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## Article

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# The Dynamic effects of Foreign Direct Investment Services and Energy Consumption on Information and Communication Technology Sector

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## ABSTRACT

This study scrutinises the influence of foreign direct investment (FDI) inflows, energy consumption on Information and Communication services (ICTs) in selected economies of South Asia. This research is based on heterogenous and second generation framework of panel data-set from 1999 to 2021. This study used augmented mean group (AMG), mean group (MG), and common correlated effects mean group (CCEMG) assessors, which further promotes the substantial and favourable influence of FDI services, and energy consumption on ICTs. However, the impact of terrorism is insignificant on ICTs in the region of South Asia. The results indicate that economies of these region must embrace investment reform measures in order to draw FDI into the services sector, increase exports of services, and progress towards economic stability.

**Keywords:** FDI, Energy Consumption, ICTs; South Asia; Services Exports

**JEL Classifications:** F3, F4

## 1. INTRODUCTION

In the recent world of Global value chain (GVC), foreign direct investment and trade have risen significantly to turn into the twin engines of world economic well-being. Multinational enterprises (MNEs) represent 80% of international exports. MNEs unique expertise, know-how represents their burst on the economy of world and also provides similar benefits for their host and home nations. The linkages between FDI and trade are very strong in the developed as well as developing economies and stands as the highly significant foreign financing.

An important aspect of FDI explored by World Investment Report 2004 and 2005 was the shift of manufacturing FDI towards services FDI. In 1970 FDI in services sector represents a quarter of world-wide FDI stock. In 1990, the share of services

sector FDI rose to about half, though in 2002, services FDI share increased to about 60% of world FDI stock (UNCTAD, 2004). Also, current statistics ensures that services accounted for 67% of global FDI from 63% in 2012 (UNCTAD, 2017). However, the sharp rise in services FDI is because of the increasing significance of services sector in the individual economies. Business activities and financial services jointly account for 62% of total global FDI stock in services. In addition, Telecommunication and trade also attracts FDI inflows.

Over the past 20 years, services has developed as the most fastest emerging sector in the worldwide economy, representing higher than 60% of world output and also contributing greater share in employment in many countries (Hoekman and Mattoo, 2008). This sector has not only contributed to higher GDP and employment but also has attracted huge amount of foreign direct investment

(FDI) into it (UNCTAD, 2009). The increasing importance of services in the world has been studied by various scholars (Shelp, 1985; Daniels, 1982; Riddle, 1986 and 1987 and Gershuny and Miles (1983)).

In today's information based economy, services are important for the competitiveness of industries in all sectors. It is noticed that complementarities may occur between services trade and foreign direct investment (FDI), especially where continuous contact with economic agents is important, despite the fact that trade between countries stays technically possible (Hardin and Holmes, 1997). Since 1995, for international trade in services, legal ground rules have been provided by WTO's (2010) General Agreement on Trade in Services (GATS). Growth of services trade is driven by various factors such as deregulation of services industries, liberalization of merchandise trade, increasing reliance on business outsourcing from MNEs and technological advances.

The remainders of this inspection are as follows: Section 2 analyses the scientific review; the section 3 discusses the empirical framework and data; Section 4 presents the results and section 5 concludes the paper.

## 2. LITERATURE REVIEW

According to WDI statistics (2011), services trade rises more rapidly than goods trade as from twenty percent in 1980 to twenty seven percent in 2010 (Shelp (1986), Riddle (1986), and Daniels (1982)). Hoekman and Mattoo (2008), inspects the structural trends in the globe and additionally investigate the continuous rise in services industry throughout the past 20 years, contributing >60% of global value added and in many economies, even greater contribution to employment. According to UNCTAD (2009), foreign direct investment is also attracted by the services sector as like high value added and employment share. On the other hand, the services sector also contributes to the worldwide trade.

Chanda (2011) empirically explored for health related services, Larsen (2002) investigated for educational services and Freund and Weinhold (2002) examined for internet related services in his study. Majeed and Ahmad (2007); Yao (2006); Jensen, 2008; Grossman and Helpman, 1991; Jawaid et al. (2016); Caves, 1996; Dunning, 1993, Dash and Parida (2013); Hsiao and Hsiao (2006); and Min (2003) explores the relationship between FDI and exports.

Various researches found positive significant effect between foreign direct investment and export performance in the sample countries (Ayaz et al. (2013); Cao et al (2022); Tekin (2012); Qayyum and Mahmood (2013)). Saadi (2014) study explore the productivity of exports in emerging economies. Zhang (2005); Xu and Gupta (2009) observe the effects of vertical and horizontal foreign direct investment on exports productivity. They concluded direct effect of vertical foreign direct investment towards exports, indirect effects by horizontal foreign direct

investment. Bhalla (1995); Popovici (2018); Shabbir et al. (2023); Sass et al. (2018); Lall (2000); Liu et al., 2023; Sikandar et al., 2023; Sharma and Kaur (2013); Okechukwu et al. (2018); Parida and Sahoo (2007); and Sleuwaegen and Smith (2021) in their study highlight the role foreign direct investment for the up gradation of low value added exports (primary or labour- intensive) into higher value added exports. They further recommend, developing countries should make policies for attracting foreign direct investment in order to get benefit from foreign direct investment spillover effects.

Min (2003) study explore the spillover effects of FDI that helped out for export sector up gradation from primary to manufacturing sector, with preferences towards key foreign direct investing economies and key foreign direct investment getting industries. Fukao et al. (2003) investigate that in order to get access to international markets and together with domestic enterprises in global manufacturing chains foreign direct investment is very helpful. Zhang and Song (2002) study explore that the exports by Foreign- invested enterprises in China improved intensely to thirty two percent in 1995 from a mere three percent in 1987. Riedel (1993) and Krueger (1997) study for East Asian economies. They confirmed that foreign direct investment in these economies boosted exports opportunities as well as modernized export sector. Haddad and Harrison (1993) study describe the indirect spillovers through foreign direct investment.

Saleena (2013) investigates the effects of foreign direct investment on services exports. The study result supports the spillover effects of FDI on services exports. Dash and Parida in 2013 examine the correlations between FDI inflows, trade in services and value added by using causality tests of VECM and co- integration. The estimation results confirmed the existence of correlation among these variable. Wong et al. in 2009 find the causal relation between FDI inflows and services trade in Singapore and Malaysia.

In south Asia, the present trend of growth directs that the services sector succeeding more in comparison with the other industries. Therefore, it is pertinent to explore the determinant of services exports, more specifically ICTs because the share of services export in the total exports is growing continuously in South Asian countries (India, Bangladesh, Pakistan, and Sri Lanka). It is observed that through the export of today's business related services; travel services and ICTs the region has tremendous growth potential. It is necessary to set up ways of tracking and evaluating the advancement of these services in order to benefit from their competitive edge via these major advantages from services productivity in the industry.

## 3. EMPIRICAL MODEL AND DATA

To estimate the influence of services FDI on ICTs of in South Asia, formed the empirical framework grounded on theoretical foundations as:

$$ICTs_{it} = \alpha_0 + \alpha_1 SFDI_{it} + \alpha_2 WGDPI_{it} + \alpha_3 GDP_{it} + \alpha_4 X_{it} + \alpha_5 TO_{it} + \alpha_6 EC_{it} + \alpha_7 T_{it} + U_{it} \quad (1)$$

Whereas, “*t*” is time frame and “*i*” denotes cross-sectional unit, *ICTs* represents for Information and Communication technology and *SFDI* is FDI inflows in the services sector.<sup>1</sup> These are used as “current prices in millions US dollars”. We also includes control variables including *WGDPI* (World GDP) which is used in constant prices in \$US billions, *T* (The total number of terrorist attacks that occurred in a given year is what is being taken into account) used from GTD (Global Terrorism Database), *GDP* (Gross Domestic Product) which is utilized in our study as constant prices 2015 US\$, *EC* represents conventional energy utilization (% of total energy utilization), *X* (Real exchange rate), *TO* (Trade as % to GDP) in the above equation (i). It is observed that the share of *ICTs* in the overall services exports in South Asia (India, Pakistan, Bangladesh, Sri Lanka and Nepal) is very high and continuously rising. In order to inspect our objective we adopts 2<sup>nd</sup> Generation framework and heterogenous strategy for our data set from 1999-2021.

## 4. RESULTS

This study inspected cross-sectional dependence. If it appears, we adopt 2<sup>nd</sup>-generational framework to procure our long-run estimates. The homogeneous slope's  $H_0$  (default hypothesis) is disproved at a 1% level of significance, indicating that gradient heterogeneity truly occurs (Table 1).

Meanwhile, Tables 1 and 2 data demonstrate that conventional methodologies like LLC, IPS, and, PP are inadequate for this inquiry due to the cross-sectional interconnectedness (Pesaran, 2007). Thus, for the South Asian countries' Panel data, this examination employed Pesaran's (2007) sophisticated unit root investigations (CADF and CIPS) (Table 3).

We proceeded to look into the long-term connection between our pointers because ordering one connects all of them. The error interconnection concept proposed by Westerlund (2007) is accepted.

Long-run parameter determining is done in the present investigation employing an empirical method shown in Table 4. In accordance with the data in Tables 1 and 2, that generate unbiased estimates, the AMG inspector is selected for this study (Bond and Eberhardt, 2013).

According to Table 5 outcomes, the regressors *SFDI*, *GDP*, *WGDPI* as well as *EC* and *TO* all have a direct influence on *ICTs*, with the exclusion of the rate of currency exchange (*X*), that has an indirect and significant impact on *ICTs*. A, a rise in *ICTs* (Information

**Table 1: Cross-sectional dependence outcomes**

Variables	Abs (correlation)	Correlation	Coefficients
ICTs	0.79	0.51	92.311***
GDP	0.53	0.52	27.312***
T	0.31	0.26	7.321***
SFDI	0.59	0.43	19.102***
WGDPI	0.61	0.39	17.912***
X	0.52	0.41	13.051***
TO	0.69	0.39	20.102***
EC	0.41	0.31	11.131***

\*\*\*P<0.05, \*\*P<0.01, \*P<0.1. ICT: Information and Communication Services, GDP: Gross domestic product, WGDPI: World GDP, X: Real exchange rate, TO: Trade as % to GDP, EC: Conventional energy, T: Time

**Table 2: Inspection for heterogeneous panel**

Variables	$\Delta$ statistic	$\Delta_{adj}$ statistics
ICTs	89.061***	91.431***
GDP	18.611***	22.312***
SFDI	19.011***	24.241***
T	17.011***	21.201***
WGDPI	10.911***	12.913***
X	11.011***	13.012***
EC	11.716***	16.415***
TO	7.641***	9.870***

\*\*\*P<0.01, \*\*P<0.05, \*P<0.1. ICTs: Information and communication services, GDP: Gross domestic product, WGDPI: World GDP, X: Real exchange rate, TO: Trade as % to GDP, EC: Conventional energy, T: Time

**Table 3: Assessment of panel's stationary features**

Variables	CIPS		CADF	
	Level	$\Delta$	Level	$\Delta$
EC	-1.391	4.204***	-1.779	-4.301***
ICTs	-1.899	-3.409***	-1.971	-3.413***
T	-1.411	-4.190***	-1.403	-4.037***
GDP	-1.490	-3.891***	-1.708	-3.753***
SFDI	-1.413	-4.311***	-1.413	-4.010***
EX	-1.629	-3.910***	-1.499	-3.910***
WGDPI	-1.631	-4.102***	-1.631	-4.102***
TO	-1.211	-2.714***	-1.103	-2.719***

ICTs: Information and communication services, GDP: Gross domestic product, WGDPI: World GDP, EX: Real exchange rate, TO: Trade as % to GDP, EC: Conventional energy, T: Time

**Table 4: Inspection for panel cointegration**

Statistics	Value	Z	P-value
$G\alpha$	-11.000***	-4.000	0.003
$G\beta$	-5.099***	-6.001	0.001
$P\alpha$	-10.000***	-1.701	0.00
$P\beta$	-16.009***	-1.999	0.001

and communication technologies) of 0.131%, 0.039%, 0.128%, 0.029%, and 0.071% is the result of a 1% progress in *TO*; *GDP*; *SFDI*; *WGDPI*; as well as *EC*. While, an increase in *ICTs* of 0.139% is the result of 1% reduction in the exchange rate. Although, terrorism shows an indirect but insignificant influence on *ICTs*. The researches by Sleuwaegen and Smith (2021); Sass et al. (2018); Cao et al., 2022; Jain et al., 2022; Malik et al., 2023; Popovici (2018); Wang et al 2023; and Okechukwu et al. (2018) obtained the similar outcomes.

<sup>1</sup> *SFDI* data is collected from BOI (Bangladesh) and Survey Report (2016) of Bangladesh Bank; Fact Sheet on FDI, “Department of Industrial Policy and Promotion”, India; State Bank of Pakistan Annual reports; BOI (Sri Lanka) and Dushni and Thennakoon (2009).



**Table 5: Assesment of long-run estimates**

IV	AMG estimator			MG estimator			CCEMG estimator		
	Coefficients	P-value	t statistic	Coefficients	P-value	t statistic	Coefficients	P-value	t statistic
SFDI	0.128***	0.000	8.01	0.112***	0.000	5.87	0.211***	0.002	5.49
T	0.221	0.411	1.31	0.112	0.312	1.10	0.131	0.291	1.01
WGDP	0.029*	0.079	2.00	0.032*	0.041	2.30	0.032*	0.031	1.790
X	-0.139***	0.000	6.51	-0.140***	0.000	6.70	-0.112***	0.001	6.60
GDP	0.039**	0.040	2.75	0.027**	0.039	2.17	0.049**	0.029	1.68
TO	0.131***	0.000	6.11	0.130***	0.001	6.01	0.410***	0.000	5.90
EC	0.071***	0.002	4.11	0.070***	0.000	4.10	0.110***	0.002	5.00
CD-inspection	0.199		0.910	0.399		0.659	1.219		0.310
Diagnostic									
I (0)		0.00			0.00			0.00	
RMSE		0.0181			0.0190			0.0170	

\*P < 0.1, \*\*P < 0.05, \*\*\*P < 0.01. RMSE suggests root mean squared error, "Root Mean Squared Error" is specified as RMSE, I (0) stands probabilities for CADF examination with H0: Nonstationarity. GDP: Gross domestic product, WGDP: World GDP, X: Real exchange rate, TO: Trade as % to GDP, EC: Conventional energy, T: Time, AMG: Augmented mean group, CCEMG: Common correlated effects mean group, MG: Mean group

## 5. CONCLUSION

The objective of this research is to explore the influence of services- FDI on the ICTs exports. The empirical inquiry of long-term impressions compelled by AMG, MG, and CCEMG propose that services FDI is a vital determinant of ICTs in Southern Asia from 1999 to 2021. Therefore, this current pattern of ICTs specifies that there is enormous prospective in the region for services related exports anticipated that these nations facilitate and attract FDI in the services sector. Meanwhile, energy consumption likewise shows significant but direct impact on ICTs in our exploration.

Besides, Services exports have trickle down impact on other sector of the economy such as manufacturing sector and can potentially address the issue of current account deficit in South Asian countries. Therefore, in order to address the issue of lagging exports, utilize their enormous potential in services exports, South Asian countries should encourage the inflows of FDI in services and need to improve investment climate. Keeping in view the widespread transformation of developing countries towards a services- or knowledge-based economy, the findings of this study may have important policy implications for developing economies as a whole. This research findings suggest that liberalising the services sector at the regional as well as multilateral trading levels is important for export promotion. Also, future inspection can be ended by reviewing the impact of all major three exports in services category like ICTs, Travel and Other business related export and exploring their in South Asia.

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