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The Determinants and Potentials of India's Textiles Exports: A Gravity Model Approach

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ABSTRACT

Textiles industry contributes 12.2 percent to India's total global exports. To devise an appropriate trade policy concerning textiles and to improve the trade balance position of India, reliable estimation of determinants of textiles export flows is essential. This paper attempts to estimate the export potential of Indian textiles in two aggregate products, fiber (SITC 26) and yarn and fabrics (SITC 65) using the Gravity model. A panel regression model is analyzed for a time span of 1988 to 2017. An augmented gravity model is utilised to examine India's textile export flows by employing a random effects model. Further, the study employed the PPML estimator for the robustness of the results. The estimation results reveal that the gravity equation fits the data well and yields convincing elasticities of income, distance and cultural, historical, and geographical attributes. The GDP of both India and her trading partners, population of India and importing country and real exchange rate (proxy for prices) are significant determinants of export of Indian textiles. The study also finds that India has the highest untapped export potential with Japan, Canada, Pakistan, France, Australia, Spain and Korea in case of SITC 65. In case of SITC 26 India has the potential to export with France, Japan, Spain, Egypt, Nepal, Iran, and Germany and has transcended its export potential with the rest of the countries. The study concludes with some policy recommendations for escalating the exports of Indian textiles and to realize untapped potentials.

ملخص

يساهم قطاع المنسوجات بنسبة 12.2% من إجمالي صادرات الهند نحو العالم. ولصياغة سياسة تجارية مناسبة بخصوص المنسوجات وتحسين وضع الميزان التجاري للهند، من الضروري التقدير الموثوق للعوامل الحاسمة في صادرات المنسوجات. وتجسد هذه الدراسة محاولة لتقدير إمكانات تصدير المنسوجات الهندية في منتجين إجماليين، الألياف (SITC 26) والغزل والأقمشة (SITC 65) باستخدام نموذج الجاذبية. وتم تحليل نموذج انحدار جدولي للفترة الزمنية الممتدة بين 1988 إلى 2017. واستخدم نموذج الجاذبية المعززة لدراسة تدفقات صادرات

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المنسوجات الهندية من خلال استخدام نموذج الآثار العشوائية. كما وظفت الدراسة نموذج التقييم PPML من أجل نتائج أكثر دقة. وتشير نتائج التقدير أن معادلة الجاذبية تناسب البيانات بشكل جيد وتنتج مرونة مقنعة للدخل والمسافة والسمات الثقافية والتاريخية والجغرافية. كما أن الناتج المحلي الإجمالي لكل من الهند وشركائها التجاريين، وسكان الهند والبلد المستورد وسعر الصرف الحقيقي (بديل للأسعار) من العناصر الهامة المحددة لتصدير المنسوجات الهندية. وتوصلت الدراسة أيضا إلى أن الهند تتمتع بأكبر إمكانات التصدير غير المستغلة إلى جانب اليابان وكندا وباكستان وفرنسا وأستراليا وإسبانيا وكوريا في حالة التصنيف الدولي الموحد للتجارة (SITC 65وفي حالة التصنيف الدولي الموحد للتجارة (SITC 26)، تتمتع الهند بإمكانية التصدير مع فرنسا واليابان وإسبانيا ومصر ونيبال وإيران وألمانيا، وقد تجاوزت إمكاناتها التصديرية مع بقية البلدان. وتختم الدراسة ببعض التوصيات المتعلقة بالسياسات للنهوض بمستوى صادرات المنسوجات الهندية واستكشاف الإمكانات غير المستغلة.

ABSTRAITE

L'industrie textile représente 12,2 % des exportations totales de l'Inde. Pour élaborer une politique commerciale appropriée concernant les textiles et améliorer la position de la balance commerciale de l'Inde, il est essentiel de disposer d'une estimation fiable des déterminants des flux d'exportation de textiles. Ce document tente d'estimer le potentiel d'exportation des textiles indiens dans deux produits agrégés, la fibre (CTCI 26) et le fil et les tissus (CTCI 65), en utilisant le modèle de gravité. Un modèle de régression en panel est analysé pour une période allant de 1988 à 2017. Un modèle de gravité augmenté est utilisé pour examiner les flux d'exportations textiles de l'Inde en utilisant un modèle à effets aléatoires. En outre, l'étude a utilisé l'estimateur PPML pour la robustesse des résultats. Les résultats de l'estimation révèlent que l'équation de gravité s'adapte bien aux données et produit des élasticités convaincantes du revenu, de la distance et des attributs culturels, historiques et géographiques. Le PIB de l'Inde et de ses partenaires commerciaux, la population de l'Inde et du pays importateur et le taux de change réel (approximation des prix) sont des déterminants significatifs des exportations de textiles indiens. L'étude montre également que l'Inde possède le plus grand potentiel d'exportation inexploité avec le Japon, le Canada, le Pakistan, la France, l'Australie, l'Espagne et la Corée dans le cas de la CTCI 65. Dans le cas de la CTCI 26, l'Inde a le potentiel d'exporter avec la France, le Japon, l'Espagne, l'Égypte, le Népal, l'Iran et l'Allemagne et a dépassé son potentiel d'exportation avec le reste des pays. L'étude se termine par quelques recommandations politiques visant à accroître les exportations de textiles indiens et à exploiter les potentiels inexploités.

Key words: India; Gravity Model; Panel estimation; Trade Potential, PPML Estimator.

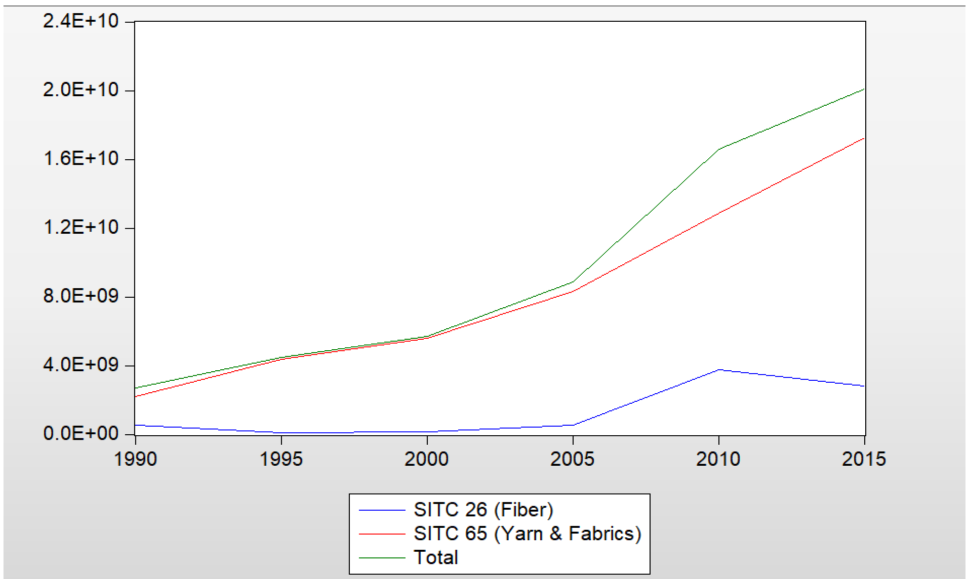
JEL Classification: F10, F17, C23

1. Introduction

International trade is one of the prime determinants of economic growth for most of the economies (Krugman and Obstfeld, 2002; Helpman, 2011). The foreign earnings from the exports are conducive to improve trade balance position of countries and has been well documented in various studies (Balasubramanyam and Wei, 2005; Dreger and Herzer, 2013; Hagemejer and Mućk, 2019; Malefane, 2021). India's overall position in total world exports is 16^{th} with a share of 1.9 percent wherein 12.2 percent is contributed by the exports of textile in 2019 (World Trade Statistical Review, 2020). This indicates that textiles are one of the major components in India's exports' basket.

The textiles and clothing industry is one of the mainstays of the Indian economy. Textiles are amongst the top ten exportable of India. The textiles industry contributes approximately four percent of GDP, 14 percent of industrial production, employs nearly 45 million people and accounts for 12 percent share of the country's exports basket (Directorate General of Commercial Intelligence and Statistics, 2020). The close linkage of the textile industry to agriculture (for raw materials such as cotton) and its association with the ancient culture and traditions of the country make it unique in comparison to its counterparts. The Indian textile industry has the ability to deliver a broad range of textile items suitable to different market segments, both inside India and across the world. Figure 1.1 shows an increasing trend in the total export value of textile items annually since the 1990s. Total exports of both SITC 26 and SITC 65 to the world have increased considerably over the time period from 1990 to 2015. The exports of SITC 65 to the world are steadily showing a rising trend. However, the exports of SITC 26 more or less remained constant and gained momentum post 2005. According to the Reserve Bank of India the sharp increment in 'textile and textile products' post 2010 can be ascribed fundamentally to the growth in exports of readymade garments, cotton yarn and synthetic fiber. Apart from revamped external demand, recuperation in the garment sector can be attributed to depreciation of rupee and competitive advantage in textiles.

Figure 1.1: Exports of textile items (in US $)



Source: UN COMTRADE

By the virtue of the endowment of labour and raw materials, India is the third biggest exporter of textiles after China and the European Union. Moreover, India’s share in world textile exports has improved from 3.6 percent in 2010 to 4.2 percent in 2020 (World Trade Statistical Review, 2020). However, India’s share in the global textiles exports portrays a unique scenario. As compared to the share of the largest exporter China (43.5 percent), India’s share in the global trade is less than five percent. Countries like Italy and Bangladesh, much smaller than India in terms of GDP, have similar share in the global trade as India. This advocates that due to various reasons India could not realize her export capabilities despite the presence of a complete value chain and competitive advantage owing to an abundant supply of cheap and skilled labour relative to major exporters of textile (FICCI, 2016). India holds a substantial manufacturing competitiveness in terms of raw materials (specifically cotton), factor costs and, scale and level of integration (Wazir Research and Analysis, 2019). Table 1.1 shows the manufacturing competitiveness of Bangladesh, China, Vietnam, Cambodia and India in terms of factor costs. The labour cost (in US $ per month) is around 160-180 in India which is less than one third of that of China. It has been argued that there is a huge window of opportunity for India due to the shrinking labour supply, high wages and slowing down of the spinning activity in the textile industry of China. Besides, though labour cost in Bangladesh appears to be lower than India, Bangladesh is currently facing wage disputes, security and compliance related issues. Bangladesh and Vietnam have strong manufacturing capacity in garments but are constrained due to limited backward linkages support to the industry (FICCI, 2016). India may avail this golden opportunity by occupying the spaces vacuumed by these two nations. Further, this would enhance the possibilities of enlarging India's textile exports' capacity to meet the presence of robust demand. With the increased penetration of organized retail, favourable demographics, and growing income level, the Indian technical textiles market is expected to inflate to US$ 23.3 billion by 2027 (Department of Industrial Policy and Promotion, 2020). Additionally, the country had experienced an increased demand for technical textiles in the form of PPE suits and instruments due to the covid-19 pandemic. The government has also allowed 100% FDI (automatic route) in textiles to boost investments and funds in the textile sector. The dominance created due to presence of robust demand, competitive advantage, policy support and rising investments makes it imperative to estimate the export potential of Indian textiles. Tapping the vast potentials of exports from textiles would also be instrumental in improving the trade balance position of India.

Table 1.1: Manufacturing Competitiveness in terms of factor costs

	Unit	**Bangladesh**	**China**	**India**	**Vietnam**	**Cambodia**
Power Cost	US cents / Kwh	9-12	15-16	10-12	08-10	20-25
Labour Cost	US$/ month	100-110	550-600	160-180	170-190	180-190

Source: Wazir Research and Analysis, 2019

In view of the above discussion, the present study focuses on estimation of export potential of Indian textiles for a panel data using the gravity model for the period 1988 to 2017. The study further seeks to identify countries with which there are unrealized export potentials in textiles. The objectives of this study are three fold. The first is to examine the bilateral export flows of India with its top 20 trading partners using gravity model in two textile items, fiber (SITC 26) and yarn and fabrics (SITC 65). The exports of Indian textiles in case of SITC 65 to its top 20 trading partners holds a share of approximately 73 percent and that of SITC 26 holds a considerable share of around 90 percent. Due to the considerable prominence and significance of these two aggregate items in the trade share, it becomes crucial to estimate the major determinants of exports of these textile items of India. The second objective is to identify the major determinants of India's textile exports using a random effects model and PPML estimator. Finally the study estimates the export potential of Indian textiles and identifies countries with which there is unrealized export potential. This study adds to the extant literature in a number of ways. Firstly, to the best of the authors’ knowledge the present study is the first study that empirically assesses the determinants of Indian textiles exports. Secondly, the study attempts to empirically predict the export potential of Indian textiles and identify countries with which there is untapped potential in textiles. Lastly, nascent panel technique PPML estimator is employed to check the robustness of random effects model and to determine the intensity of untapped potential of textiles in India.

The remaining paper is organized as follows: Section 2 provides a brief survey of the literature; Section 3 discusses data and model specification used in the study; Section 4 discusses empirical estimation followed by conclusion and policy implications in Section 5.

2. Literature Review

In the empirical literature pertaining to international trade, the gravity model is widely used to understand the trade flows between nations. First employed by Tinbergen (1962), the model is inspired from Newton's theory of gravitation. The model postulates that just as planets are mutually attracted in proportion to their sizes and distance, countries trade in proportion to their respective size and distance. More specifically, trade between two nations is directly related with their GDPs and inversely related with the geographic distance between them.

At first, the gravity equation was viewed as just a portrayal of an empirical association between the size of economies, their proximities and the volume of trade. However, the stability and power of the gravity equation to explain bilateral trade flows provoked the quest for a theoretical explanation for it. The principal endeavor toward this direction was made by Anderson (1979). In the context of a model, where goods were differentiated by country of origin and where consumers have preferences over all the differentiated products, Anderson (1979) posited that irrespective of price, a country consumes at least some quantity of every good from every country. In an open economy, multiple countries trade multiple commodities and, in equilibrium, national income of a nation is the sum of home and foreign demand for the unique goods that each nation produces. Hence, larger economies import and export more.

Ensuing discussions showed that gravity models can emerge out of a range of trade theories. Specifically, Bergstrand (1985, 1989) showed that the gravity model is an immediate implication of the trade model based on monopolistic competition developed by Krugman (1980). In this model, identical nation's trade differentiated goods because consumers prefer variety. Models based on monopolistic competition overcame the undesirable characteristic of Anderson's models whereby commodities are differentiated by location of production by assumption.

Over the course of time, a number of studies tried to augment the gravity model by adding more variables affecting trade between countries. Anderson (1979) and Bergstrand (1985) explicitly introduced bilateral trade barriers in the model. Dummies for common language, proximity and other pertinent cultural attributes like colonial history have been considered to encapsulate information costs (see e.g., Melitz, 2007; Grant and Lambert, 2008; Irshad and Xin, 2017). Search costs are lower for trade between countries whose business practices are notable to each other. Firms in adjacent nations, nations with a common language or other relevant cultural features are also likely to know more about each other and to understand each other's business practices better than firms operating in less-similar environments. In addition, GDP per capita (see e.g., Fratianni and Kang, 2006; Bun and Klaasen, 2007); population (Elliott, 2007; Tzouvelekas, 2007; Papazoglou, 2007); exchange rates (Tang, 2005; Thorpe and Zhang, 2005; Kandogan, 2005) are also used as instrumental variables influencing the bilateral trade between nations.

Over the last five decades, numerous studies have employed gravity models in respect of various countries and regional trade blocs to estimate their trade potential (see e.g., Martinez- Zarzoso, 2003; Rahman et al., 2003; Batra, 2004; Rahman et al, 2006; Ram and Prasad, 2007; Rahman, 2009; Jordaan and Eita, 2007; Hatab et al, 2010; Greene, 2013; Jomit, 2014; Irshad and Xin, 2018). Moreover, research has also been conducted to estimate the export potential of specific commodities like environmental goods, leather, agricultural goods, raw skin and hides, and metal products (see e.g., raw hides and skins (other than fur skins) and leather (H41) and metals and articles of base metal sector (SIC72-83) (Eita and Jordaan, 2007); agricultural exports (Hatab et.al, 2010); advanced technology goods (Greene, 2013); environmental goods (Jomit, 2014)).

A few studies in the past have estimated the export potential of textiles using gravity model. Chan et al., (2007) estimated the export potential of China in textiles for 10 partner countries from 1985- 2004 and found that factors significantly affecting the export of textiles include per capita GDP, real exchange rate, trade agreements, and population of the importing country. Hermawan (2011) estimated the export potential of two aggregate textile items, especially fiber (SITC 26) and yarn and fabric (SITC 65) for Indonesia with 26 partner countries for the time period 2000-2008. The results identified geographical distance, size of partner countries’ economies and per capita income as significant determinants of exports. Makochekanwa et al (2012) analyzed the export potential of textiles for Botswana from 1999-2006 for 24 partner countries. The research found that the presence of untapped export potential in this sector resulted from poor product quality, stringent rules of origin (RoO), unrecorded informal trade and inadequate international marketing. Rahman et al (2019) analyzed the export potential of Bangladeshi Textiles & Clothing from 1990 to 2017 for 40 trade partners. The GDP of importing and exporting countries and real exchange rate are found as the major determinants of Bangladesh’s textile exports.

3. Data and Model Specification

The study uses a balanced annual panel data to estimate the major determinants of India's textile exports and to estimate the export potential of Indian textiles with its top 20 trading partners for the period 1988 to 2017. India's top 20 partners in case of (SITC 65) include USA, Bangladesh, China, UAE, UK, Germany, Sri Lanka, Turkey, Italy, Egypt, Republic of Korea, Pakistan, Australia, Iran, Canada, Spain, France, Japan, Portugal and Vietnam. In the case of SITC 26 the top 20 trading partners are Bangladesh, China, Pakistan, Vietnam, USA, Turkey, Indonesia, Iran, Italy, Nepal, Republic of Korea, Spain, Germany, Netherland, Israel, Thailand, France, UAE, Japan and Egypt.

The gravity equation in its standard basic form explains bilateral trade ($Trade_{ij}$) being directly proportional to the product of GDP of the two countries and inversely proportional to the distance ($Distance_{ij}$) between them as mentioned in equation (1).

$$Trade_{ij} = a.\frac{GDP_i^{\beta 1}.GDP_j^{\beta 2}}{Distance_{ij}^{\beta 3}}.\mu_{ij} \quad (1)$$

The Gravity equation in its standard log form is expressed as:

$$log(Trade_{ij}) = \alpha + \beta_1 \, log \, log \, (GDP_{\ i}) + \beta_2 log(GDP_j) + \beta_3 log(Distance_{ij}) + u_{ij} \quad (2)$$

Equation (2) is the core gravity model equation where the dependent variable is predicted to be positively related to income and negatively related to distance. β_1, β_2 and β_3 are the elasticities to be evaluated. The error term (u_{ij}) captures any other random disturbances that may affect bilateral export flows between two nations. Based on the earlier literature, we account for several other determinants that may affect export of textiles. The augmented gravity equation can be expressed as given in equation (3):

$$log(T_{ij}) = \alpha + \beta_1 \, log \, log \, (GDP_i) + \beta_2 log(GDP_j) + \beta_3 log(DIS_{ij}) + \beta_4 log(EXPOP_i) + \beta_5 log(IMPOP_j) + \beta_6 \, log \, log \, (RealEX_{ij}) + \beta_7(ComLang_{ij}) + \beta_8(ComCol_{ij}) + \beta_9(Border_{ij}) + \beta_{10}(ComLangE_{ij}) + u_{ij} \quad (3)$$

Where i denotes the home country (India) and j denotes its trading partner. T_{ij} denotes the value of exports of textiles between country i and country j. This study uses both the parameters GDP and population of a country to measure the size of the economies.

A priori relationship between explanatory variables and exports is as follows: (i) Distance (DIS_{ij}): Greater distance between two countries implies huge transportation cost and hence less trade. (ii) Population of the exporting country ($EXPOP_{ij}$): From the theoretical and empirical perspective, the impact of an exporter's population on exports is indecisive. On one hand, a larger population suggests a larger workforce, higher productive capacity and hence more exports. On the contrary, a high population of exporters shows a large domestic market, which may reduce the pressure on the sales to international markets, thereby depressing the export dynamism of domestic industries. (iii) Importer’s population ($IMPOP_{ij}$): A large population of the importing country indicates greater reliance on imports and hence, positively affects the export of the trade partner. (iv) Real exchange rate ($RealEX_{ij}$): It is used as a proxy for relative prices. Exports become relatively cheaper when the exchange rate increases (i.e., when currency depreciates). This means that an increase in the exchange rate positively affects exports. (v) Common official language ($ComLang_{ij}$): Sharing a common language with the trade partner reduces the transaction costs of the exporting country as it facilitates and expedites trade negotiations. (vi) Common Language Ethno (ComLangE): It is a similar dummy which indicates the same results as that of a common official language. (vii) Common colony ($ComCol_{ij}$): It is hypothesized that shared history reduces transaction costs between trading partners. (viii) Border ($Border_{ij}$): Countries sharing a common border tend to have lower transaction costs and huge bilateral flows of goods. A brief overview of the variables and data sources is given in Table 3.1.

Table 3.1: Description of Variables and Data Sources

Variable	Description	Data Source
LnT_{ij}	Export value of textile between country i (India) and j (trading partner) expressed in USD.	UN COMTRADE
$LnGDP_i$	Gross Domestic Product of the exporting country expressed in USD.	WDI
$LnGDP_j$	Gross Domestic Product of the importing country expressed in USD.	WDI
$Ln\ D_{ij}$	Distance between country i and j, used as a proxy for transportation costs expressed in Kilometer.	CEPII
$LnEXPOP_i$	Population of the exporting country, total.	WDI
$LnIMPOP_j$	Population of the importing country, total.	WDI
$Ln\ RealEX_{ij}$	Real Exchange Rate, used as a proxy for relative prices expressed in USD.	RBI
ComLang	If trading partners share a common official language dummy value of 1 is assigned, otherwise 0.	CEPII
ComCol	If countries were colonies after 1945 with the same colonizer, a dummy value of 1 is assigned, otherwise 0.	CEPII
Border	If two countries share a common border dummy value of 1 is assigned, otherwise 0.	CEPII
ComLangE	If a common language is spoken by at least 9% of the population in both the countries, a dummy value of 1 is assigned, otherwise 0.	CEPII

4. Empirical Estimation

4.1 Unit Root Test

Table 4.1 provides the descriptive statistics of the variables used in the study.

Table 4.1: Descriptive Statistics

SITC 65	Ln_TRADE65	LN_EXGDP	LN_IMGDP	LN_EXPOP	LN_IMPOP	LN_REAL_EX	LN_DIS	COMCOL	COMLANG	COMLANG_ETHNO	BORDER
Mean	18.478	27.242	26.871	20.79	17.909	4.011	8.404	0.20	0.250	0.40	0.20
Median	18.864	26.953	27.056	20.80	17.932	4.142	8.558	0.00	0.00	0.00	0.00
Maximum	22.004	28.448	30.555	21.00	21.044	4.5369	9.397	1.00	1.00	1.00	1.00
Minimum	10.911	26.308	22.567	20.54	14.319	2.928	6.527	0.00	0.00	0.00	0.00
Std. Dev.	1.752	0.735	1.750	0.139	1.183	0.419	0.70	0.40	0.433	0.490	0.40
Skewness	-1.316	0.327	-0.171	-0.218	0.078	-1.135	-0.87	1.50	1.154	0.408	1.50
Kurtosis	5.128	1.572	2.321	1.818	4.489	3.623	3.551	3.25	2.33	1.66	3.25
Jarque-Bera	277.032	59.679	13.973	38.35	54.190	133.94	81.41	219.01	139.62	97.33	219.01
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	580	580	580	580	580	580	580	580	580	580	580
SITC 26	**LN_TRADE26**	**LN_EXGDP**	**LN_IMGDP**	**LN_EXPOP**	**LN_IMPOP**	**LN_REAL_EX**	**LN_DIS**	**COMCOL**	**COMLANG**	**COMLANG_ETHNO**	**BORDER**
Mean	15.408	27.242	26.634	20.796	17.985	4.011	8.215	0.200	.100	0.300	0.198
Median	15.598	26.953	26.608	20.809	18.007	4.142	8.410	0.000	0.000	0.000	0.000
Maximum	21.807	28.448	30.555	21.004	21.044	4.536	9.372	1.00	1.00	1.00	1.00
Minimum	2.893	26.308	21.947	20.542	14.319	2.928	6.527	0.000	0.000	0.000	0.000
Std. Dev.	2.528	0.735	1.833	0.139	1.247	0.419	0.705	0.4003	0.3002	0.458	0.399
Skewness	-0.810	0.327	-0.162	-0.218	-0.212	-1.135	-0.97	1.50	2.667	0.872	1.513
Kurtosis	5.360	1.572	2.693	1.818	4.072	3.623	3.426	3.250	8.111	1.761	3.290
Jarque-Bera	198.15	59.679	4.839	38.354	32.136	133.94	96.39	219.01	1318.7	110.659	223.48
Probability	0.000	0.000	0.088	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	580	580	580	580	580	580	580	580	580	580	580

Source: Authors' calculation

Table 4.2 and 4.3 show the results of the panel unit root test. All the series in both the categories SITC 65 and SITC 26 are checked for stationarity before employing the Hausman Test and Poisson Pseudo-Maximum Likelihood (PPML) estimator. The results of the panel unit root test indicate that all the variables reject the null hypothesis of a unit root. However, the variable lnEXPOP in case of SITC 26 is not stationary even at first difference according to ADF - Fisher Chi-square statistics. Nevertheless, the null hypothesis of the unit root under Levin, Lin & Chu, PP-Fisher chi-square test and IM, Pesaran & Shin W-stat test is rejected.

Table 4.2: First Generation Panel Unit Root Tests (with intercept) (SITC 65)

Variable	**ADF - Fisher Chi-square**		**PP - Fisher Chi-square**		**Im, Pesaran and Shin W-stat**		**Levin, Lin & Chu**	
	I(0)	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**
Ln TRADE_26	36.13 (0.644)	339.45 (0.000)	80.50 (0.000)	490.93 (0.000)	0.09 (0.53)	-18.79 (0.000)	-1.94 (0.02)	-15.37 (0.000)
Ln IMPOP	67.63 (0.004)	102.29 (0.000)	307.32 (0.000)	89.50 (0.000)	0.64 (0.739)	-4.25 (0.000)	-0.40 (0.344)	-3.42 (0.000)
Ln EXPOP	38.95 (0.517)	290.03 (0.000)	473.37 (0.000)	30.50 (0.000)	-1.32 (0.092)	-16.03 (0.000)	-5.50 (0.000)	-13.71 (0.000)
Ln IMGDP	26.47 (0.950)	175.97 (0.000)	28.23 (0.918)	243.53 (0.000)	2.11 (0.982)	-10.06 (0.000)	-1.65 (0.049)	-8.02 (0.000)
Ln EXGDP	0.47 (1.000)	91.39 (0.000)	0.31 (1.000)	288.82 (0.000)	10.45 (1.000)	-5.34 (0.000)	5.27 (1.000)	-5.37 (0.000)
Ln REAL EX	175.66 (0.000)	76.50 (0.000)	240.73 (0.000)	137.06 (0.000)	-10.15 (0.000)	-4.34 (0.000)	-14.31 (0.000)	-8.47 (0.000)

Source: Authors’ calculation Note: p value in parenthesis.

Table 4.3: First Generation Panel Unit Root Tests (with intercept) (SITC 26)

Variable	ADF - Fisher Chi-square		PP - Fisher Chi-square		Im, Pesaran and Shin W-stat		Levin, Lin & Chu	
	I(0)	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**
Ln TRADE_65	70.06 (0.002)	243.80 (0.000)	83.56 (0.000)	399.08 (0.000)	-2.209 (0.013)	-13.50 (0.000)	-6.58 (0.000)	-9.38 (0.000)
Ln IMPOP	58.08 (0.032)	99.45 (0.000)	197.97 (0.000)	105.00 (0.000)	3.99 (1.000)	-4.54 (0.000)	1.77 (0.96)	-4.13 (0.000)
Ln EXPOP	38.95 (0.517)	38.95 (0.517)	473.37 (0.000)	473.37 (0.000)	-1.32 (0.09)	-1.32 (0.092)	-5.50 (0.000)	-5.508 (0.000)
Ln IMGDP	28.58 (0.910)	164.97 (0.000)	31.85 (0.817)	224.64 (0.000)	1.83 (0.967)	-9.41 (0.000)	-1.74 (0.04)	-7.62 (0.000)
Ln EXGDP	0.47 (1.00)	91.39 (0.000)	0.31 (1.00)	288.82 (0.000)	10.45 (1.00)	-5.34 (0.000)	5.27 (1.00)	-5.37 (0.000)
Ln REAL EX	175.66 (0.000)	76.50 (0.000)	240.73 (0.000)	137.06 (0.000)	-10.15 (0.000)	-4.34 (0.000)	-14.31 (0.000)	-8.47 (0.000)

Source: Authors' calculation Note: p value in parenthesis.

The selected countries share a common border and have numerous bilateral and multilateral agreements in addition to cultural and socio- economic similarities. As a result it becomes important to check the cross sectional dependence in the data. Towards this end, we employ CD and scaled LM tests by Pesaran et al. (2004) and Breusch- Pagan LM test. Table 4.4 reports the results of cross- sectional dependence tests. The results reject the null hypothesis of "no cross- sectional dependence" at one percent significance level and indicate the presence of cross- sectional dependence in the data for both SITC 65 and SITC 26.

Table 4.4 Cross-Sectional Dependence Test

	SITC 65		SITC 26	
Test	**Statistic**	**Probability**	**Statistic**	**Probability**
Breusch-Pagan LM	2354.814*	0.0000	1155.113*	0.0000
Pesaran scaled LM	111.052*	0.0000	49.509*	0.0000
Pesaran CD	4.194*	0.0000	6.066*	0.0000

"*" indicates level of significance at 1%.

Since the first generation unit root tests may not provide unbiased results in presence of cross- sectional dependence , second generation panel unit root tests namely, cross- sectionally augmented IPS (CIPS) proposed by Pesaran (2007) is also being performed (Shastri et al., 2018; Shekhawat et al., 2021). The results for CIPS with trend specification are reported in Table 4.5. The results indicate that the test fails to reject the null hypothesis (of I (1) series) for both the components of textiles at five percent level of significance. The results are robust to the second and third lag.

Table 4.5 Second- generation unit root test

	SITC 65		SITC 26	
Variable	**Lag (0)**	**Lag (1)**	**Lag (0)**	**Lag (1)**
Ln TRADE	-4.251 (0.000)	-3.383 (0.000)	-6.740 (0.000)	-2.840 (0.000)
Ln IMPOP	-2.890 (0.002)	-1.728 (0.042)	-1.862 (0.031)	-3.887 (0.000)
Ln EXPOP	-4.127 (0.000)	-3.359 (0.000)	-3.614 (0.000)	-1.704 (0.044)
Ln IMGDP	-2.236 (0.013)	-1.568 (0.050)	-4.608 (0.000)	3.231 (0.001)
Ln EXGDP	-4.313 (0.000)	-3.666 (0.000)	-4.147 (0.000)	-5.711 (0.000)
Ln REAL EX	-4.044 (0.000)	-3.160 (0.001)	-3.389 (0.000)	-3.198 (0.000)

Source: Authors' calculation Note: p values in parenthesis, Zt-bar statistics are reported.

4.2 Random effect model

The individual country specific effects can be estimated using the fixed effect model (FEM) and the random effect model (REM). The random effects model (REM) is a suitable specification if N observations are drawn from an enormous population (Baltagi 2008) whereas FEM is suitable when trade flows are estimated between pre-determined selections of observations (Egger 2000).

Hausman test is employed to choose the suitable model between the fixed and random effects. The p value of the Hausman test was greater than 0.05. So, the estimation was preceded with the non rejection of the null hypothesis that the random effects model is more suitable.

Table 4.6 represents the regression results of the augmented gravity model for SITC 65 and SITC 26. In case of SITC 65 approximately 74 percent variation in the export of Indian textiles is explained by the model. The results suggest that if the population and GDP of the importing country increase by one percent, export of textiles increases by around 0.63 percent and 1.43 percent respectively .Sharing a common language ethno also increases export by 1.6 times. Countries sharing the same colonial links with India improve exports by 2.6 times. In case of SITC 26, all the explanatory variables are significant except common language, common border and common language ethno. Coefficients of both GDP of importing and exporting countries are positive and significant. An increase in GDP of the importing country indicates higher imports, while a higher GDP of India indicates a higher level of production which increases the availability of more textile products. The population of the importing country positively affects the exports of textile although less than proportionately (0.11 percent). On the other hand a one percent increase in the population of India reduces exports of SITC 26 items by 9.7 percent. Exchange rate is one of the important factors affecting export flows of textile in case of both SITC 65 and SITC 26. Depreciation of rupee against other currencies stimulates the country's export of textile. If the real exchange rate rises, export of textiles appears relatively more profitable. To conclude, IMPOP, IMGDP, REAL EX, COMLANG are significant determinants of India’s textile exports in both the categories of textiles.

However BORDER is an insignificant determinant which does not conform to a priori relationship as mentioned in the literature. Also the top 20 trading partners in SITC 65 and SITC 26 categories include the countries sharing borders with India (Pakistan, Sri Lanka, Bangladesh and China). Therefore to confirm with the consistency and robustness of the regression coefficients obtained above the PPML estimator is being employed.

Table 4.6: Augmented Gravity Model Estimation (Panel EGLS Cross- Section Random Effects)

Dependent Variable: Ln (T_{ij})

REGRESSORS	**SITC 65**			**SITC 26**		
	Coefficient	**S.E**	**p value**	**Coefficient**	**S.E**	**p value**
C	-23.207 (0.66)	35.095	0.508	131.368 (1.66)	34.273	0.096***
Ln DIS	0.093 (0.22)	0.224	0.822	-1.95 (-2.98)	0.653	0.003*
Ln IMPOP	0.628 (3.52)	0.178	0.000*	0.107 (0.465)	0.230	0.084***
Ln EXPOP	0.738 (0.36)	2.033	0.716	-9.689 (-2.107)	4.597	0.035**
Ln IMGDP	1.427 (16.65)	0.085	0.000*	1.053 (6.382)	0.165	0.000*
Ln EXGDP	-0.200 (0.83)	0.239	0.403	2.316 (4.25)	0.544	0.000*
Ln REAL EX ($)	0.816 (2.49)	0.327	0.012*	2.152 (2.905)	0.741	0.003*
COMCOL	2.607 (3.08)	0.845	0.002*	0.430 (-0.518)	0.829	0.074***
COMLANG	-2.511 (4.84)	0.518	0.000*	-0.432 (-0.464)	0.930	0.642
COMLANG_ETHNO	1.605 (3.63)	0.441	0.000*	-0.152 (-0.250)	0.608	0.802
BORDER	0.434 (0.61)	0.702	0.536	-0.034 (-0.041)	0.827	0.967
OBSERVATIONS	580			580		
R^2	0.746			0.613		
Adjusted R^2	0.741			0.607		
F STATISTICS	167.430 p value 0.000*			90.432 p value 0.000*		

Note: t statistics in parenthesis, (*) significant at 1%, (**) significant at 5% and (***) significant at 10%.

Source: Author's calculation

4.3 Poisson Pseudo-Maximum Likelihood (PPML) estimator

The authors have also employed the Poisson Pseudo-Maximum Likelihood (PPML) estimator as suggested by Silva and Tenreyro (2006) to check the robustness of the coefficients and to obtain consistent estimates. PPML is considered the most appropriate method as it produces consistent results (Álvarez et al., 2018). In addition, Baldwin and Harrigan, 2011; Wei et al., 2012; Rahman et al., 2019 and Kumar et al., 2021 have successfully employed the PPML in estimating their gravity equations as it overcomes the problems of zero trade values, multicollinearity, endogeneity, autocorrelation and heteroscedasticity. Also, Shepherd (2013) suggested that the desirable properties of the PPML estimation technique signify that the policy suggestions should depend on Poisson estimates rather than OLS. Table 4.7 shows the results using the PPML estimator. All the explanatory variables are significant according to the PPML estimator in case of both SITC 65 and SITC 26. This implies that all the explanatory variables including dummy variables are the significant determinants of Indian textiles in these two categories. EXPOP, EXGDP and Border were insignificant in the Random Effect model but are significant according to the PPML estimator for SITC 65. For SITC 26, ComLang, ComLangE and Border were insignificant in the Random effect model but are significant according to the PPML estimator.

The PPML estimation result demonstrates that a one percent increase in the population and GDP of an importing country increases textile's exports, less proportionately. This suggests that if the partner country's GDP increases by one percent the exports increase by 0.40 percent (SITC 65) and 0.10 percent (SITC 26) in India .This indicates that the increasing income level of the partner country results in increased demand for imports of the country. Similarly, a one percent increase in the importing country's population ameliorates exports by 0.34 percent (SITC 65) and 0.83 percent (SITC 26). This indicates that the rising population of the trading partner will be inclined towards importing fibers, and yarn and fabrics. Similarly, a one percent rise in GDP of India, leads to 3.74 percent increase in the export of fibers and 0.74 percent increase in the exports of yarns and fabrics. However, a one percent growth in India's population retards exports of fibers by approximately ten percent and exports of yarns and fabrics by four percent.

This indicates that the consumption pattern of the rising population of India will be inclined towards fibers and yarns and fabrics thus reducing its exports. These findings are in line with previous studies of Chan and Au, 2007; Jomit, 2014; Rahman et al., 2019; Kumar et al., 2021. The results also demonstrate that distance positively affects textile exports. The distance elasticities imply that the yarn and fabrics, and fibers' export of the host country increases by 0.83 percent and 0.39 percent respectively for every 1 percent increase in the distance of the partner countries. This shows that greater the distance with the partner country greater will be the exports of textiles. Linders (2005) recognizes that positive distance elasticity might emerge, not only from sample and estimation differences, but also from influence of regressors that may be correlated to distance. Some of the notable regressors in this category include common language, colonial ties, sharing borders and ethnic lingual identity in our study. Apart from this, the level of trade facilitation and even the size of income of the sample countries may affect the distance parameter. This outcome endorses the findings of (Brun et al., 2005; Wu, 2015). Depreciation of rupee against other currencies also stimulates the country's export of textile by 0.23 percent (SITC 26) and 1.19 percent (SITC 65). This indicates that if the real exchange rate rises, export of textiles would become more profitable.

The coefficient of ComCol is also significantly positive and indicates that India tends to export more to the countries sharing common colonial history. The results also demonstrate that sharing common ethnic language with a partner country ameliorates exports. Thus cultural and ethnic lingual similarities with partner countries tend to have a positive impact on exports. On the other hand, sharing ComLang reduces textiles exports although, less proportionately. This evidence corroborates the findings of (Melitz and Toubal, 2014) that have shown that common language dependent exclusively on the country's official language is not enough to capture the several nuances of the influence of language in international trade. However, the result contradicts the conclusion of (Melitz, 2007; Grant and Lambert, 2008; Irshad and Xin, 2017) who have found a positive correlation between common language and trade volumes. These outcomes imply that some degree of ethnic linguistic identity between languages must be found, because sharing a common ethnic language may have considerable positive impact on trade flows. The coefficient of border is negative for yarn and fabrics and positive for fibers. The literature explains two contradictory effects of border or distance on trade. Linder (1961) posited that countries tend to increase their mutual trade (intra- industry trade) with trading partners sharing borders due to the similar demand structures. On the contrary, Heckscher- Ohlin argued that higher economic distance might boost inter- industry trade between trading partners (Le 2017).

Table 4.7: PPML Estimation Results

REGRESSORS	SITC 65		SITC 26	
	Coefficient	p value	Coefficient	p value
C	47.102	0.000	112.655	0.000
Ln DIS	0.826	0.000	0.388	0.000
Ln IMPOP	0.343	0.000	0.826	0.000
Ln EXPOP	-3.737	0.000	-10.360	0.000
Ln IMGDP	0.402	0.000	0.096	0.000
Ln EXGDP	0.743	0.000	3.743	0.000
Ln REAL EX ($)	1.191	0.000	0.234	0.000
COMCOL	3.073	0.000	1.165	0.000
COMLANG	-0.568	0.000	-0.197	0.000
COMLANG_ETHNO	0.452	0.000	0.718	0.000
BORDER	-0.749	0.000	1.302	0.000
OBSERVATIONS	580		580	
R^2	0.847		0.785	
Adjusted R^2	0.844		0.781	
Avg Log Likelihood	-36938794		-13332827	
Prob (LR Statistic)	0.0000		0.0000	

Source: Author's calculation

Hence, one of the possible explanations for the negative coefficient of border in yarn and fabrics could be the inter- industry nature of trade between India and its borders sharing trading partners. On the other hand the positive coefficient of border explains the intra- industry trade in fibers. However, this negative coefficient of border in case of SITC 65 and positive in case of SITC 26 requires further empirical investigation.

4.4 Measurement of Export potentials

After estimating the gravity model, we proceed to estimate the export potential of Indian textiles. In this section the regression results derived from the PPML estimator in the preceding section are employed to estimate India's export potential in textiles with all the countries in the sample. The bilateral export potential is defined as the difference between actual exports (A) and the level of trade predicted (P) by empirical gravity model is expressed in equation (4) (Batra, 2006; Papazoglou, 2007; Hermawan, 2011).

$$Potential\ export\ =\ Predicted\ value - \ Actual\ value \qquad (4)$$

The difference between the predicted and actual value of trade shows the potentials of India for expansion of textiles export. A positive value indicates possibility of future export expansion (Batra, 2006; Hermawan, 2011). While a negative value shows that India has surpassed its export capabilities with the particular trade partner.
In literature the bilateral export potential is also estimated as the ratio of anticipated trade value (P) to actual trade value (A) i.e.
$\frac{P}{A}$, if P / A is greater than 1 then there is potential for expansion of textile export with a type of country provided the values of the control variables. If the ratio is less than 1 then India has already surpassed its potential with that country.

Table 4.8 shows that India has unrealized export capabilities with seven countries out of the 20 sample countries in SITC 65 category of textiles. The capacity of India's export potential in case of SITC 65 is highest with countries like Japan, Canada, Pakistan, France, Australia, Spain and Korea in that order. With all these countries there is a possibility to increase the exports of textiles approximately twice as compared to present exports.

Table 4.8: Export potentials (SITC 65)

COUNTRY	EXPORT POTENTIAL (Predicted value/ Actual value)	EXPORT POTENTIAL (Predicted value- Actual Value)
Japan	2.818866	7563868188
Canada	2.08625	3368177439
Pakistan	1.999609	2356729292
France	1.914948	3525497270
Australia	1.410161	1292754550
Spain	1.393418	1493403861
Rep. of Korea	1.155264	747773231.9

Source: Author's calculation

Table 4.9 shows the export potentials of India for SITC 26. In case of SITC 26 India has potential with 13 countries. The magnitude of India's export potential in case of SITC 65 is highest with countries like France, Japan, Spain, Egypt, Nepal, Iran, Germany, Indonesia, Pakistan, UAE, Netherlands, USA and China in that order. The possible causes of unexploited export potential in textiles may be attributed to stringent rules of origin, market access problem and less adequate infrastructure and technology. Moreover textiles are still under sensitive and exclusion lists with regard to trade agreements thus elevating untapped potential.

Table 4.9: Export Potentials (SITC 26)

COUNTRY	EXPORT POTENTIAL(Predicted value/ Actual value)	EXPORT POTENTIAL (Predicted value – Actual value)
France	3.476077	379969011.6
Japan	2.090613	431235885.8
Spain	2.038875	225548798.6
Egypt	1.851215	163143062
Nepal	1.749702	293357196
Iran	1.431006	149435177.9
Germany	1.296416	138997582.4
Indonesia	1.219134	290586042.3
Pakistan	1.104429	346684140.9
UAE	1.059133	13809345.37
Netherlands	1.054986	9931546.857
USA	1.036624	28809430
China	1.008923	138804689.5

Source: Author's calculation

5. Conclusion

In this study a gravity model is employed to estimate the trade potential of Indian textile (SITC 65 and SITC 26) with its top 20 trading partners. Initially the basic gravity equation is estimated for both the items. The estimation results demonstrate that GDP of both the importing and the exporting country affects exports of textiles positively whereas distance is inversely related with exports. Further, an augmented gravity model is estimated by employing the random effects model and PPML estimator by incorporating some explanatory variables (IMPOP, EXPOP, REAL EX) and some dummy variables (COMCOL, COMLANG, COMLANG_ETHNO, BORDER) that reflect cultural and historical characteristics.

The estimated result of the PPML estimator shows that the GDP of both India and its trading partners, population of India and importing country, real exchange rate, ComCol, ComLang, ComLangE and Border are significant determinants of the export of textiles. Although India's population, Border and ComLang are significant but negatively affect the exports of textiles. The distance coefficient, GDP of India, GDP of importers, population of importers, real exchange rate, common colony and common language ethno positively affects textile exports. A negative effect of population on exports implies that the growing population of India has resulted in a greater domestic consumption of yarn & fabrics and fibers. The greater the size of the partner country the greater would be the exports of textiles with the country. Sharing the same colonial links and ethnic language also stimulate exports of textiles significantly. Depreciation of Indian currency against other countries also stimulates the export of textile.

This study also estimated the export potential of Indian textiles and the countries with which India has untapped export potential. The results indicate that the major countries with which there is untapped export potential in case of SITC 65 are Japan, Canada, Pakistan, France, Australia, Spain and Korea. With all these countries there is a potential to approximately double the exports of textiles, yarns and fabrics. While with the rest of the countries in the sample India has exceeded its potential to export. On the other hand in case of SITC 26 India has potential to export with France, Japan, Spain, Egypt, Nepal, Iran, Germany, Indonesia, Pakistan, UAE, Netherlands, USA and China and has surpassed its export capabilities with the rest of the countries.

The unrealized export potentials in the textile sector are a result of various hindrances on domestic as well as international fronts. India still has a long way to go in terms of technology upgradation and optimum utilization of labour intensive technology in the unorganized sector and capital intensive technology in the organized sector. As already stated, stringent rules of origin, inadequate international marketing and textiles being in the exclusion lists of Bilateral and other trade agreements still pose a problem for exporting Indian textiles. In addition, the termination of India’s Generalized System of Preferences (GSP) benefits by the US in June 2019 has adversely affected India’s export-oriented sectors such as pharmaceuticals, textiles, automotive parts and agricultural products. At the same time due to the Covid-19 pandemic the country is experiencing an increased demand for technical textiles in the form of PPE suits and instruments as mentioned in the introduction section. The pressing priority is that the government should move its consideration from bilateral trade disputes and retaliatory tariffs and utilize the existing opportunities inherent in the export baskets’ commodities in order to further develop India’s Foreign Trade Policy.

Data Availability

Data will be made available upon request.

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