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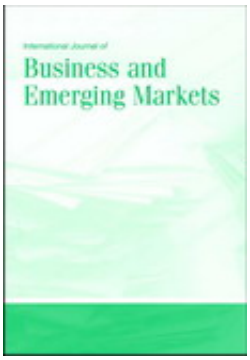

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Omdeep Gupta, Krishna Chandra Balodi, Mohd Afaq Khan

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Explicating India's outward trade mode using augmented gravity approach

Omdeep Gupta*

Department of Business Administration,
Aligarh Muslim University,
Aligarh, India
Email: omdeepg@gmail.com
Email: ogupta@gehu.ac.in
and
School of Management,
Graphic Era Hill University,
Dehradun, India
*Corresponding author

Krishna Chandra Balodi

Indian Institute of Management,
Lucknow, Prabandh Nagar, IIM Road,
Lucknow – 226013, Uttar Pradesh, India
Email: krishna.balodi@iiml.ac.in

Mohd Afaq Khan

Department of Business Administration,
Faculty of Management Studies and Research,
Aligarh Muslim University,
Aligarh, India
Email: afaq061960@gmail.com

Abstract: International trade irrespective of its mode – exports and foreign direct investment (FDI) is a key enabler of national economic growth. Amongst the various theoretical explanations of international trade, gravity theory is one the most widely applied. According to gravity theory, modes of international trade, viz., exports and FDI are shown to be associated with GDP, comparable sizes of GDP, relatively similar factor endowments and are negatively affected by transportation cost. India has recently risen to the fifth position among the largest economies reflecting India's influence in shaping the future of international trade. The researchers have asked for more empirical research in the Indian context. This paper adds to existing studies on outward trade mode in four ways: firstly, it employs an augmented gravity model; secondly, it uses the most recent data; thirdly, it examines both external trade modes-exports and FDI; and fourthly, the dataset includes panel data for all 154 trading economies of the world that India has trade relations with. Results gives an in-depth analysis of gravity factors associated with Indian outwards trade and compares between the Indian's trade modes.

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Keywords: India; outward FDI; exports; emerging economies; EE; augmented gravity model; panel data.

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Biographical notes: Omdeep Gupta is a post-graduate in Marketing Management from Lucknow University and is UGC-NET qualified, has more than 22 years of experience including seven years' in industry. He has published 12 research papers in refereed journals and presented 15 research papers at national and international conferences. His research areas include internationalisation of emerging market firms, institution and international business, and marketing analytics. He is presently working as an Assistant Professor in School of Management, Graphic Era Hill University, Dehradun and research scholar at Aligarh Muslim University, Aligarh.

Krishna Chandra Balodi is an Associate Professor with the Strategic Management Area at IIM Lucknow. He pursued his Fellow Program in Management at Indian Institute of Management Indore before joining IIM Lucknow.

Mohd Afaq Khan is an Associate Professor in the Department of Business Administration, Faculty of Management Studies and Research, Aligarh Muslim University, Aligarh. He has been teaching international business, business law and ethics, international economics, and international business law. He has published more than 30 research papers in reputed/refereed journals and has been guiding PhD scholars, ten of whom have been awarded degrees. His areas of interest include emerging sectors like BPO/KPO, pharmaceuticals, textiles and garments, and floriculture.

1 Introduction

The performance of the world economy relies heavily on the growth of emerging markets (Arnold and Quelch 1998; Hoskisson et al. 2000; Khanna et al., 2005; Ramamurti and Singh, 2009). Even though emerging economies (EE) face a more volatile business environment, over the last two decades EE grew at an annual rate of 5.44% as against the overall global economic growth of 3.05% (Choi et al., 1999; UNCTAD, 2019; Yakubu et. al., 2020). Exports and foreign direct investment (FDI) are the two key enablers of economic growth of a country (Pfaffermayr, 1994; Rob and Vettas, 2003; Tekin, 2012; Girma and Maemir, 2022). Whereas export is an indicator of short term commitment of the actors to the international trade, the FDI represents the long term commitment. Global exports volumes have seen an overall growth of 26.62% from 2010–2014 and a growth of 16.5% from 2015–2019, the trend is positive with a cyclic movement (a reoccurring pattern) of seven years, showing a lower limit in the year 2016 (UNCTAD, 2019). During the years 2010–2019, developing economies exports grew at a rate of 37.06% as compared to developed economies exports that grew at 28%. The share of exports of developed economies and developing economies in the global exports for the period of 2015–2019 is around 55% and 41% respectively. Global Outward FDI flows, however,

show an uneven negative trend and have dipped by 24% for the period of 2010–2019, with the exception in the year 2015. Developing economies outward FDI had a positive growth of 4.50% against a decline of 7.24% of developed economies outward FDI for the period of 2010–2019.

While a lot of theories such as mercantilism (Blaug, 1997; Aizenman and Lee, 2007), absolute advantage (Smith, 1937); comparative advantage (Ricardo, 1887, 1955) factor endowment (Bertil, 1933; Jones, 1956) have been forwarded to explain the international trade (export and FDI), gravity theory is one the most widely applied (Isard, 1954; Anderson, 1979; Mátyás, 1997; Bergstrand, 1985; Anderson and Van Wincoop, 2003; Kolstad and Wiig, 2012). According to Gravity theory, modes of international trade, viz., exports and FDI are shown to be associated with GDP, comparable sizes of GDP, relatively similar factor endowments (Dixit and Stiglitz, 1977; Buckely and Casson, 1981; Helpman and Krugman, 1985; Helpman, 1987; Gopinath et al., 1999) and are negatively affected by transportation cost (Hummels and Levinsohn, 1995). EEs although heavily regulated are slowly reducing the constraints on private players (Kumar and McLeod, 1981). As these economies are experiencing fast institutional and economic transformation (Choi et al., 1999), it becomes interesting to study how well gravity theory continue to explain EE outward trade mode as more recent data becomes available.

While there are ample studies on the use of gravity (or augmented gravity) theory to understand either mode – exports or FDI in developed economies (Helpman and Krugman, 1985; Anderson and Van Wincoop,2003; Anderson, 2011; Kolstad and Wiig, 2012) or selected EE, viz., china (Gu, 2008; Liu, et al., 2016), MENA countries (Mina, 2012), Czech (Schäffler et al., 2017), Vietnam (Binh et al., 2011), the application of augmented gravity theory to understand India's outwards trade is somewhat limited (Batra, 2006; Kumar and Prabhakar, 2017; Asghar and Gupta, 2018; Lohani, 2020). Researchers have, however, pointed out that because of diverse institutional undercurrents, conclusions drawn for one country may not be equally applicable in another (Khanna and Rivkin, 2001; Gallon et al., 2021). To augment the empirical evidence on the application of gravity models based on developed economies (e.g., US, Europe, and Japan) and EE (e.g., China, MENA), the use of an Indian sample has been suggested (Lohani, 2020). Therefore, this paper analyses India's global outward trade (exports and FDI) flow using the augmented gravity model. We employ panel estimation techniques on the most recent seven years (2011–2017) global outward trade data to answer this research question. This paper complements the existing studies on Indian context on four important counts: first, it employs augmented gravity model including resource endowment, trade openness, international trade membership, and border adjacency; second, it employs most recent data; third, it analyses both external trade modes – exports and FDI; and fourth, our dataset includes all 154 economies of the world that India has trade relations with. This paper makes an important contribution by providing much sought empirical evidence of the behaviour and application of the augmented gravity model in the scantly studied Indian context using recent data.

2 Literature review

2.1 Gravity and augmented gravity models

The core idea of gravity model of trade is similar to Newton's (1687) universal law of gravitation postulating that the strength of inter-country trade is directly proportional to the countries' economic size (GDP) and inversely proportional to the bilateral distance (Isard, 1954; Poyhonen, 1963). Anderson (1979), Bergstrand (1985, 1990) and Helpman and Krugman (1985) made some early empirical contributions for developing and testing the gravity model. In addition, Mátyás (1997), Cheng and Wall (1999), Breuss and Egger (1999), Anderson and Wincoop (2003), Martinez-Zarzoso and Nowak-Lehmann (2003), Bellos and Subasat (2012), Bergstrand et al. (2013) and Kucera and Principi (2017), among others, added to the refinement of the explanatory variables, addition of new variables, and improving the econometric specification of the gravity equation. Drawing on the theoretical and empirical evolution of gravity model and following Kepaptsoglou et al. (2010), we use augmented gravity model incorporating GDP (origin and destination), GDP per capita (origin and destination), Geographical distance (flight distance between capital cities of countries) and share boundaries, Trade openness, Natural resource endowment (origin and destination), and multilateral trade associations/bodies membership to investigate India's outward international trade.

2.2 Economic prowess

A country's economic size and development is measured by its gross domestic product (GDP). Higher GDP represents higher output which could induce countries with excess cost-efficient production potential and capacities to look for international markets to sell their goods and services (Helpman and Krugman, 1985). GDP is used as an explanatory variable to study the impact of economic development on FDI across different regions and countries like Germany MNC's in Czech Republic (Schäffler et al., 2017), China and Africa (Johnston et al., 2015), Kenya and Malaysia (Kinuthia and Murshed, 2015). Following the comparative production and productivity logic of the new theory of economic growth (Romer, 1990), which highlights the role of endogenous technological as a growth engine for economic development, the traditional gravity model also predicts that countries with high levels of output will engage in more outward trade (Anderson and Van Wincoop, 2003; Anderson, 2011). Large economies also report a high demand (Crescenzi et al., 2021). For this reason, larger destination economies (as indicated by high GDPs) may also be more welcoming to the trade imports. Accordingly, we hypothesise that:

H1a The higher the GDP of the trading countries (home and destination), the higher is the quantum of trade (both exports and FDI).

Two trading countries with similar GDPs may, however, have different populations. This would mean a difference in their per capita economic endowment (Helpman, 1984; Bergstrand, 1985). A higher per capita GDP (GDPPC) or purchasing power in the destination economy would increase demand for high quality goods and services (Johnson, 1968) resulting in higher international trade. Similar theory put forth by Linder (1961) was that nations with comparable per capita incomes would have more in common in terms of preferences and products, leading to increased commerce between

them. Likewise, home countries with a higher GDPPC have high quality products which may be in demand with certain strata of countries with lower GDPPC. Such scenarios may prompt richer countries to supply high quality products to other countries and thus contribute positively to its outward trade. GDPPC is a commonly used proxy for the capital-endowment ratio of a country in the gravity model. (Ravishankar and Stack, 2014; Yu et al., 2014; Kahouli and Maktouf, 2015; Schäffler et al., 2017). Accordingly, we hypothesise that:

H1b The higher the GDP per capita of the trading countries (home and destination), the higher is the quantum of trade (both exports and FDI).

2.3 Geographic proximity

In the traditional gravity model, the distance between a pair of trading countries is negatively associated with the trade between those countries due to cost implications (Tinbergen, 1962; Poyhonen, 1963; Linneman, 1966; Anderson, 1979; Elmslie, 2018). Larger geographic distance is associated with increase in logistical challenges, delivery time, documentary requirements, regulatory compliances, transport costs, reducing the attractiveness of commercial cooperation (Brun et al., 2005), recent research, however, argue that due to advances in the transportation and communication technologies and increasing globalisation, the traditionally negative impact of geographic distance on international trade is declining (Cairncross, 2001; Wach, 2015). In accordance with the extant research, we hypothesise:

H2a The lesser the geographic distance of the trading countries (home and destination), the higher is the quantum of trade (both exports and FDI).

Sharing a common border between trading partner countries is said to aid business in establishing networks and partnerships (Shin and Serlenga, 2004), trade documentation formalities, logistical issues, and cultural adaptation (Felipe and Kumar 2010; Wach, 2015). Accordingly, we hypothesise:

H2b Having a common border between the trading countries (home and destination) increases the quantum of trade (both exports and FDI).

2.4 Trade openness

Some countries are more liberal in taking such policy measures that promote active and faster globalisation of their economies. Trade or market openness measured as trade values divided by GDP (export or import by GDP) of the nation allows researchers to capture the effect of such policy measures in economic globalisation. Research using augmented gravity models has investigated the role of trade openness in explaining international trade (Battese and Coelli, 1988; Chakrabarti, 2001; Anderson and Van Wincoop, 2003; Ekholm et al., 2007; Hye and Lau, 2015; Kinuthia and Murshed, 2015). Following this stream of research, we hypothesise that:

H3 Higher trade openness (export or import by GDP) of the trading countries (home and destination) increases the quantum of trade (both exports and FDI).

2.5 Natural resource endowment (destination/home: Heckshier-ohlin theory)

Factor-endowment theory the Heckscher-Ohlin model signifies the roles of heterogeneous factor endowments in motivating specialisation and trade. It suggests that intrinsic differences in endowments and encouraging initial conditions among countries explain the geographical pattern of international trade (Anderson, 2011; Antonucci and Manzocchi, 2006; Liu et al, 2016; Ly et al., 2018; Osinubi, 2020). This prompted researcher to augment the traditional gravity model to include natural resource endowments of the trading countries. Following this stream of research, we hypothesise that:

H4 Higher resource endowment of the trading countries (home and destination) increases the quantum of trade (both exports and FDI).

2.6 Membership in multilateral trade associations/ bodies

WTO and IMF are the world's most prominent bodies that aim at facilitating international trade among other things. The World Trade Organisation's (WTO) primary goals include enhancing standard of living, resolving disputes and easing trade tensions, lowering the cost of conducting business internationally, and promoting national development.

The WTO helps in global trade flow by providing countries with a forum for dealing with trade issues and disputes. Through various negotiation platforms, WTO could stimulate members' economic growth and employment. Membership in WTO has a significant influence on both tariff rates, quota regimes, and international trade openness (Yu et al., 2014). Research, however, has reported that WTO members, in general, keep one's tariff rates higher than otherwise which adversely affects the probability that a country will open its boundaries for trade (Milner and Kubota, 2005). Rose (2004) showed that being a WTO member does not always lead to increase in trade flows nor in reduced their trade barriers. Lissovolik and Lissovolik (2006), in the context of Russia, WTO membership tend to be negatively related with exports, thus Russia exported more to non-WTO countries as compared to WTO countries. This stream of scholars suggested that some countries reduce their barriers before they join WTO and those already a member are much less likely to become more open. Given the overall weaker trade position that developing countries like India may held against powerful economies, we argue that WTO membership should allow for favourable trade terms. Hence, we hypothesise that

H5 (a) The membership of trading countries (home and destination) in WTO increases the quantum of trade (both exports and FDI).

The primary objective of the IMF is to facilitate the expansion of balanced international trade growth and promote balance of payment related stability. Researchers note that IMF's support may increase other countries' confidence in the supported country and attract more trade and investment (Corsetti et al., 2006; Morris and Shin, 2006; Zwart, 2007). IMF's assistance to the beneficiary countries is mostly contingent upon the countries committing to trade and exchange liberalisation (Rose, 2005). Hence, it follows that:

H5 (b) The membership of trading countries (home and destination) in the IMF increases the quantum of trade (both exports and FDI).

3 Methodology

3.1 Context

3.1.1 India's outward trade

Post-independence Indian foreign trade was influenced by varying motives that can be segregated into three distinct phases namely, control policy during 1978–1992, privatisation policy during 1992–2003, and liberalisation policy, since 2003. Post-independence was an era of restrictive international trade policy and few incidents of overseas investment by Indian firms were seen in the early 1960s, that too mainly by family-owned business houses. In this first phase that is from 1978 to 1992, India's exports grew from US$ 8.6 Bn to US$ 25.48 Bn, growing at an average of US$ 1.20 Bn/year. India's second phase of growth journey or 'second wave' started in 1991, after adopting a major economic reform known as liberalisation, privatisation and globalisation (LPG) which was in contrast to the previous policy that discouraged overseas investment. In the second phase (1992–2003) exports from India grew from US$ 25.48 Bn to US$ 90.83 Bn, growing at an average of US$ 5.94 Bn/year. In the third or liberal policy era, there was a rapid increase in India's foreign trade. Kumar (2007) referred to the increased OFDI as the 'coming of age' of Indian firms in the international arena. In terms of net growth India's exports grew 252.99%, from US$ 154.58 Bn in 2005 to 545.69 Bn in 2019, similarly, India's OFDI grew by 305.43% from 2005 to 2019. India's share in world export increased from 1.20% in 2005 to 2.21% in 2019, and from 0.35% in 2005 to 1.16% in 2018 for OFDI. The following sections provide an in-depth analysis of recent trends in Indian exports and outward FDI.

3.1.2 India's exports

India's total exports increased from US$253 billion in 2007 to US$375 billion in 2010 and crossed US$ 500 billion for the first time in 2018. India's share of the world export is, however, low when compared with other EE at only 2.21% in 2019. Indian export's growth rate is high when compared with world exports. India's exports grew by 252.99% from 2005 to 2019 which is significantly higher compared to world exports, which grew at 92.28% in the same time period. Since 2015-16, the USA, UAE, China PRP, Hong Kong, and Singapore have consistently been the top five destinations for Indian exports accounting for 16.94%, 9.21%, 5.30%, 3.50%, and 2.85% of overall India exports in 2019 respectively. UK, Netherlands, Germany, Bangladesh, and Saudi Arabia are the next five top destinations for Indian exports. In terms of commodities exported during 2015–2016 to 2019–2020 mineral fuels, mineral oils, bituminous substances, and mineral waxes; natural or cultured pearls, precious or semiprecious stones, and artificial jewe lry; boilers, machinery and mechanical appliances; organic chemicals; automobiles and their spares; and pharmaceutical products are the top six exported commodities accounting for 13.63%, 11.52%, 6.65%, 5.58%, 5.33%, and 5.2% of overall Indian exports in 2019 respectively. Among the above six commodities, only the proportion of exports of natural

or cultured pearls, precious or semiprecious stones, and artificial jewelry and Automobiles and their spares has decreased during this period.

3.1.3 India's OFDI

OFDI from India shows a more volatile pattern as compared to its exports. India's OFDI, until 2000's, was mainly through greenfield investments (Boellis et al., 2016) and was US$ 514.45 million in 2000. In the following eight years, India's OFDI showed an impressive upward trend, growing from US$ 1.39 billion in the year 2001 to US$ 21.14 billion in 2008, the highest OFDI in a year till date. There was a sharp negative trend in India's OFDI from 2008 to 2013 reaching US$ 1.67 billion in 2013 which was almost the same as 2002. India's OFDI in the year 2019 was US$ 12.10 billion, which was 0.92% of world OFDI. Since 2015-16, Singapore, USA, Mauritius and Netherlands have been the most preferred destinations for India's OFDI, followed by UAE, Switzerland, Russia and British Virgin Islands. Two countries, UAE and UK, are worth noting as they show an inverse trend. OFDI to UAE in 2015-16 was US$ 1.75 billion which stood at US$ 430 million in 2019–2020. Similarly, OFDI to the UK was US$ 642.13 million in 2015–2016 which increased to US$ 1.30 billion in 2019. Industry-level trend analysis of India's OFDI also reveals an interesting pattern. Prior to 2005, the manufacturing sector, viz., pharmaceuticals, chemicals, textiles, automotive components, engineering goods, and paper and pulp, accounted for more than 80% of OFDI (Lall, 1982; Wells,1983). From 2005, the manufacturing sector started losing its sheen and the service sector comprising banking and financial services, transport, insurance, hospitality and real estate, construction, telecom and communication, and IT and ITES, started to drive India's OFDI. In 2019 the service sector accounted for 48.55% of India's OFDI.

3.2 Data and variables

The analysis of India's OFDI was based on the monthly data published by Reverse Bank of India, which is the central bank in India, and the analysis of India's export was based on the data provided by the UNCTAD stat. The panel data from the years 2011–2017 is used on this study. Sources and description of other variables are detailed in Table 1.

3.3 Descriptive statistics

Table 2 shows the descriptive statistics of all the variables during the observed period. The analysis was first performed on the complete dataset of 134 destination countries for OFDI and 132 destination countries for exports. Time period for panel data is 7 years (T = 7), i.e., from 2011 till 2017. To avoid bias, the rows with missing values were removed resulting in 695 and 908 data points for analysis for OFDI and exports respectively. Due to missing data, the panel is unbalanced, which is a common phenomenon of international trade studies. The descriptive statistics and pairwise correlation are reported in Table 2.

Table 1 Variables: description, source, and metric

Type of variable	*Indicator*	*Variable*	*Description*	*Unit*	*Data source*
Dependent variables		$LOFDI_{Idt}$	Value of FDI flows from India to the destination country (j) in t^{th} year	Millions of US	RBI (Authors compilation)
		$LEXP_{Idt}$	Value of Total Exports from India to destination country (j) in t^{th} year	Millions of US$	UNCTADstat
Independent variables	Economic prowess	$LGDP_{It}$	Log of GDP of India in t^{th} year	Millions of US$	UNCTADstat
		LGDPdt	Log of GDP of destination country in t^{th} year	Millions of US$	UNCTADstat
		LGDPPCIt	Log of GDP per capita of India in t^{th} year	US$	UNCTADstat
		$LGDPPC_{dt}$	Log of GDP per capita of destination country in t^{th} year	US$	UNCTADstat
	Geographical proximity	$LDIST_{Id}$	Log of geographical distance between New Delhi (capital city) of India and destination country capital city	K.M.	European commission's distance calculator
		$Adjacent_{Id}$	Shared international boundaries between India and destination country	dummy (0, 1)	European commission's distance calculator
	Trade openness	$IMPGDP_{dt}$	Ratio of import to GDP of the destination country in t^{th} year	Ratio	UNCTADstat
		$EXPGDP_{dt}$	Ratio of export to GDP of the destination country in t^{th} year	Ratio	UNCTADstat
		$IMPGDP_{It}$	Ratio of import to GDP of India in t^{th} year	Ratio	UNCTADstat
		$EXPGDP_{It}$	Ratio of export to GDP of India in t^{th} year	Ratio	UNCTADstat
	Natural resource endowment	NRE_{dt}	Natural resource endowment of the destination country in t^{th} year	Millions of US$	UNCTADstat
		NRE_{It}	Natural resource endowment of India in t^{th} year	Millions of US$	UNCTADstat
	Multilateral trade associations membership	WTO_{dt}	WTO membership of the destination country in t^{th} year	dummy (0, 1)	WTO dataset
		IMF_{dt}	IMF membership of the destination country in t^{th} year	dummy (0, 1)	IMF dataset
		Develop_St $\sim_s$	Development status of destination country in t^{th} year As per Annexure A	dummy (0, 1, 2)	UNCTADstat

Source: Author's compilation

Table 2 Descriptive statistics and pairwise correlation

	Obs.	*Mean*	*Std. dev.*	*LOFDI*	*LEXP*	*LDIST*	*NRED*	*NREI*	*WTO_D*	*IMF_D*	*Adjacent_*	*LGDPI*	*LGDPD*	*LGDPPCI*	*LGDPPCD*	*IMPGDPID*	*EXPGDPI*	*IMPGDPD*
LOFDI	734	1.52131	3.332991	1														
LEXP	956	12.21468	2.10751	0.3986*	1													
LDIST	987	8.749504	0.6114129	–0.0716	–0.2873*	1												
NRED	942	7.83863	10.72064	–0.1025*	–0.0799*	–0.0754*	1											
NREI	987	3.441738	1.229769	–0.0149	–0.0869*	0.0000	0.1233*	1										
WTO_D	987	0.8216819	0.3829744	0.1311*	0.3265*	0.1140*	–0.1380*	–0.0439	1									
IMF_D	987	0.9574468	0.2019498	–0.1677*	0.2119*	–0.0997*	0.0795*	0.0000	0.3608*	1								
Adjacent_D	987	0.0425532	0.2019498	0.0234	0.1591*	–0.4731*	–0.1019*	–0.0000	–0.0854*	0.0444	1							
LGDPI	987	12.28566	0.0429296	0.0209	0.0948*	0.0000	–0.1005*	–0.8933*	0.0413	–0.0000	0.0000	1						
LGDPD	947	10.80764	0.901753	0.4883*	0.7496*	0.0132	–0.1801*	–0.0172	0.2437*	–0.0020	–0.0033	0.0201	1					
LGDPPCI	987	3.179216	0.0327896	0.0188	0.0912*	–0.0000	–0.0970*	–0.8639*	0.0401	–0.0000	0.0000	0.9970*	0.0191	1				
LGDPPCD	954	3.799548	0.6677617	0.4141*	0.2512*	0.1277*	–0.2221*	0.0031	0.0894*	–0.1476*	–0.2093*	0.0006	0.5888*	–0.0003	1			
IMPGDPI	987	26.70932	3.718795	0.0093	–0.0475	–0.0000	0.1267*	0.8773*	–0.0391	0.0000	–0.0000	–0.7734*	–0.0033	–0.7606*	0.0182	1		
EXPGDPI	987	22.74335	2.205275	0.0204	–0.0237	0.0000	0.1167*	0.7657*	–0.0328	–0.0000	0.0000	–0.7090*	0.0042	–0.7162*	0.0253	0.9278*	1	
IMPGDPD	943	49.25044	29.62086	0.0893*	–0.1555*	–0.1155*	–0.1218*	0.0136	–0.0218	–0.3372*	–0.1079*	–0.0101	–0.2829*	–0.0109	0.1409*	0.0324	0.0368	1
EXPGDPD	943	45.06957	33.14546	0.2299*	–0.0070	–0.1301*	–0.0722*	0.0371	0.0635	–0.3414*	–0.1746*	–0.0315	–0.0044	–0.0315	0.4513*	0.0511	0.050	0.8642*

Note: NB: *= correlation significant at 0.05 %.

Source: Author's compilation

Table 3 Stata output for DV: OFDI

DV = LFDI	*All countries*			*Group 0 (Developed countries)*			*Group 1 (Developing countries)*			*Group 2 (Under-developed countries)*		
Column no.	*1*			*2*			*3*			*4*		
Variable	*Random effect method*			*Fixed effect model*			*Random effect method*			*Random effect method*		
Develop_St~s	*Coeff*	*S.E.*	*t*	*Coeff*	*S.E.*	*t*	*Coeff*	*S.E.*	*t*	*Coeff*	*S.E.*	*t*
1	1.531**	0.692	2.21									
2	1.804	1.195	1.51									
LGDPD	1.669***	0.409	4.08	5.8	11.828	0.49	1.353***	0.478	2.83	2.627***	0.878	2.99
LGDPPCD	1.511**	0.642	2.35	–11.719	13.291	–0.88	0.985	0.873	1.13	–0.949	1.09	–0.87
LGDPI	0.083	2.469	0.03	–65.344	93.292	–0.7	–0.756	3.658	–0.21	–8.345	5.323	–1.57
LGDPPCI	–5.599	8.993	–0.62	59.302	108.124	0.55	–1.625	13.559	–0.12	24.306	19.973	1.22
LDIST	–0.664	0.404	–1.64	(omitted)			–1.144**	0.46	–2.49	–0.396	0.918	–0.43
Adjacent_D	0.951	0.83	1.14	(omitted)			–0.586	0.953	–0.62	2.059	1.587	1.3
IMPGDPD	0.022	0.016	1.41	0.101**	0.04	2.54	0.02	0.018	1.1	0.023	0.027	0.85
EXPGDPD	–0.009	0.015	–0.57	–0.116**	0.044	–2.66	0.011	0.018	0.6	0.009	0.032	0.28
IMPGDPI	–0.303	0.285	–1.06	–0.126	0.096	–1.32	–0.639	0.437	–1.46	0.006	0.636	0.01
EXPGDP	0.346	0.261	1.33	0.376**	0.16	2.35	0.734*	0.39	1.88	0.022	0.615	0.04
NRED	0.012	0.018	0.67	0.098	0.281	0.35	–0.005	0.021	–0.26	0.036	0.036	1.02
NREI	–0.082	0.242	–0.34	–1.042	0.639	–1.63	0.083	0.363	0.23	0.228	0.584	0.39
WTO_D	1.247*	0.742	1.68	0.081	0.654	0.12	2.553**	1.167	2.19	0.635	0.78	0.81
IMF_D	–3.411	2.992	–1.14	(omitted)			3.199***	1.15	2.78	(omitted)		
N	695			230			310			155		
N_g	134			41			61			32		
sigma_u	2.479			7.345			2.431			1.778		
r2_o	0.361			0.003			0.368			0.312		
rho	0.736			0.964			0.747			0.543		

Note: legend: * p < 0.1; ** p < 0.05; *** p < 0.01.

Source: Author's compilation

Table 4 Stata output for DV: exports

DV = LEXP	*All countries*			*Group 0 (Developed countries)*			*Group 1 (Developing countries)*			*Group 2 (Under–developed countries)*		
Column no.	*1*			*2*			*3*			*4*		
Variable	*Random effect method*			*Random effect method*			*Random effect method*			*Random effect method*		
Develop_St~s	*Coeff.*	*S.E.*	*t*	*Coeff.*	*S.E.*	*t*	*Coeff.*	*S.E.*	*t*	*Coeff.*	*S.E.*	*t*
1	0.828***	0.197	4.20									
2	1.355***	0.369	3.67									
LGDPD	2.231***	0.116	19.29	2.570***	0.189	13.59	2.177***	0.146	14.92	2.041***	0.414	4.93
LGDPPCD	–0.332	0.207	–1.60	–0.833***	0.285	–2.92	0.082	0.426	0.19	–1.039**	0.484	–2.15
LGDPI	–0.902	0.876	–1.03	–1.904***	0.676	–2.82	–0.462	1.837	–0.25	–2.108**	0.839	–2.51
LGDPPCI	0.777	3.110	0.25	2.734	1.667	1.64	–0.389	6.83	–0.06	4.031**	1.792	2.25
LDIST	–0.513**	0.199	–2.57	0.007	0.43	0.02	–0.747***	0.196	–3.82	0.589	0.411	1.43
Adjacent_D	0.297	0.587	0.51	(omitted)			–1.520***	0.301	–5.05	2.297***	0.804	2.86
IMPGDPD	0.017***	0.004	4.42	0.022	0.016	1.41	0.017***	0.005	3.13	0.010***	0.003	3.31
EXPGDPD	–0.005	0.004	–1.16	–0.009	0.009	–0.94	–0.004	0.007	–0.65	0	0.007	0.04
IMPGDPI	–0.100***	0.035	–2.85	–0.129**	0.051	–2.5	–0.067	0.068	–1	–0.091	0.056	–1.63
EXPGDPI	0.159***	0.032	4.96	0.166***	0.052	3.15	0.125**	0.059	2.11	0.216***	0.05	4.29
NRED	0.012**	0.005	2.16	–0.043**	0.019	–2.28	0.004	0.007	0.48	0.006	0.009	0.65
NREI	–0.182***	0.062	–2.93	–0.097**	0.047	–2.08	–0.176	0.135	–1.3	–0.310***	0.058	–5.31
WTO_D	0.207	0.132	1.57	0.105	0.173	0.61	0.488**	0.223	2.19	–0.056	0.344	–0.16
IMF_D	0.474	0.665	0.71	0.768*	0.448	1.71	0.427	0.462	0.92	(omitted)		
N	908			281			418			209		
N_g	132			41			61			30		
sigma_u	0.99			0.817			0.916			1.002		
r2_o	0.724			0.796			0.786			0.6		
rho	0.854			0.919			0.74			0.951		

Note: legend: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Source: Author's compilation

3.4 Model and estimation

The study assumes the equation (1), i.e., log linearised form of the gravity model to evaluate India's OFDI and equation (2), i.e., log linearised form of the gravity model for Exports.

$$\begin{aligned} LOFDI_{Idt} = {} & \alpha_0 + \alpha_1 LDIST_{Id} + \alpha_2 NREd_{t-1} + \alpha_3 NREI_{t-1} \\ & + \alpha_4 WTO_{dt} + \alpha_5 IMF_{dt} + \alpha_6 Adjacent_{Id} + \alpha_7 LGDP_{It-1} \\ & + \alpha_8 LGDP_{dt-1} + \alpha_9 LGDPPC_{It-1} + \alpha_{10} LGDPPC_{dt-1} \\ & + \alpha_{11} IMPGDP_{It-1} + \alpha_{12} EXPGDP_{It-1} + \alpha_{13} IMPGDP_{dt-1} \\ & + \alpha_{14} EXPGDP_{dt-1} + \alpha_{15} Develop_S_{tdt} + \lambda OFD_{It} + \varepsilon OFD_{I\,Idt} \end{aligned} \quad (1)$$

$$\begin{aligned} LEXP_{Idt} = {} & \beta_0 + \beta_1 LDIST_{Id} + \beta_2 NRE_{dt-1} + \beta_3 NRE_{It-1} \\ & + \beta_4 WTO_{dt} + \beta_5 IMF_{dt} + \beta_6 Adjacent_{Id} + \beta_7 LGDP_{It-1} \\ & + \beta_8 LGDP_{dt-1} + \beta_9 LGDPPC_{It-1} + \beta_{10} LGDPPC_{dt-1} \\ & + \beta_{11} IMPGDP_{It-1} + \beta_{12} EXPGDP_{It-1} + \beta_{13} IMPGDP_{dt-1} \\ & + \beta_{14} EXPGDP_{dt-1} + \beta_{15} Develop_S_{tdt} + \lambda EXP_t + \varepsilon EXP_{Idt} \end{aligned} \quad (2)$$

The acronyms used in the above algebraic equations are summarised in the Table 2. Suffix I denotes India, d denotes destination, and t denotes time. λ_t denotes the time effects and ε_{Idt} denotes the error term. The majority of the empirical augmented gravity model studies rely on panel data and either of the, fixed-effect model (FEM) or a random-effect model (REM), or a pooled ordinary least squares model (OLS). To identify the best estimation technique, tests for assumptions of autocorrelation, heteroscedasticity, and cross-sectional dependence were performed on panel data using STATA version 14.2 software.

The Wooldridge test for serial autocorrelation was conducted. The result rejected the null hypothesis, reflecting the presence of first-order autocorrelation. The result of the Modified Wald test for group-wise heteroskedasticity rejected the null hypothesis, reflecting the presence of group-wise heteroscedasticity. The Breusch-Pagan LM test for cross-sectional correlation and Pesaran CD (cross-sectional dependence) test for contemporaneous correlation could not be completed due to the lack of enough common observations across panels. To choose between FEM and REM estimation techniques for the overall sample, the Hausman Test was conducted. The result rejected the null hypothesis, suggesting REM for both the dependent variables.

3.4.1 OFDI results

The results are shown in Table 3, column no 1 for OFDI. Destination country's WTO membership, log of destination country GDP and log of destination country GDP per capita are positively associated with Indian OFDI. To test the robustness of our results, we divided the overall sample into three sub samples based on the development status of the destination country. For the sub-group (labelled group 0 in column no 2, Table 3) capturing India's foreign trade with developed economies, India's export to GDP ratio and destination countries import to GDP ratio are positively and destination countries export to GDP ratio is negatively associated with OFDI. For the second sub-group (labelled group 1 in column no 3, Table 3) capturing India's foreign trade with

developing economies, IMF and WTO memberships of destination countries, log of destination country GDP and India's export to GDP ratio are positively and log of geographic distance is negatively associated with OFDI. Third and last sub-group (labelled group 2 in column no 4, Table 3) capturing India's foreign trade with under-developed, log of destination country GDP is positively associated with Indian OFDI.

3.4.2 Exports results

The results are shown in Table 4, column no 1 for exports. Destination country's natural resource endowment, log of destination country GDP, Indian exports to GDP ratio of India, destination country's import to GDP ratio are positive and log of distance, India's natural resource endowment, India's import to GDP ratio are negatively associated with exports. For the sub-group (labelled group 0 in column no 2, Table 4) capturing India's foreign trade with developed economies, destination country's IMF membership, log of destination country GDP and Indian export to GDP ratio are positively and destination country natural resource endowment, Indian natural resource endowment, log of India's GDP, log destination country GDP per capita, and India's import to GDP ratio are negatively associated with exports. For the second sub-group (labelled group 1 in column no 3, Table 4) capturing India's foreign trade with developing economies, log of destination country GDP, India's exports to GDP ratio, destination country's import to GDP ratio are positively and log of geographic distance, common international borders (Adjacent_D) are negatively associated with exports. Third and last sub-group (labelled group 2 in column no 4, Table 4) capturing India's foreign trade with under-developed, common international borders (Adjacent_D), log of destination country GDP, log of India's GDP per capita ratio, India's exports to GDP ratio, destination country's exports to GDP ratio are positively and India's natural resource endowment, log of India's GDP, log of destination country's GDP per capita and India's import to GDP ratio are negatively associated with exports.

4 Analysis and discussion

The following table (Table 5) summarises the results for hypothesis.

The results show a positive association between high economic prowess of destination countries and both the Indian foreign trade modes – FDI and exports. This is in line with previous studies of Kandogan (2016), Ly et al. (2018) and Paniagua et al. (2015) on FDI and Johnston et al. (2015), Lohani (2020), Völgyi and Lukács (2021) and Shukla (2022) on exports who also found that with an increase in a country's economic size, it becomes a favourable international trade destination. This supports the argument that a growth in the economic size of a country enhances its capacity of consumption, increasing the demand for goods, services, and technological and financial capital. This makes such a country a fertile ground for foreign countries to launch their both short term (export) and long term (FDI) international trade operations. As per our results, an increase in India's economic prowess is not statistically associated with its OFDI and export. This is in line with previous studies by Johnston et al. (2015) who found that for predominantly factor driven economies, an increase in a country's economic size is not statistically associated with its either foreign trade modes. India being a predominantly

factor economy is unlikely to be a world-level hub of high quality finished goods or inexpensive capital or rare technology. It is, therefore, not surprising that at the global level India's foreign trade modes are not statistically associated with its economic size.

Table 5 Results for hypothesis

				DV: OFDI	DV: LEXP
Construct	Variable	Hypothesis	Expected sign	Result	Result
Economic prowess	$LGDP_d$	H1a	+	Positive	Positive
	$LGDPPC_d$	H1b	+	Positive	Not significant
	$LGDP_I$	H1a	+	Not significant	Not significant
	$LGDPPC_I$	H1b	+	Not significant	Not significant
Geographical proximity	$LDISTI_d$	H2a	-	Not significant	Negative
	$Adjacent_{Id}$	H2b	+	Not significant	Not significant
Trade openness	$IMPGDP_d$	H3	+	Not significant	Positive
	$EXPGDP_d$	H3	+	Not significant	Not significant
	$IMPGDP_I$	H3	+	Not significant	Positive
	$EXPGDP_I$	H3	+	Not significant	Positive
Natural resource endowment	NRE_d	H4	+	Not significant	Positive
	NRE_I	H4	+	Not significant	Negative
Multilateral trade associations membership	WTO_d	H5a	+	Positive	Not significant
	IMF_d	H5b	+	Not significant	Not significant

In the present study, geographical distance and shared boundaries are statistically insignificant for India's overall OFDI, contradicting the results of Paniagua et al. (2015), Kandogan, 2016 and Ly et al. (2018). India's OFDI in the first phase of internationalisation (1978–1992) was mainly focussed in the developing countries or with countries in geographical proximity. During the second phase (1993–2003), India's OFDI shifted to developed and developing countries (Joseph, 2019). During recent times, the post-second phase, the OFDI objective is predominantly market seeking and resources seeking (Asghar and Gupta, 2018) through long term commitment. This is facilitated by advancements in technology, especially in transportation and telecommunications that make geographical distances insignificant. For India's exports, the short-term business intervention, the analysis supports the arguments put forth by gravity theory of negative association of exports with geographic distance.

In our study, inward trade openness of the destination country has a positive influence on Indian exports for the overall sample and Indian FDI for the sub group of developed nations (Pradhan and Husain, 2020). Likewise, Indian outward trade openness has a positive influence on Indian exports for the overall sample and Indian FDI for the sub group of developed and developing nations. This is in line with the results of Anderson and Van Wincoop (2003), Ekholm et al. (2007), Hye and Lau (2015), Kinuthia and Murshed (2015) and Asghar and Gupta (2018), and who reported a positive role of trade openness of the home and the host countries in international trade. Our results suggest that natural resource endowments or factors of production of India and the destination nations are not statistically associated with Indian OFDI. This is in line with the argument

given by Porter (1990: comparative advantage) that because of the advancement of economies, increasing technological sophistication among industries, and the convergence among the quality of life standards across nations, it is the advanced and specialised factors of production that may matter more instead of generalised or natural resource endowments for competitive advantage of a nation's companies. Porter (1990) suggests that a nation will preferably export the goods that make use of its available natural resource endowments. This view, however, assumes the favourable exploitation conditions for natural resources and governance quality, relative prices of natural to manufactured products, trade and tariff protection policies, and human capital development investment, etc. Therefore, a country's handling of its natural resources may be more important than its mere availability (Redmond and Nasir, 2020).

WTO membership reflects a nation's acceptance of the importance of global-trade and commitment towards and adoption of fair and transparent international trade rules and policies. IMF membership of a nation is an indicator of a commitment towards and adoption of fair and transparent foreign exchange rate mechanisms, international financial regulations, balance of payment management techniques, and a source of grants and relief for financial stress management. Consistent with these ideas and in agreement with the past studies, our research also finds that Indian OFDI is positively associated with the WTO membership of the destination country and IMF membership of developing destination countries. Given the short term and intermittent nature of exports, Indian exports are not much associated with WTO and IMF memberships of destination nations. Geo-political conflicts (Jhunior et. al., 2022) and de-globalisation (James, 2018; Witt, 2019). In international trade are emerging challenges in front of WTO, IMF and other apex organisations.

5 Policy and managerial implications

Our study has important implications for policy makers. To promote international trade, it is advisable to have aggressively pursue existing regional trade associations like SAARC, ASEAN, and enter into more multilateral and regional membership agreements, and have friendly and pro international-trade relationships with economically and natural-resource rich nations, and nations which are relatively open and have welcoming international trade policies at the same time international relations with major world economies (as represented by GDP), should also be strengthened as economic prowess of the host country has a positive on India's bilateral trade.

India shares its boundaries with seven countries and its international trade is not dependent on geographical proximity, and is also not significantly related with its adjacent countries, the main reasons could be strained relations with Pakistan and China's aggressive policies, this is a major policy paradox for India.

Indian firms are also in the strategic leadership position in many industries across different geographies. Indian firma are dominating not only in service sector like software, IT and ITES, financial services but also in research oriented sectors like pharma. The rate of international mergers and acquisition involving Indian firms has also increased and is no longer limited to developing or underdeveloped nations, in fact Indian firms have acquired more firms from developed nations than developing nations.

6 Conclusions and limitations

Our research set out to explore the application of augmented gravity models in explaining the various internationalisation modes, viz., exports and FDI. Using Indian outward trade data for 154 countries, all economies of the world that India has trade relations with, for 2011-2017-time period, the panel data analysis revealed that OFDI is positively associated with the destination country's multilateral body (WTO) membership, and economic prowess of the destination country (GDP and GDP per capita). Indian exports are positively associated with destination country's natural resource endowment, economic prowess of destination country (GDP), inward trade openness of destination country and India's outward trade openness, and negatively associated with geographical proximity, India's natural resource endowment, and India's inward trade openness.

Some of the limitations of our study include, using only one emerging country's outward FDI and exports data. This, however, helps us against country specific fixed effects (e.g., famine, coup, or unrest, etc.). The time period of the study is limited due to non-availability of data before 2011 for Indian Outward FDI. To overcome this limitation, authors have used the most recent period, this also helps against year specific fixed effects. To overcome above noted limitations, it is suggested that future studies should include outward data from more countries, for a broader time period. Further it is suggested to include more industry specific augmented gravity variables such as advanced factors of production, viz., telecom and internet, try alternative operationalisation of constructs such as trade openness, inclusion of destination characterisation as tax havens, and macro-economic variables such as currency exchange rates, international trade financing, most favoured nation status, political orientations, colonial past, and cultural and language similarities, etc. This paper employed an augmented gravity model to analyse external trade modes using the global outward trade data with all 154 economies of the world that India has trade relations with. Broadly consistent with the core gravity model determinants, viz., economic prowess and geographic distance are statistically associated with India's outward trade mode.

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Appendix A

List of countries considered in the present study

Developed nations	*Developing nations*	*Under developed nations*
Australia; Austria; Belarus; Belgium; Bermuda; Bolivia; Bulgaria; Canada; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Gibraltar; Greece; Hong Kong; Hungary; Ireland; Israel; Italy; Japan; Lithuania; Luxembourg; Malta; Netherlands; New Zealand; Norway; Poland; Portugal; Republic Of Serbia; Romania; Russia; Singapore; Slovakia; Slovenia; South Korea; Spain; Sweden; Switzerland; Taiwan; Ukraine; UK; USA	Algeria; Argentina; Azerbaijan; Bahamas; Bahrain; Barbados; Belize; Botswana; Brazil; British Virgin Islands; Brunei; Cameroon; Cayman Island; Chile; China; Colombia; Costa Rica; Dominican; Republic; Ecuador; Egypt; Fiji; Gabon; Ghana; Guatemala; Guyana; Honduras; Indonesia; Jordan; Kazakhstan; Kenya; Kuwait; Libya; Malaysia; Maldives; Marshall Island; Mauritius; Mexico; Mongolia; Morocco; Namibia; Nigeria; Oman; Panama; Paraguay; Peru; Philippines; Qatar; Republic Of Macedonia; Saudi Arabia; Seychelles; South Africa; Sri Lanka; Tajikistan; Thailand; Trinidad And Tobago; Tunisia; Turkey; United Arab Emirates; Uruguay; Uzbekistan; Venezuela; Vietnam; Zimbabwe	Afghanistan; Bangladesh; Benin; Bhutan; Burkina Faso; Cambodia; Central African Republic; Chad; Ethiopia; Gambia; Georgia; Guinea Republic; Kyrgyz Republic; Laos; Liberia; Malawi; Mali; Mauritania; Mozambique; Myanmar; Nepal; Niger; Republic Of Madagascar; Rwanda; Senegal; Sierra Leone; Sudan; Tanzania; Togo; Uganda; Yemen; Zambia