and Asia. They compared the

performance of competitive and non-competitive markets and proved that competitive markets have higher teledensity.

From the review of other researchers' work it is concluded that competition and technology are the key forces that can enhance firm's efficiency. In Pakistan neither sufficient research work has been done on this important issue nor is enough literature available. So this study was chosen under the same consideration.

## RESEARCH METHODOLOGY

Empirical work in this section is based on the model of Madden et al (2003) that was used to measure the TFP of 12 Asia–Pacific telecommunication carriers for the period from 1987-1990. Total factor productivity calculation is made separately for each mobile company by using the same model with little modification, keeping in view of data availability. For the purpose of analysis time series data have been taken from 2000q1-2006q2 on quarterly basis.

The functional equation is based on theoretical formulation, developed earlier in this section. The equation is given in log –linear form as:

$$LTFP = \delta_0 + \delta_1 LQ + \delta_2 LTEL + \delta_3 LG.A + \delta_4 LCOMP + Q_1 + Q_2 + Q_3 + ut$$

Where; TFP= Total Factor Productivity

Q= Output

TEL= Teledensity

G.A= Geographical areas covered

COMP= Competition

### It is hypothesized that

$$\partial LTFP / \partial \delta_1 LQ > 0 \quad \partial LTFP / \partial \delta_3 LG.A > 0$$

$$\partial LTFP / \partial \delta_2 LTEL > 0 \quad \partial LTFP / \partial \delta_4 LCOMP > 0$$

### Dependent Variable

TFP is taken as dependent variable. Total revenue is taken as an out put. While capital expenditures are taken as an input. Both revenue and capital expenditures are deflated by transport and telecommunication index (base year 2000-01, taken from economic survey of Pakistan, 2005-06). Output and input data for the companies have been taken from the concerned companies' annual reports. TFP is calculated as:

**TFP= Output –Input**

### Explanatory Variable

**Out put (Q)** is taken as an independent variable. Telecom sector out put is normally measured in terms of subscribers or in terms of traffic in

minutes. Madden et al (2003) measured out put of telecommunication in terms of minutes of local exchange, long distance and international outgoing traffic. But due to non-availability of data, here it is measured in terms of total number of subscribers. Data for total number of subscribers has been taken from annual reports of each company.

**Teledensity (TEL)** is the second independent variable. It is calculated by dividing the number of main lines offered by each company per million of the people in each year. Data for number of main lines of each company has been taken from annual reports of concerned companies.

**Geographical Area (G.A)** covered is also taken as an independent variable. The number of cities where each company network has reached in each year measures it. Data for total number of cities covered has been taken from annual reports of the company as well as from their websites and PTA annual reports.

**Competition (COMP)** is the last independent variable. It is calculated as total number of competitors (telephone, mobile and wireless local loop

companies) per million of the people. Data for population has been taken from various issues of Economic Survey of Pakistan.

### **LIMITATIONS OF THE STUDY**

As a researcher one should try to get enough and reliable data about the given research study. We collected data from various available sources as mentioned above. However, in this study there are certain limitations about the length of the data like:

- Relevant data for mobile companies was not available from their date of inception of operation in Pakistan. Thus time period of the study for the model mentioned above chosen with this consideration.
- Only three companies were selected with the consideration of data availability. Furthermore these were pioneering firms that introduced mobile phones in Pakistan and spend sufficient time with their business in Pakistan.

### **Data analysis and interpretation**

The empirical investigation on the TFP of Paktel, Instaphone and Mobilink Company using time series data has been

taken for the period 2000-2006 (on quarterly basis). Summary statistics and correlation between variables were calculated in all cases. In order to determine the order of integration of variables, Augmented Dickey Fuller (ADF) tests for unit roots was employed in all three cases to find out that the variables were concluded to be integrated of the same order. ADF tests for three companies showed that all variables had stationarity in the levels of 95% critical values without trend. All variables were in first difference except Geographical Area (G.A) in case of Mobilink that was in third difference. From the Unit Root tests we conclude that all of the variables in all cases were integrated of order I (1) except variable Geographical Area (G.A) in case of Mobilink that was integrated of order I(3).

Ordinary Least Square (OLS) estimation in case of Paktel showed that all variables were found statistically significant at 1% level of significance except competition that was obtained significant but with negative sign at 1% level of significance.  $R^2$  was at 0.93 but serial correlation lies so an ECM was applied. ECM results indicated that

again all variables were found significant with the same sign as obtained earlier. Residual found insignificant with positive sign.  $R^2$  was also improved and no serial correlation lies.

OLS results of Instaphone Company revealed that all of the variables were found significant at 1% level with positive sign except competition with negative sign.  $R^2$  was at 0.70 and also serial correlation lies so an ECM was applied. Again all variables were found significant with the same sign as obtained earlier.  $R^2$  and adjusted  $R^2$  were also improved and no serial correlation lies.

OLS estimation was also applied in case of Mobilink to find the impact of variables on TFP. Empirical results showed that all variables were found significant at 1% level with positive sign.  $R^2$  was 0.78 and adjusted  $R^2$  was 0.70. Serial correlation lies so an ECM was applied, result indicated that all variables were found significant with the same sign as obtained earlier but now geographical area coverage was found insignificant.  $R^2$  and adjusted  $R^2$  were also improved and no serial correlation lies.



## CONCLUSION

This study examines the TFP of three multinational cellular firms i.e. Paktel, Instaphone and Mobilink, currently operating in Pakistan for the period from 2000q1-2006q2. TFP was taken as dependent variable in all three cases. While, Output (Q), Teledensity (TEL), Geographical Area Coverage (G.A) and Competition (COMP) were taken as independent variables. Empirical results indicated the positive and significant impact of all variables in case of Paktel and Instaphone except competition that revealed its negative impact on TFP. However in case of Mobilink situation was somewhat different. Here all variables revealed their significant and positive impact except geographical area that remained insignificant.

From results (given in appendix) we conclude that with the increase in number of subscribers, area coverage and teledensity, total factor productivity of both Paktel and Instaphone has increased. While, increase in number of competitors is dangerous for companies' survival. Since competitors are offering more attractive packages that have great variety to meet the needs of various classes of subscribers. Further more they

are also offering other valuable value added services. Subscribers are demanding for more services but Paktel and Instaphone are looking unsuccessful to meet their demand and results showing negative relation between competition and TFP. This is the reason that competition is the major force that is eating their share from the market. As it can be seen that market share of both Paktel and Instaphone is declining day by day.

In case of Mobilink we conclude that subscribers, teledensity and competition are the major factors that jointly determine the success of company and enhance factors' productivity. In order to shut down its competitors it has offered variety of packages and other value added services. Geographical area is not looking important since in the limited area it has greatly increased its teledensity and from its beginning in its history in Pakistan, still it is the market leader.

As we can see that with the entry of strong competitors Paktel and Instaphone shares from the market has greatly reduced i.e. from 7% and 4% (2004-05) to 4% and 1% (2005-06) and 3% and 1% (2006- Mar. 07)

respectively. Although Mobilink's market share has also declined from 58% (2004-05) to 51% (2005-06) and 44% (2006-Mar.07) (Economic Survey of Pakistan 2005-06, 2006-07), yet it still holds the market. This study can be more valuable for the present and potential investors as well as for the new entrants in telecom sector.

## References

- "About Global Operations (Asia)". (2007), Available at <http://www.millicom.com>
- "About Mobilink, GSM Operation". (2007), Available at <http://www.orascomtelecom.com>
- "About Services (Mobilink)". (2007). Available at <http://www.mobilinkgsm.com>
- Economic Survey of Pakistan. (2005-06, 2006-07). Finance division. Economic adviser's wing. Islamabad. Pakistan.
- Gort M and Sung N (1999). Competition and Productivity, Growth: The Case of US Telephone Industry . Economic Inquiry, 37: 678-691.
- Madden G and Savage SJ (2001). Productivity Growth and Market Structure in Telecommunications. Economics of Innovation and New Technology, 11: 203-222.
- Madden G; Savage S J and NG J (March, 2003). Asia-Pacific Telecommunication Liberalization and Productivity Performance. Australian Economic Papers. Blackwell Publishing Ltd. pp: 91-102.
- Millicom International Cellular, SA. Annual Reports & Accounts. (2006).
- Mobilink-Coverage. (Feb 22, 2010), Available at <http://www.mobilinkgsm.com/coverage/index.php>
- "Motorola, Mobilink Accord". (December 6, 2007). Business News. The NEWS, p: 17.
- Orascomtelecom ,Annual Report, (2008). P.16.
- Oum,T.H. and Zhang,Y. (1995). Competition and Allocative Efficiency: The Case of US Telephone Industry. Review of Economics and Statistics, 77: 82-96.
- Petrazzini, B. and Clark,T. (1996). Cost and Benefits of Telecommunication Liberalization in Developing Countries.

**Appendix**

**RESULTS FOR PAKTEL**

**Table 4 SUMMARY STATISTICS (Sample period: 2000Q1 to 2006Q2)**

Variables	TFP	Q	TEL	G.A	COMP
Mean	2.5864	2.6687	3.0568	5.6074	4.7680
Std. Deviation	0.77673	0.92341	0.88044	0.099807	0.36128
Coef of Variation	0.30032	0.34601	0.28802	0.017799	0.075771

**Table 5 CORRELATIONS BETWEEN TFP & OTHER VARIABLES**

	LTFP	LQ	LTEL	LG.A	LCOMP
LTFP	1.0000				
LQ	0.89260	1.0000			
LTEL	0.89647	0.99985	1.0000		
LG.A	0.89666	0.97246	0.97109	1.0000	
LCOMP	-0.70745	0.70001	0.70782	0.69345	1.00000

**Table 6 RESULTS OF ADF TEST**

Variables	Level/Difference	Without trend	Conclusion
TFP	Level	-0.71442	I(1)
	First difference	-4.5696	
Q	Level	-0.93645	I(1)
	First difference	-5.4533	
TEL	Level	-0.92756	I(1)
	First difference	-5.4360	
G.A	Level	-0.33351	I(1)
	First difference	-10.0575	
COMP	Level	-0.6394	I(1)
	First difference	-4.4369	

95% critical value for ADF Statistics for all variables: -3.0199 (without trend)

**REGRESSION RESULTS (2000Q1- 2006Q2)**

**Table 7 DEPENDENT VARIABLE: TFP**

Variables	Coefficient	t-Statistics
Constant term	-72.8501	-4.5664
L Output	24.5291	5.4706
L Teledensity	25.1766	5.4972
L Geographical area	13.9454	4.9347
L Competition	-0.74581	-2.8510
Q1	0.26590	2.8481
Q2	0.008987	0.11686
Q3	-0.040677	-0.50059
R <sup>2</sup>	0.93635	
Adjusted R <sup>2</sup>	0.91160	
D.W	1.69	
No of observations	26	

**Table 8 ECM RESULTS**

Variables	Coefficient	t-Statistics
Constant term	-68.1877	-4.1842
DL Output	23.4514	5.0333
DL Teledensity	24.1144	5.0618
DL Geographical area	13.0866	4.5388
DL Competition	-0.70042	-2.6653
Q1	0.26494	2.7415
Q2	0.0089999	0.11659
Q3	-0.051200	-0.62604
PP(-1)	0.34882	1.4104
R <sup>2</sup>		0.94098
Adjusted R <sup>2</sup>		0.91146
D.W		1.9641
No of observations		25

**RESULTS FOR INSTAPHONE**

**Table 9 SUMMARY STATISTICS (Sample period: 2000Q1 to 2006Q2)**

Variables	TFP	Q	TEL	G.A	COMP
Mean	-2.7954	2.5014	-2.5021	4.8944	-4.7680
Std.Deviation	0.30934	0.57208	1.0127	0.13964	0.36128
Coef of Variation	0.11066	0.22871	0.40473	0.028530	0.075771

**Table 10 CORRELATION BETWEEN TFP & OTHER VARIABLES**

	LTFP	LQ	LTEL	LG.A	LCOMP
<b>LTFP</b>	1.0000				
<b>LQ</b>	0.049877	1.0000			
<b>LTEL</b>	0.25199	0.73122	1.0000		
<b>LG.A</b>	0.26597	0.90306	0.49527	1.0000	
<b>LCOMP</b>	-0.42133	0.40537	-0.17174	0.71496	1.00000

**Table 11 RESULTS OF ADF TEST**

Variables	Level/Difference	Without trend	Conclusion
<b>TFP</b>	Level	-0.90409	I(1)
	First Difference	-4.3267	
<b>Q</b>	Level	-0.95903	I(1)
	First Difference	-4.9624	
<b>TEL</b>	Level	-1.4856	I(1)
	First Difference	-4.2494	
<b>G.A</b>	Level	-0.58415	I(1)
	First Difference	-4.6264	
<b>COMP</b>	Level	-0.60394	I(1)
	First Difference	-4.4369	

95% critical value for ADF Statistics for all variables: -3.0199 (without trend).

**REGRESSION RESULTS (2000Q1- 2006 Q2)**

**Table 12 DEPENDENT VARIABLE: TFP**

Variables	Coefficient	t-Statistics
Constant term	85.1675	5.2286
L Output	2.1375	4.9097
L Teledensity	0.31509	3.2764
L Geographical area	14.2957	5.4794
L Competition	-2.4824	- 4.6616
Q1	-0.43276	-4.3850
Q2	-0.14347	-2.0817
Q3	0.13207	1.8443
R <sup>2</sup>		0.70910
Adjusted R <sup>2</sup>		0.59597
D.W		0.89536
No of observations		26

**Table 13 ECM RESULTS**

Variables	Coefficient	t-Statistics
Constant term	70.5004	4.664
DL Output	1.6703	3.9429
DL Teledensity	0.32518	3.9240
DL Geographical area	11.9381	4.9272
DL Competition	-2.0680	- 4.2825
Q1	-0.34476	-3.5460
Q2	-0.11403	-1.8963
Q3	0.083970	1.2912
PP(-1)	0.68535	2.8918
R <sup>2</sup>		0.80592
Adjusted R <sup>2</sup>		0.70888
D.W		1.4435
No of observations		25

**Table 14 SUMMARY STATISTICS (Sample period: 2000Q1 to 2006Q2) RESULTS FOR MOBILINK**

Variables	TFP	Q	TEL	G.A	COMP
Mean	0.58028	1.2102	1.5841	6.0143	4.7680
Std.Deviation	0.26435	1.5696	1.5263	0.075228	0.36128
Coef of Variation	0.45555	1.2970	0.96353	0.012508	0.075771

**Table 15 CORRELATION BETWEEN TFP & OTHER VARIABLES**

	LTFP	LQ	LTEL	LG.A	LCOMP
<b>LTFP</b>	1.0000				
<b>LQ</b>	0.70823	1.0000			
<b>LTEL</b>	0.70938	0.99999	1.0000		
<b>LG.A</b>	0.75470	0.94906	0.94918	1.0000	
<b>LCOMP</b>	0.59837	0.69906	0.69846	0.62989	1.00000

**Table 16 RESULTS OF ADF TEST**

Variables	Level/Difference	Without trend	Conclusion
TFP	Level		
	First Difference		
Q	Level	0.012808	
	First Difference	-4.5164	I(1)
TEL	Level		
	First Difference	-0.19221	
G.A	Level	-5.7522	I(1)
	First Difference	-0.18941	
COMP	Level	-5.7413	I(1)
	First Difference	0.88916	
	Second Difference	-1.2012	
	Third Difference	-2.3003	I(3)
	Level	-4.0731	
	First Difference	-0.60394	
	Level	-4.4369	I(1)
	First Difference		

95% critical value for ADF Statistics for all variables: -3.0199 (without trend)

**Table 18 ECM RESULTS**

Variables	Coefficient	t-Statistics
Constant term	-0.29964	-0.020125
DL Output	16.0869	3.0094
DL Teledensity	16.5431	3.0070
DDD L Geographical area	1.3893	0.57981
DL Competition	0.28009	2.4669
Q1	0.072132	1.0597
Q2	0.016150	0.34329
Q3	0.040556	-0.81704
PP(-1)	0.63851	1.6104
R <sup>2</sup>	0.82037	
Adjusted R <sup>2</sup>	0.73055	
D.W	2.0930	
No of observations	25	

**Table 17DEPENDENT VARIABLE: TFP REGRESSION RESULTS (2000Q1- 2006Q2)**

Variables	Coefficient	t-Statistics
Constant term	-19.1596	-2.0397
L Output	15.5122	2.8045
Teledensity	15.8119	2.7767
L Geographical area	4.5399	3.1497
L Competition	0.27143	2.3563
Q1	0.11526	2.0605
Q2	0.0089157	0.18542
Q3	-0.045913	-0.90374
R <sup>2</sup>	0.78943	
D.W	1.5494	
No of observations	26	