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India on the Move
An examination of the volume and direction of internal trade in India

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Abstract

While there is an almost unanimous view on the benefits of trade - fuelling economic growth, supporting a greater number of and better paying jobs, raising living standards, and enhancing the consumer surplus with affordable goods and services - contemporary research has primarily looked at external trade, i.e. trade across national borders. This has led to an under-appreciation of the quantum and the effects of internal trade. This is of particular significance for larger economies such as India. One reason is the relative paucity of data for tracking internal trade. This study proposes to make use of domestic taxation (VAT/GST/Sales Tax) data to get a sense of the volume and directions of internal trade with a special emphasis on India. The study quantifies interstate trade flows in India to amount to about 69% of the GDP when domestic movement of imported goods are included, and about 35% of the GDP when only domestically-produced goods are taken into account. Further, internal trade appears to be growing at more than twice the pace of growth of the GDP. Amongst other reasons, this enhanced economic integration is attributable to the transportation efficiency gains that have accrued after the introduction of the Goods & Services Tax (GST).

Keywords: Internal Trade; Economic Integration; Movement of Labour

JEL Codes: B17, F15, F16

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# The views expressed are the author's own and are expressed purely in his personal capacity.

Prologue

John Godfrey Saxe, the celebrated 19th century American poet credited with a poetic retelling of the old Indian parable of "The Blind Men and the Elephant"1 wrote,

> It was six men of Indostan, to learning much inclined;
> Who went to see the Elephant, (Though all of them were blind);
> That each by observation, Might satisfy his mind.

Ironically, the parable itself finds mention in multiple sources - the Chandogya Upanishad, Jain Syādvādamanjari of Ācārya Mallisena, Buddhist Tittha Sutta as well as in the works of Rumi and Kurosawa2. In the same vein, the introduction of a unified Goods & Services Tax (GST) not only has led to the creation of 'One market; One tax' but has also led to the generation of substantial production and consumption data, all of which can be viewed in new and exciting ways.

There can be little doubt that the GST has been independent India's single biggest reform in indirect taxation3. The benefits of GST have been well documented4; from an economist's perspective such high frequency economic indicators can yield a treasure trove of insights5. In this paper, an attempt is made to examine the patterns and characteristics of India's internal [or domestic] trade, on the basis of analysis of GST data.

1. Introduction

In his study of the origins of economic wealth, noted US Economist Edward Barbier finds that, even before domestication of plants and animals occurred, long-distance trading networks were prominent among some hunter-gatherer societies, such as the *Natufians*, and other sedentary populations[6]. The importance of and correlation of trade to prosperity and economic growth has been brought out in a number of studies, most notably perhaps in the World Bank Paper on *Trade, Growth, and Poverty* by David Dollar and Aart Kraay[7]. The paper adroitly brings out the impact that trade has on economic growth and the effects of the distribution of the benefits consequent to that growth.

In a 2019 paper titled, *'Trade policies and their impact on inequalities'* the United Nations Conference on Trade and Development (UNCTAD) notes that, in the last four decades, international trade, along with finance and technology, has been instrumental in the development process in many countries. Trade reforms undertaken in developing countries have been accompanied by more rapid economic growth, leading to a reduction in income gaps and lower levels of inequality between countries, observed since the 1990s[8].

This has been due to faster growth in some developing countries, in particular Brazil, China and India, relative to developed countries, as a consequence of their engagement in rapid and deep trade reforms and rapid integration into world markets, which has reduced the overall income per capita gap between developed and developing countries. Worldwide movement of Trade-GDP Ratio [*Sum of exports and imports of goods and services, measured as a share of gross domestic product*] is captured in Figure 1 below[9].

Figure 1: World Trade-GDP Ratio Movement [1960-2021]

While there is an almost unanimous view of the benefits of trade - fuelling economic growth, supporting a greater number of and better paying jobs, raising living standards, and enhancing the consumer surplus with affordable goods and services - a majority of the present research on effects of Trade has looked at *external trade,* i.e. trade across national borders.

This has led to an under-appreciation of the quantum and the effects of *internal trade,* i.e. trade within national borders. Admittedly, given the sheer amount of data collected through Border Agencies as well as the financial system, there is a surfeit of data available to quantify and study the patterns of external/international trade, whereas doing the same for the internal/domestic trade presents unique challenges on account of the deficient data. It is this challenge that this paper seeks to address. It is proposed to make use of domestic taxation (VAT/GST/Sales Tax) data to get a sense of the volume and directions of internal trade, as well as to understand spatial flows of goods and labour. Special emphasis has been laid on the case of India.

2. The International Context

A look at international estimations of trade is instructive. We begin by taking a look at the trends in internal trade in the United States of America (USA), the European Union (EU), Brazil, and China.

The US Case

In the absence of a national VAT/Sales Tax administration in the US, examination of the internal trade in the US has been done on the basis of the Freight Analysis Framework (FAF), of the US Bureau of Transport Statistics and the Federal Highway Administration (FHWA), which integrates data from various sources to create a comprehensive picture of freight movement among US states and major metropolitan areas by all modes of transportation10.

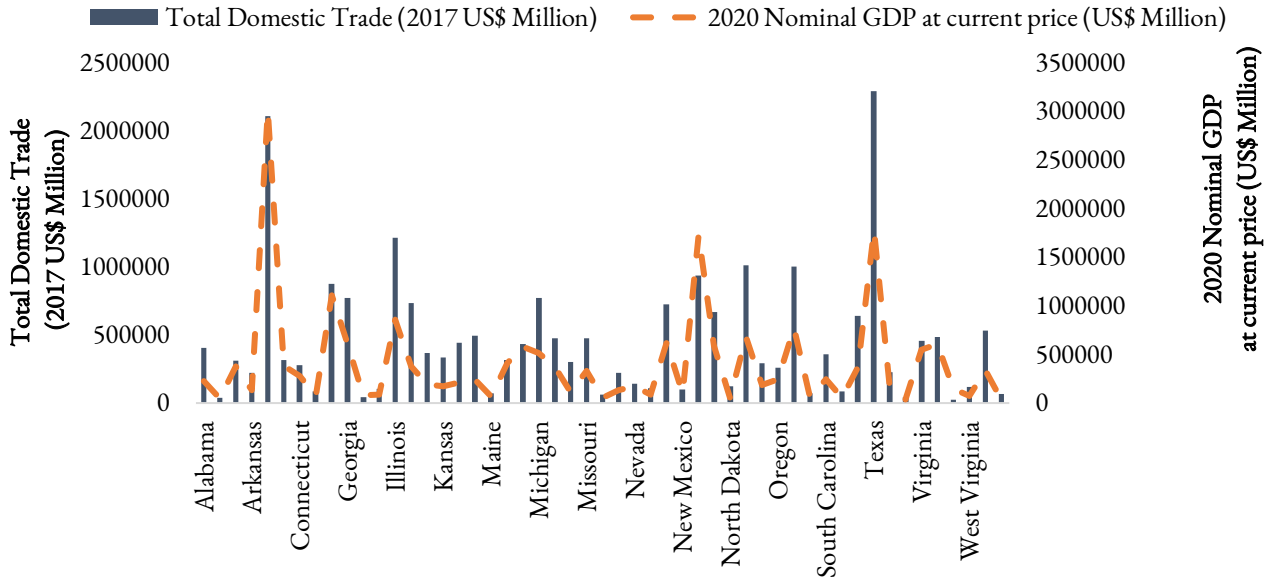
As per the latest FAF data, the value of total Domestic Flows of goods in the US for the years 2017 to 2019 are tabulated as under:

Table 1: Value of Domestic Flow of Goods in the USA [2017-2019]

2017 [Current USD Millions]	2018 [Current USD Millions]	2019 [Current USD Millions]
1,50,81,746.70	1,60,52,917.10	1,57,33,506.60

A state-wise breakup of the domestic flows [cumulating flows within the states, outbound from states, and inbound to the given state] is captured in the following graph. The chart also indicates the states' Nominal GDP.

Figure 2: Value of Domestic Flow of Goods against Nominal GDP US States

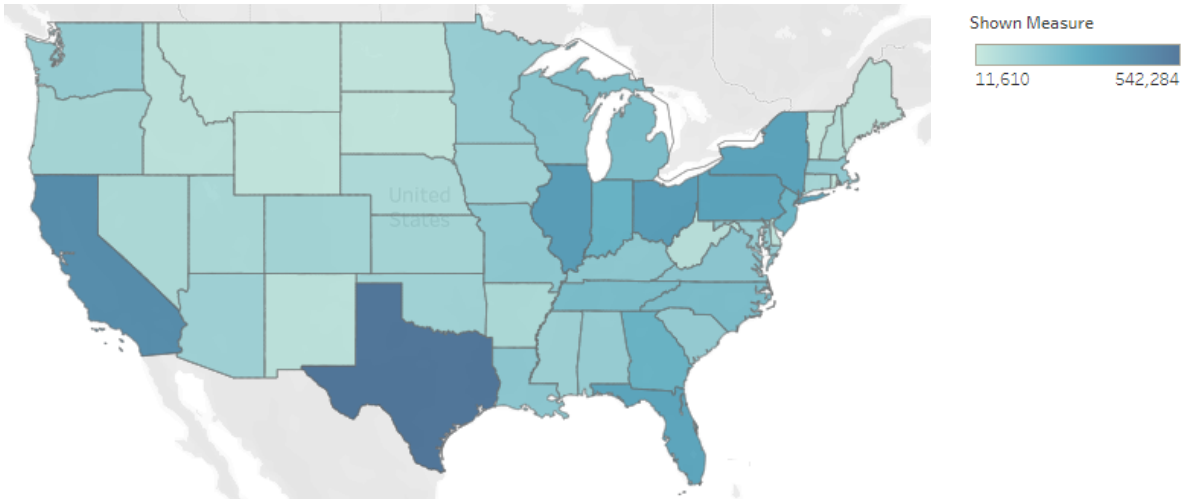


From the above it may be noted that quantum of trade in most states broadly corresponds with the size of the economy of the state. This is intuitive. An analysis of the distance of the trade flows indicates that a majority of trade flows happen within 500 miles [800 kms.] of the origin. This is perhaps indicative of the gravity effect of trade and consumption. The values are summarized in the table below and depicted in a map of the 48 contiguous states of the US, with the deeper blues indicating greater trade.

Table 2: Movement of US Domestic Trade by distance

Distance Band (Miles)	Value of Trade (USD Dollar Million – 2018)
Below 100	4892812
100 - 249	4241144
250 - 499	1919367
500 - 749	1037398
750 - 999	867747
1,000 - 1,499	1048708
1,500 - 2,000	434331
Over 2,000	896238

Figure 3: Domestic Trade Flows in US States [2017]

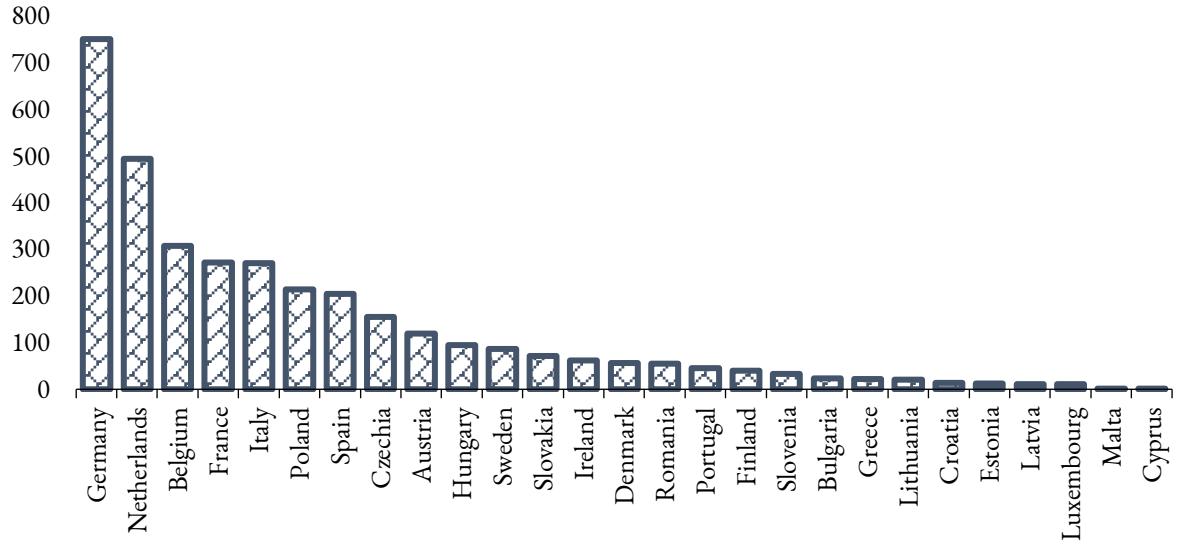


The EU Case

The countries of the Europe Union (EU) are governed by the "*four freedoms*" viz. unfettered movement of goods, services, capital, and people. Given its structure, one of the prime objectives of the EU is to promote trade links amongst its members.

The total amount of exports by EU countries to other EU Members amounted to EUR 3.44 Trillion in 2021[11]. A country wise breakup of the exports and imports are as under:

Figure 4: Exports of goods to other Member States, 2021 [Figures in EUR Billions]



It bears noting that, amongst EU Member States, the top three partners account for over 50% of exports within the EU (Fig. 5)[12]. For a further six Member States, the top three partners have between 40% and 50% of exports within the EU. Only in Germany (38%) is this share below 40%. Germany appeared most often (25 times) as a top three partner; France and Italy both 10 times. This again is perhaps indicative of the gravity effect of trade and consumption.

Figure 5: Main EU partners for exports of goods by Member State, 2021

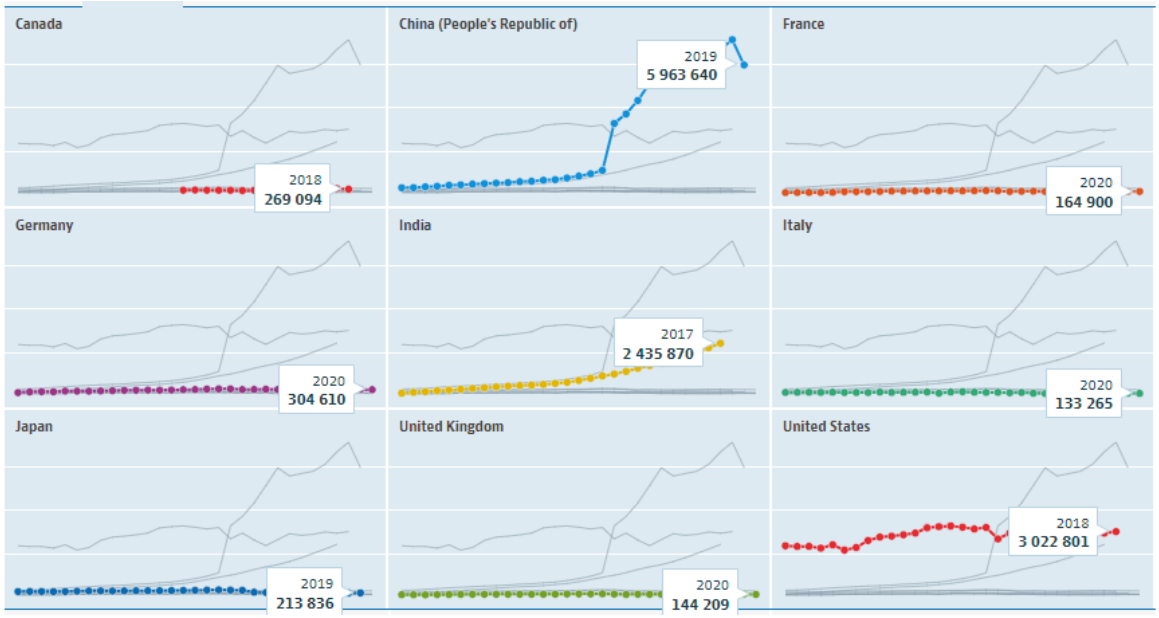
The World Context

Given the challenges of data availability and varied reporting/statistical practices, undertaking a cross-country comparison can be challenging. One dataset that can perhaps be used for an insight into the quantum of internal trade is the Freight Transport database of the Organization for Economic Co-operation and Development (OECD)[13].

The database collates freight statistics, and defines Freight Transport as the total movement of goods using inland transport. The Data is expressed in *million tonne-kilometres*, which represents the transport of *one tonne* over *one kilometre*. An analysis of Road Freight movement across a panel of 9 countries [USA, China, India, Canada, France, Germany, Italy, Japan and the United Kingdom] throws up some interesting insights.

The present analysis takes into account only the road component. The results are captured in the composite graph below. The grey line graphs in the background of each sub-graph reflects the countries in our control set[14].

Figure 6: Domestic Freight movement of goods in selected countries. Unit is million tonne-kilometres



Based on the above dataset, we may see that the top five countries with largest internal movement of freight, a reliable indicator for the quantum of trade, are China, US, India, Poland and Germany15.

Table 3: Value of Road Freight Movement of Goods – Top 5 Countries [2017]

Country	Year	Million Tonne-KMs
China	2017	6677150
USA	2017	2952877
India	2017	2435870
Poland	2017	348559
Germany	2017	313143

Major highlights from the above graphs are the rapid increase in movement of road freight in China and in India, and the impending rise of India as the country with the second-highest movement of internal freight. This process will be further impacted, in no small measure, by the removal of internal barriers to trade consequent to changes brought about by the introduction of the Indian Goods and Services Tax (GST).

It is in this context that the present paper seeks to examine the contours of India's domestic trade flows and linkages, especially looking at trade at the sub-national [state] level. An attempt is also made to examine the determinants and impact on states, on the basis of their levels of trading, and whether there exists any correlation between the quantum of trade and the state GDP.

This examination is done on the basis of data collected in the process of compliances to be made by taxpayers under the GST laws. Introduced by the One Hundred and First Amendment to the Constitution of India[16], GST is an indirect tax (or consumption tax) levied on the supply of goods and services. Barring a few local taxes, GST has subsumed almost all the indirect taxes in India. By design, it is a multistage, destination-based, value-added tax. In general, it is charged on the value of the supply, and credit is available of the taxes paid on inputs.

The design is intended to capture taxes on the value added, and to act as an in-built mechanism to enhance upstream compliance, as well as to reduce the cascading effect of taxes. Further, GST is designed as a destination-based tax, i.e. it is collected from the point of consumption and not point of origin like previous taxes. A unique feature of the Indian GST is that the central [federal] and state [sub-national] units have pooled sovereignty, and important decisions are taken by the GST Council, which has representatives from the centre as well as from the states.

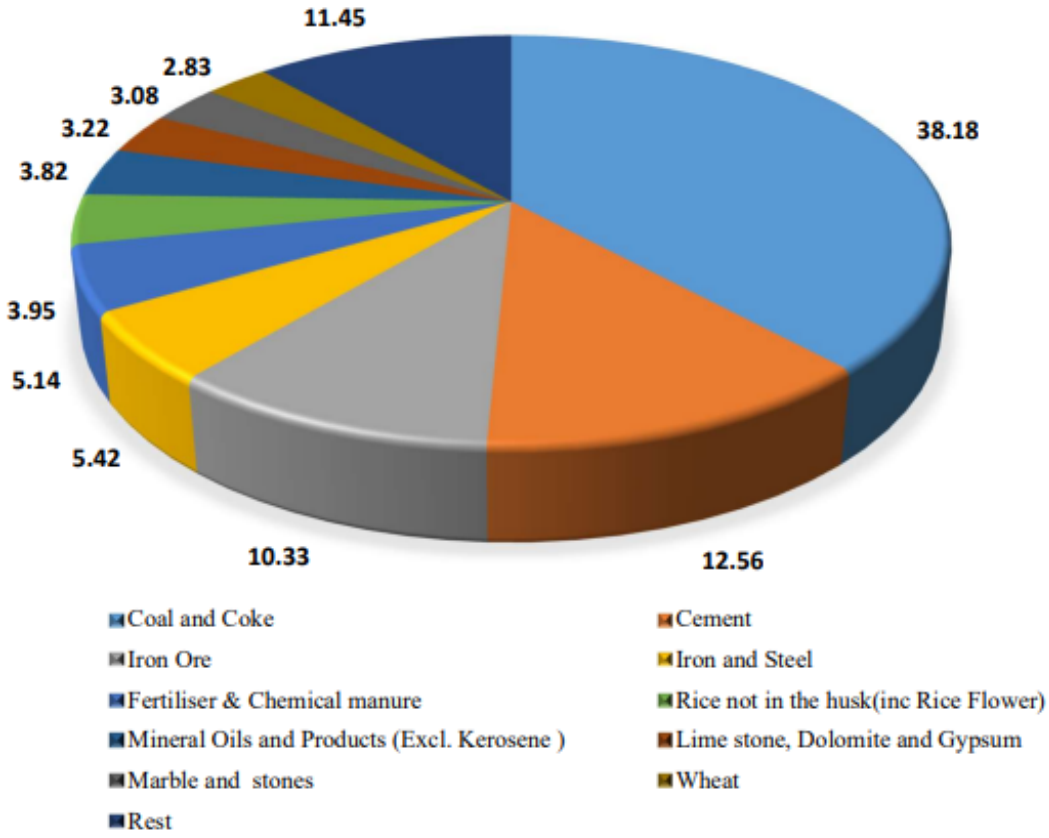
3. How much does India Trade Domestically?

An estimation of the direction, quantum and value of internal trade in India has been like Heisenberg's Uncertainty Principle – estimating all variables together often can be a challenge! Attempts have been made in the past, notably in the Economic Survey, 2016-17[17], however the paucity of reliable data in the public domain makes this analysis difficult.

Among the studies available is a Directorate General of Commercial Intelligence and Statistics (DGCIS) study of intra-national movement of goods between states; however, the data captures only goods movement through rail, air, and inland waterways, thus failing to capture the most important component of trade, i.e. via roads[18]. Crucially, this data also fails to capture the rupee value of the trade flows, and only captures quantities. Moreover, analysis of Railway Freight Data can be distortive, given the heavy [raw materials] preference for rail transport.

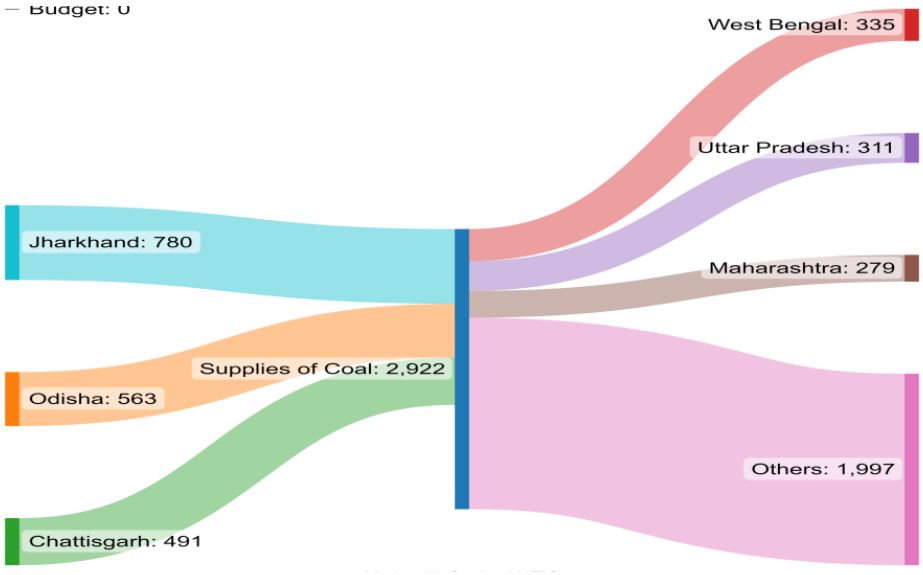
It is perhaps intuitive that the top items transported by Rail include heavy items such as Coal, Cement, Iron Ore, Iron and Steel, Fertilizer & Chemical etc. The share of top 10 commodity groups in state-to-state movement of goods in 2020-21 by rail is depicted as under[19]:

Figure 7: Share of top 10 commodity groups in state-to-state movement of goods in 2020-21 by rail



Given the tilt of rail movement of goods towards primary raw materials, an examination of the inward and outward movement of goods between Indian States gives us interesting pointers as to the direction of flow of raw materials and therefore of industrialization and value addition. The following Sankey Diagram captures the direction of the flows.

Figure 8: Flows of Rail movement of Coal – Major Suppliers to Major Consumers (Quantity in 100,000 MTs)



An estimation of the quantum of trade could perhaps be made on the basis of National Statistical Data on the nominal Gross Value Added (GVA). Although rich data on GVA is available at a disaggregated sectoral level from 1950 onwards, however given the manner of grouping of the data in wide buckets with multiple components, it is difficult to disaggregate and distil the components pertaining to trade.

Further, while there is likely to be a correlation with domestic trade, the statistical yardstick for the Gross Value Added [*at Basic Prices*] includes measures such as construction, electricity, gas and water supply, hotels, transport & communication etc. That being so, an estimation of the quantum of trade from the GVA statistics is unlikely to give an accurate picture.

4. Estimating India's Domestic Trade Flows: Through the GST Crystal Ball

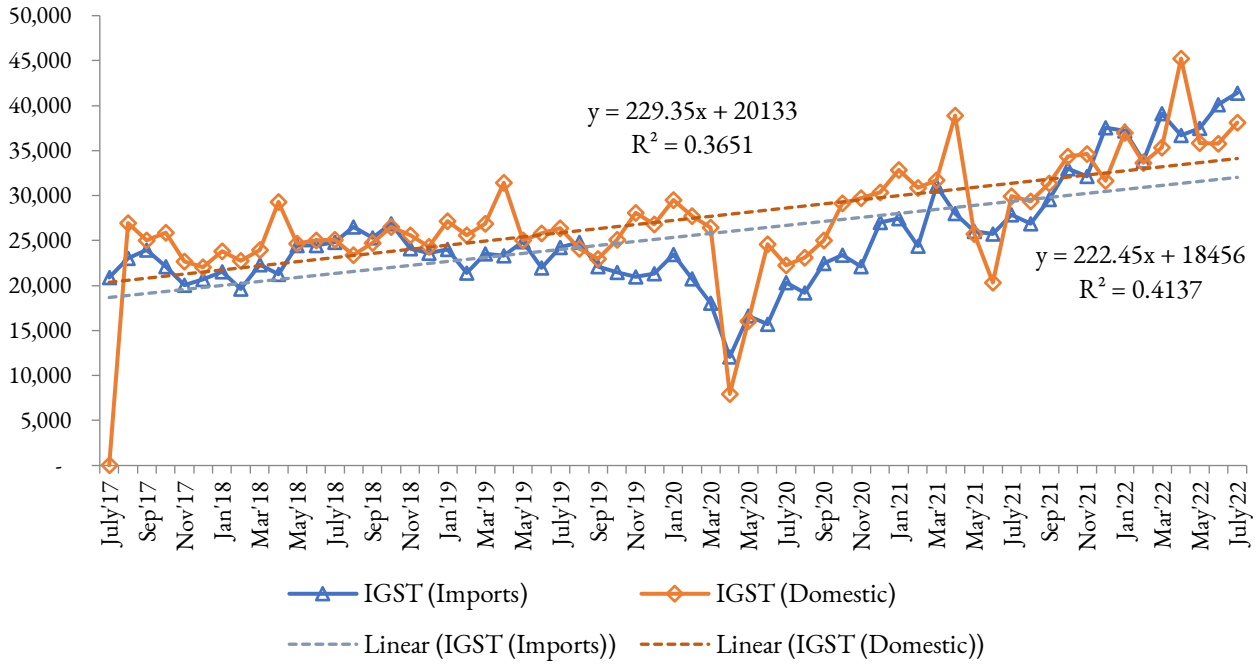
The Goods & Services Tax (GST) introduced in India from the 1st of July, 2017 replaced a large number of national and sub-national taxes and levies, thereby not only uniting India into a truly common market with minimal distortions and tax arbitrages, but also put in place administrative structures which provide for regular reporting of rich tax data.

Further, owing to the uniqueness of the Indian GST meta-structure and the need for apportionment of Revenue between the States and the Centre, the reporting requirements for GST taxpayers is designed in a way that lends itself to interpretation of domestic flows of goods across the country[20].

The GST in India encompasses three taxes – the Central GST (CGST) [reflecting the Federal component]; State GST (SGST) [reflecting the State component], and the Integrated Goods and Services Tax (IGST). Whereas CGST and SGST are levied on intra-State supplies, IGST is levied on inter-State transactions and on imports.

Therefore, tracking IGST collections can provide interesting insights into the inter-State movement of goods in India[21]. Since the introduction of GST, we see a general upward trend in IGST Collections. The same is captured in the figure below. It may be kept in mind that IGST collections pertain to both services as well as goods.

Figure 9: IGST (Domestic & Import) Collections from Jul '17 to Jul '22 [Figures in Rs. Crores]



Estimating the size of the pie: Decomposing the Taxable Base

E-way Bill data captures the assessable value of intrastate as well as interstate supplies; however, since the values pertain to each supply, there are bound to be supplies the credit of which will be available as an input. Taking into account E-way Bill based assessable data is thus likely to cause an overestimation of the quantum of domestic trade. Therefore, an alternative mechanism is proposed.

As the thrust of the instant examination is with regard to the transport of goods, the taxable base needs to be disaggregated so as to reflect only Goods. To do so, it is proposed stand on the shoulders of giants, making use of the 2015 Report on the Revenue Neutral Rate and Structure of Rates for the Goods and Services Tax (GST), chaired by the then Chief Economic Advisor, Government of India[22].

The report deploys three approaches to estimate the taxable base. One amongst the three is the Indirect Tax Turnover Approach. Initially presented by the National Institute of Public Finance and Policy (NIPFP)[23], it estimates the base in a three-step process.

First, it estimates the goods base at the level of the States. This base is estimated by converting data on actual collections and statutory rates into a goods base. In other words, the effective rate becomes the basis for the estimation of the goods base. In the absence of data for all the States, the key assumption is that States collect revenues at the three rates (1 per cent, 6 per cent, and 14 per cent) in such a proportion so as to yield a total taxable base of Rs. 30.8 Lakh Crore [USD 387.5 billion]. In the second stage, the services base is estimated at Rs. 40.8 Lakh Crore [USD 513.5 billion], based on turnover data of 3.25 Lakh [325,000] firms as per Ministry of Corporate Affairs database.

In a third stage, adjustments are made to this base to remove IT-related services, because a large part of them are exported, and to remove most of real estate and financial services from the base, because of the way these items there are treated under the GST. This adjusted base is then subject to an input-output analysis, to deduct from the base taxable inputs used for service provision, and to deduct services used as inputs into taxable manufacturing.

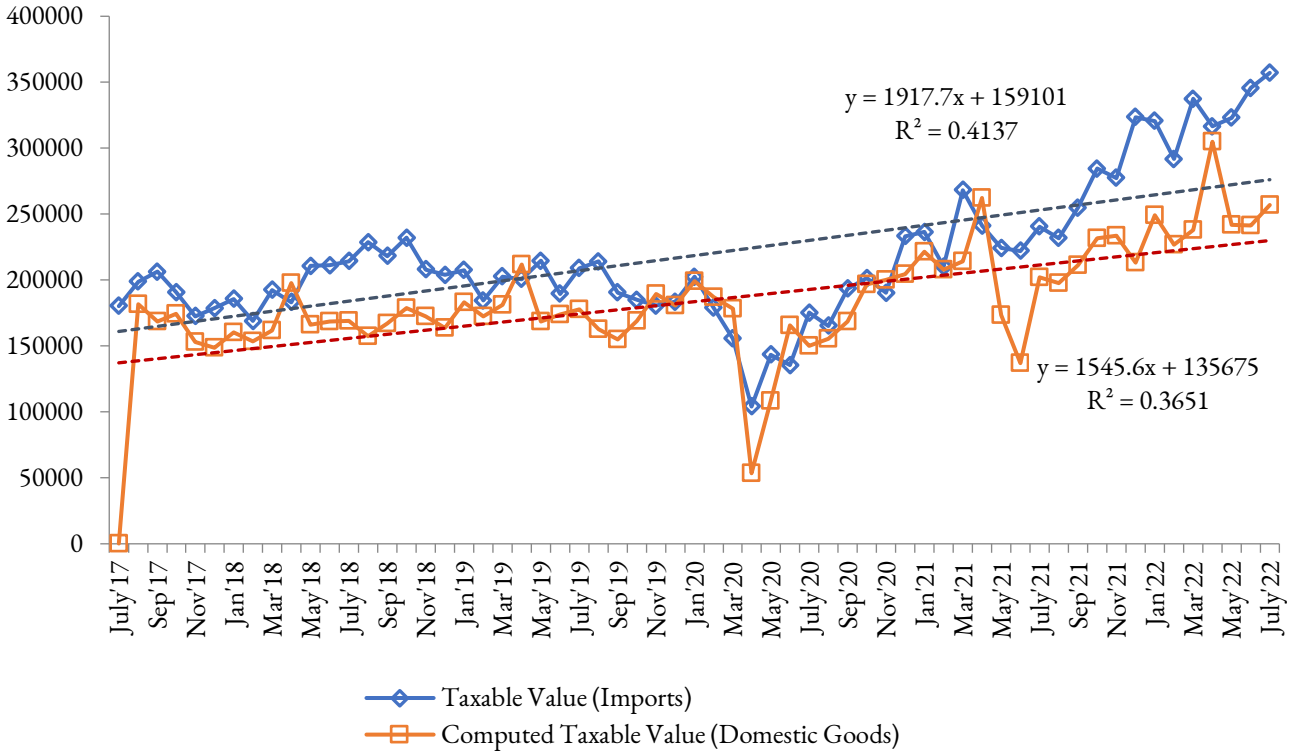
All these adjustments result in an incremental services base (incremental to whatever has already been incorporated in goods) of Rs. 8.5 Lakh Crore [USD 106 billion] and a combined base (goods and services) of Rs. 39.4 Lakh Crore [USD 495.77 billion]. Therefore, removing the incremental services base, the Goods only taxable base [including services incorporated in them] is indicated to be about Rs. 30.9 Lakh Crore [USD 495.77 billion]. As these figures pertain to 2015, when India's GDP was USD 2,103 Billion, the figures are extrapolated to 2021 [GDP USD 3,173 Billion], therefore the adjusted goods tax base comes to Rs. 46.62 Lakh Crore [USD 748.01 billion].

In light of the above, in order to obtain a goods only picture of IGST on Import and Domestic Goods Supplies, the Domestic IGST collections are bifurcated into the Goods and the Services component. This is done in the same proportion as the apportionment of the taxable base between goods (78.17%) and services (8.5%) as discussed above. Accordingly, Figure 9 is recast as Figure 10 below. It may be seen that the broad contours and trends remain the similar.

As per Reserve Bank of India (RBI) estimates, the effective weighted average GST rate has declined from 14.4 at the time of introduction of GST to about 11.6 in July 2019[24]. Presuming the weighted effective rate to be 11.6%, the value of interstate supplies [*IGST Collections x Weighted Average Rate*] can be calculated. However, since certain commodities are outside the purview of GST, the above calculation would yield an underestimation.

In order to smoothen the data, the computed import value data [from IGST Import Collections] is compared to the actual value of import into the country. Since the import basket is broadly comparable to the basket of goods being traded internally, fitting the same ratio on the computed value of domestic clearances provides an estimate of the values for value of Goods [Domestic] and the total value of Goods [Imports + Domestic] transported Inter-State.

Figure 10: IGST Goods (Domestic [Computed] & Import) Collections from Jul '17 to Jul '22 [Figures in Rs. Crores]



Further, using the International Monetary Fund's (IMF) Macroeconomic Approach[25] for calculating the tax base, which makes use of national income accounts data and supply-use tables to arrive at the base – B, expressed as:

$$B = \Sigma\,(Y + M - X) - [(1 - e)\,\Sigma(N + I)]$$

Where:

- B is the potential GST base;
- Y is domestic output;
- (M-X) is net imports (imports minus exports);
- (N+I) is consumption of intermediate and capital inputs;
- e is the exempt output ratio (i.e. the tax base associated with inputs used in the production of exempt final consumption);
- and the summation is over 140 goods and services and 66 sectors, based on national accounts.

The following assumptions are made: full compliance; full pass-through of the GST into prices; no behavioural response; a single positive GST rate, and zero-rated exports. Further, the Chief

Economic Advisor's Report on a Revenue Neutral Rate (RNR) estimated that taking into account exemptions and exclusions from GST, the potential taxable base reduces to 67 per cent of GDP. Further, the report also estimates a 20% revenue loss.

Factoring the above into our calculations, the value of Goods [Domestic] and the total value of Goods [Imports + Domestic] transported Inter-State for the period 2017-18 to 2021-22 yields the following figures. The figures include both goods under GST as well as goods outside the purview of GST.

Table 4: Computed Value of Goods Transported

Figures in USD Billions

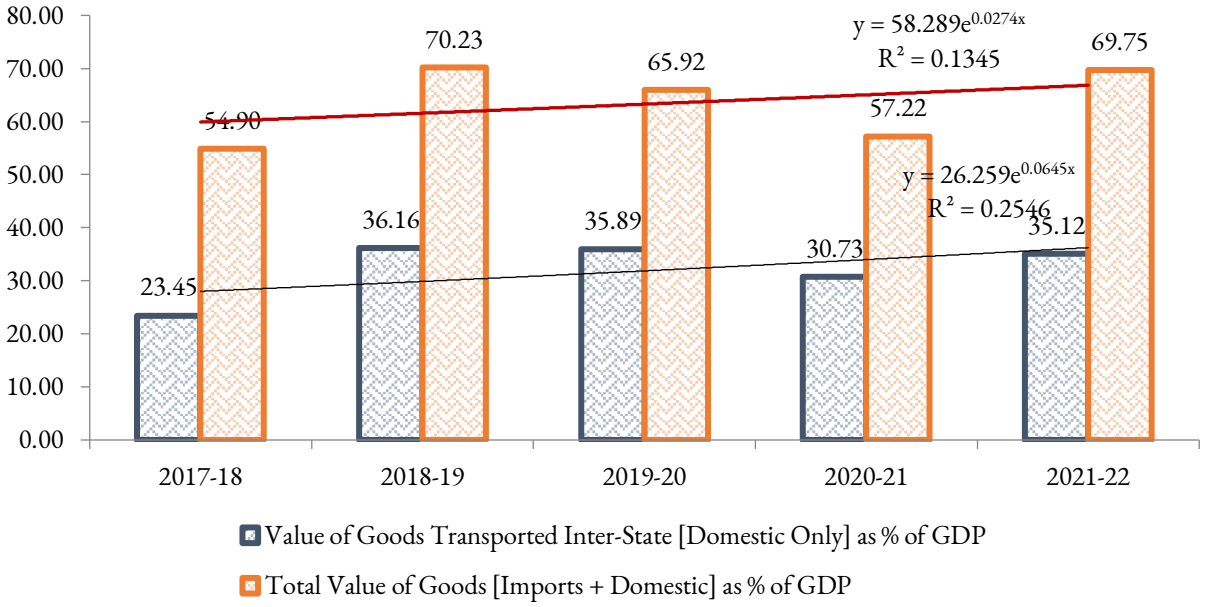
	2017-18	2018-19	2019-20	2020-21	2021-22
Computed Value of Goods Transported Inter-State [Domestic] [USD Billion]	621.72	977.00	1016.09	819.70	1114.24
Total Value of Goods Traded Domestically [Imports + Domestic] [USD Billion]	1455.45	1897.72	1866.30	1526.14	2213.08

5. Making One India to Make in India

Computing domestic trade and domestic trade including value of imported goods over the last five years shows that as a percentage of GDP, both the Value of Goods Transported Inter-State [Domestic Only] as well as the Cumulative Value of Imports and Domestic Goods have shown an upward trend. In the period under examination, i.e. 2017-18 to 2020-21, India's GDP grew from USD 2651 Billion to USD 3173 Billion, a growth of 19.7%. In the corresponding period, the Value of Goods Transported Inter-State [Domestic Only] increased by 44% and the Cumulative Value of Imports and Domestic Goods increased by 34%.

In many ways this is indicative of the transportation efficiency gains that have accrued after the introduction of GST, as well the enhanced economic integration of Indian states. The Value of Goods Transported Inter-State [Domestic Only] as well as the Cumulative Value of Imports and Domestic Goods, expressed as a percentage of the GDP is as under:

Figure 11: Value of Goods Transported Inter-State [Domestic Only] and Cumulative Value of Imports and Domestic Goods, expressed as a percentage of the GDP



From where to where?

While the above data gives an indication of the cumulative figures increasing economic cohesion between Indian states, to take our examination a step further, it would be interesting to note the contours of the trade.

Once again an administrative tool from the GST toolkit – E-Way Bill Data – is deployed to give us some insight into the movement of goods. E-way bills were introduced from April 2018, and are documents required to be carried by a person in charge of a conveyance carrying goods of value exceeding Rs. 50,000 [~USD 628]. E-way Bills can be generated from a Common Portal, the *GST e-Way Bill System*.

While, as discussed above, a quantification based on E-Way Bills may be an overestimation of internal trade, since that both inputs are final products are reported, however the examination is useful for making an intra-temporal study of how the flows. At an aggregate (all-India) level the figures are as under:

Table 5: Assessable Values of Intra-State and Inter-State Supplies as per E-Way Bills issued

Year	Value of Intra State Supplies (Rs. Cr.)	Value of Inter State Outward Supplies (Rs. Cr.)	Value of Inter State Inward Supplies (Rs. Cr.)
2019-20	76,72,185.07	79,40,746.30	83,89,027.53
2020-21	7,78,46,713.84	7,72,98,049.40	8,04,42,957.02
2021-22	42,38,00,715.40	42,97,91,482.71	44,70,87,983.39
2022-23 [Apr-Jul]	42,15,42,492.69	41,59,25,123.45	43,55,33,812.81

From the above, we may make an interference that states, taken as a whole, trade within almost as much as they trade amongst themselves.

With the introduction of E-way Bill data, it is now possible to examine the trade flows into and out of a State. Analysis of data put out by the GST Council[26], leads to an Internal Trade Balance measurement [*assessable value of outgoing supplies - assessable value of incoming supplies*], which brings to light some novel insights.

Figure 12: Net Trade Balance of Indian States [Net Outgoing Supplies – Incoming Supplies] 2022-23 [Apr-Jul]

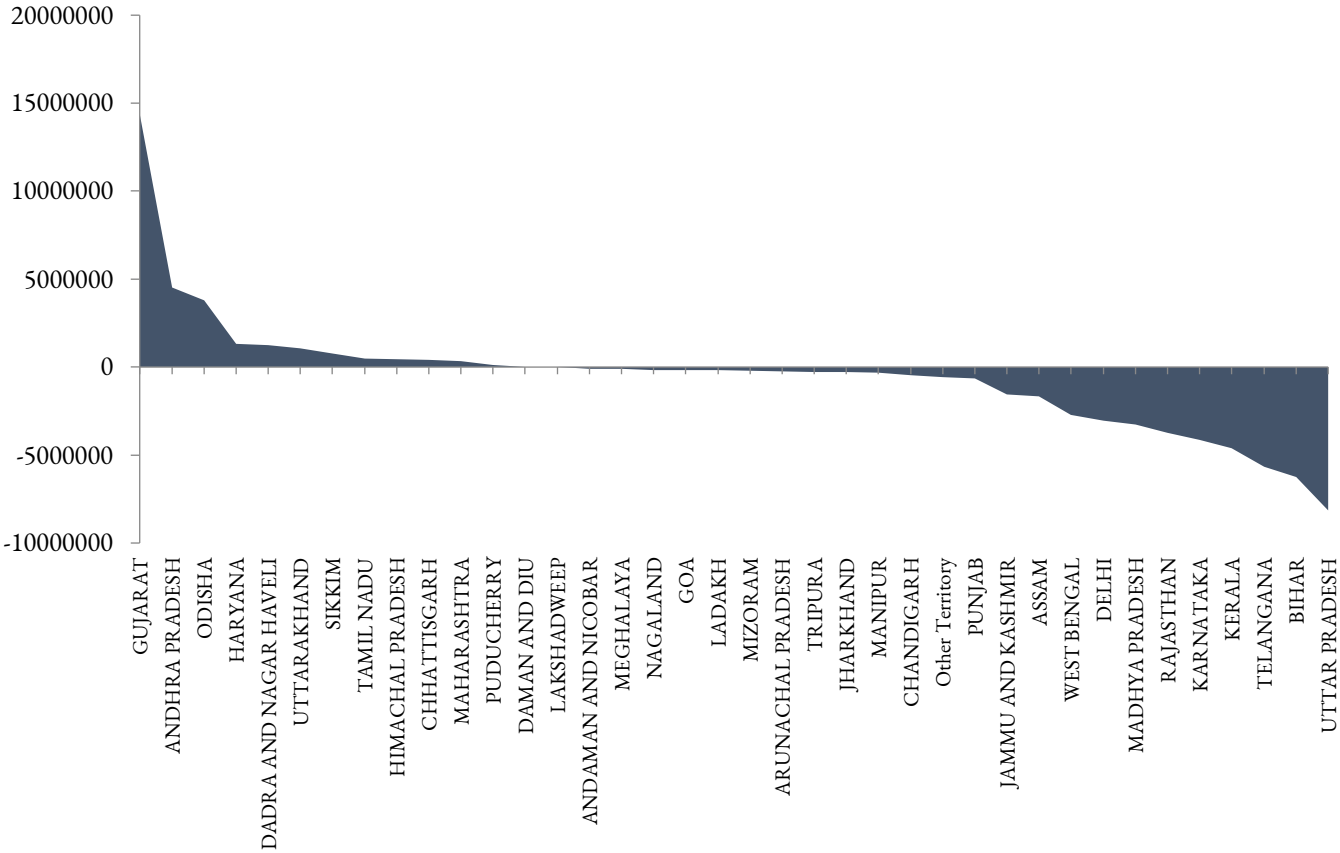
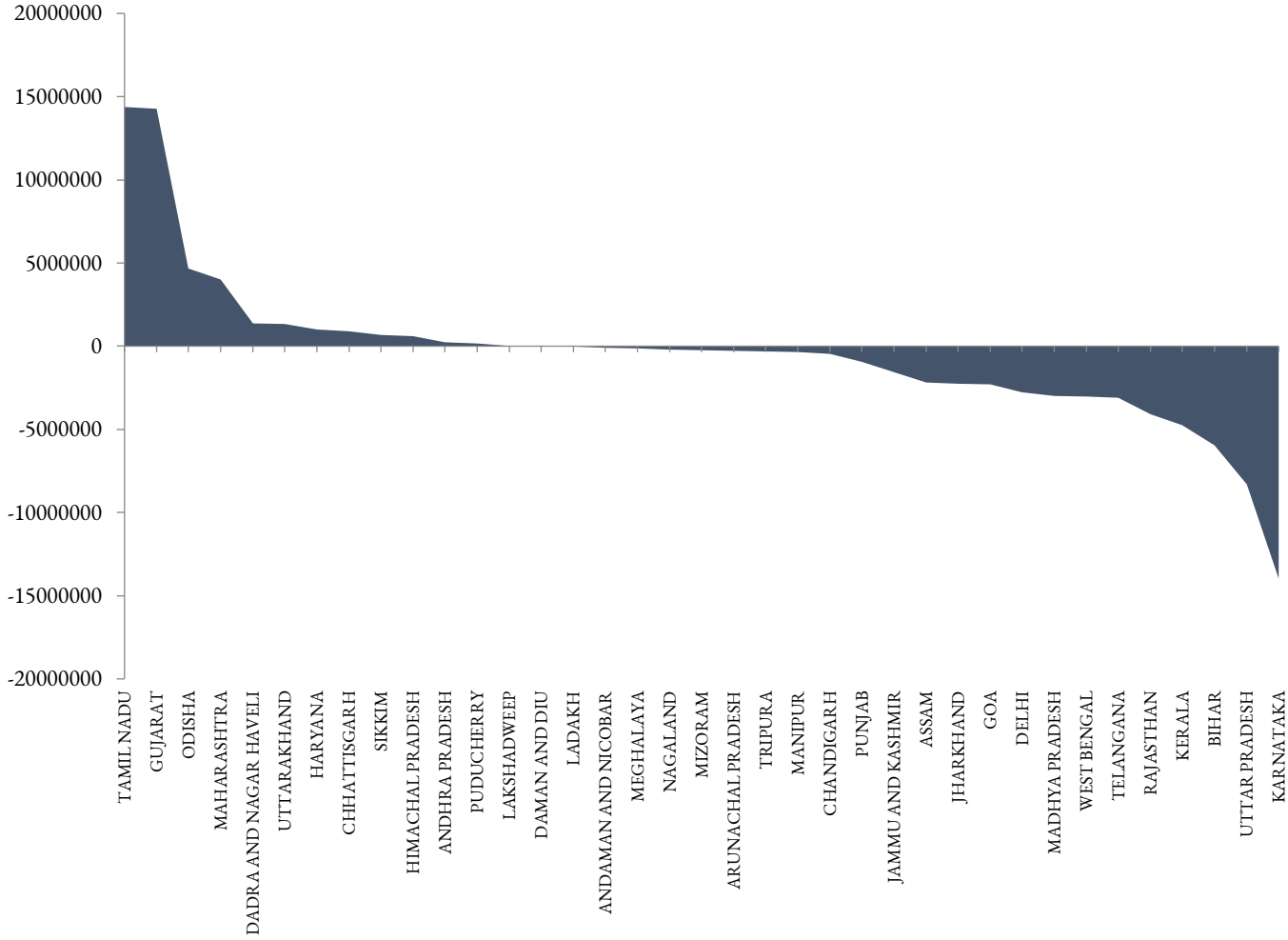


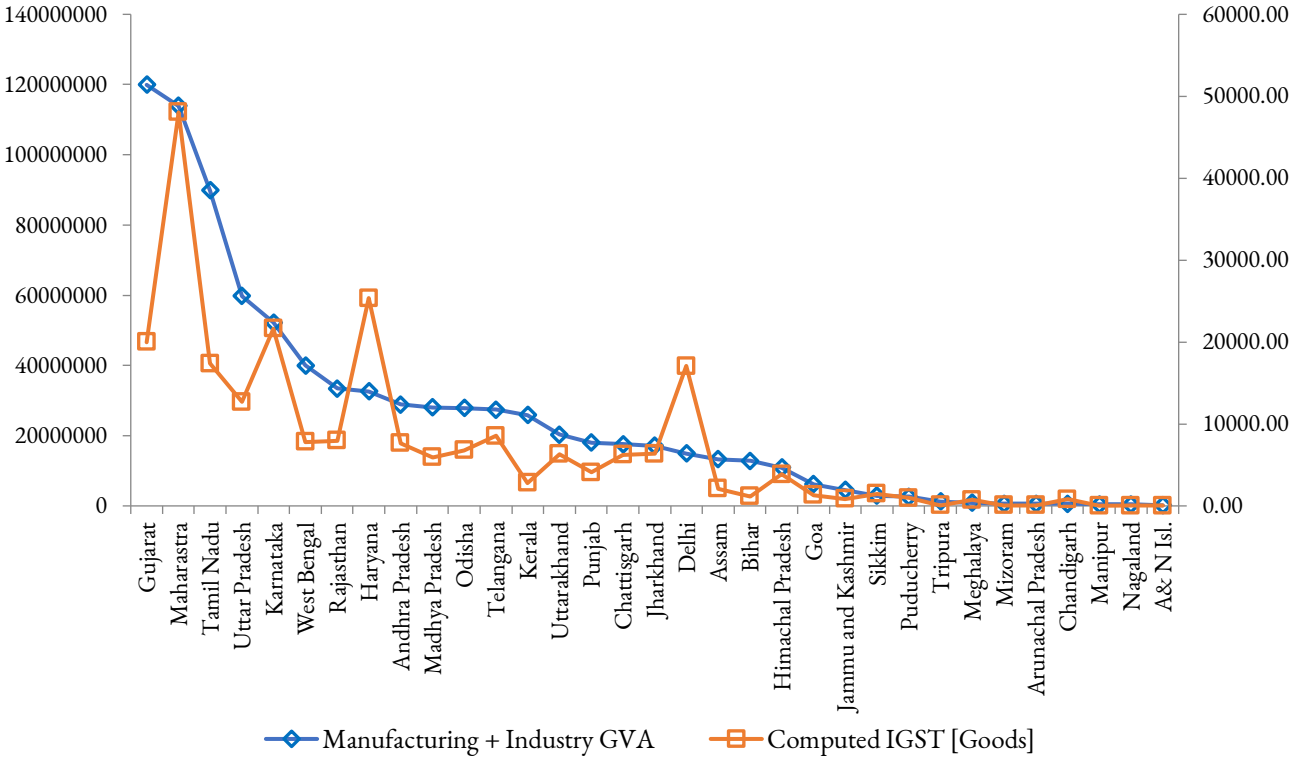
Figure 13: Net Trade Balance of Indian States [Net Outgoing Supplies – Incoming Supplies] 2021-2022



The above figures capture the net trade balance for the year 2021-22 and the first four months of 2022-23 [April to July]. While the major consuming and producing states are intuitive, it is interesting to note the smaller states such as Dadra & Nagar Haveli, Uttarakhand and Sikkim being net internal exporters. It may be noted that this figure is dynamic, and would perhaps take some time to settle down.

Another interesting dimension of the analysis of the IGST Data is obtained by plotting it against state-wise Gross Value Added (GVA) Data. Since the IGST Data is taken on the goods base, a strong correlation may be expected. The GVA Data used is as per RBI Handbook of Statistics on Indian States 2020-21[27]. The GVA data is available disaggregated into manufacturing, services, agriculture, banking/insurance etc. Since an examination of the trade in goods is the prime focus, the GVA in *Manufacturing* and *Industries* has been used for the following analysis.

Figure 14: State wise Gross Value Added and IGST Collections (2019-20) Rs. In Crore



The above figure indicates that, barring a few exceptions, GVA and IGST collections indicate a broad correlation. One hypothesis for outliers with higher proportionate GVA as compared to the IGST collections (e.g. Gujarat, Tamil Nadu etc.) is that it could be on account of a higher proportion of zero-rated supplies - essentially exports. On the other hand, the cases of IGST collections proportionately being higher could indicated states with a higher proportion of trade.

Who moved my goods?

E-way Bills contain rich granular data in terms of origins, destinations, description of the goods, related parties, distance travelled etc. However, perhaps because the information is collected in a fiduciary capacity and is likely to be commercially sensitive, there is little information available in the public domain.

However, a sense of the details at the aggregate level is published by the GST E-Way Bill System, maintained by the National Informatics Centre (NIC)[28].

Figure 15: Top 5 Sectors (Nos. of E-Way Bills in 0.1 Millions)

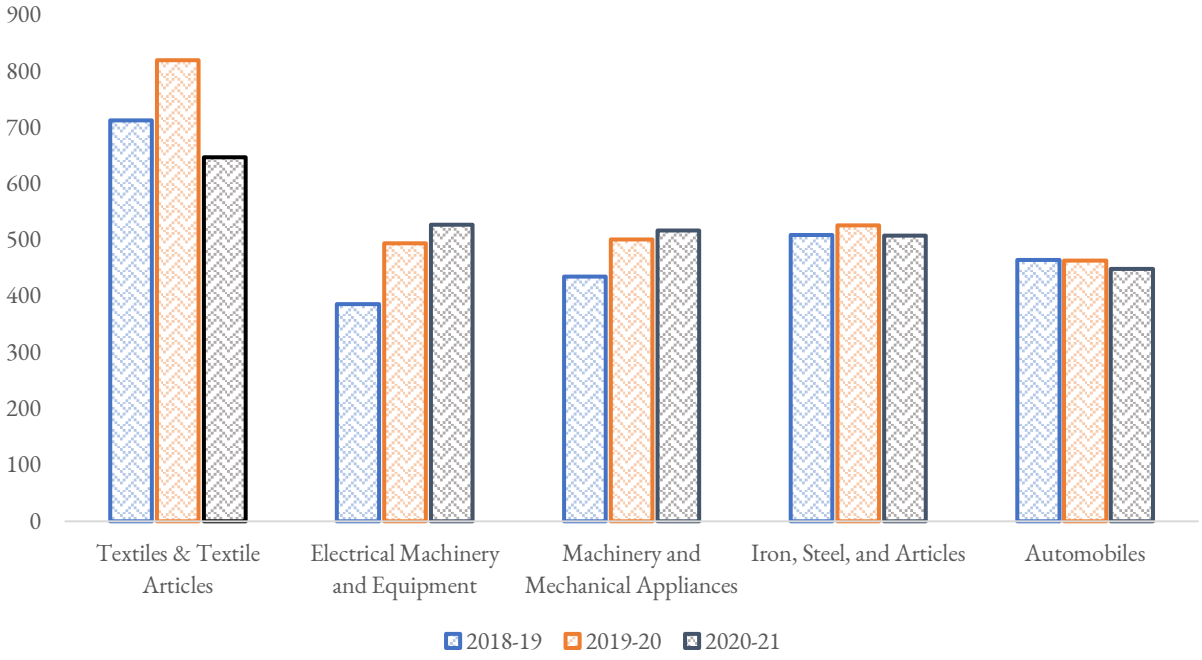


Figure 16: Top 5 States with Inter-state EWB (Nos. In 0.1 Millions)

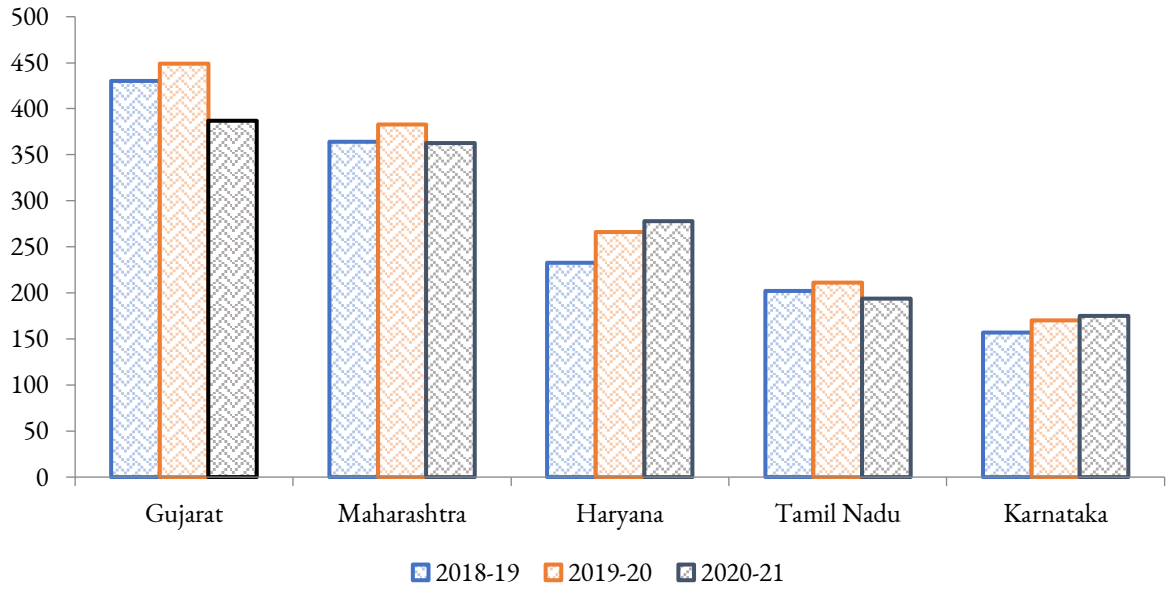
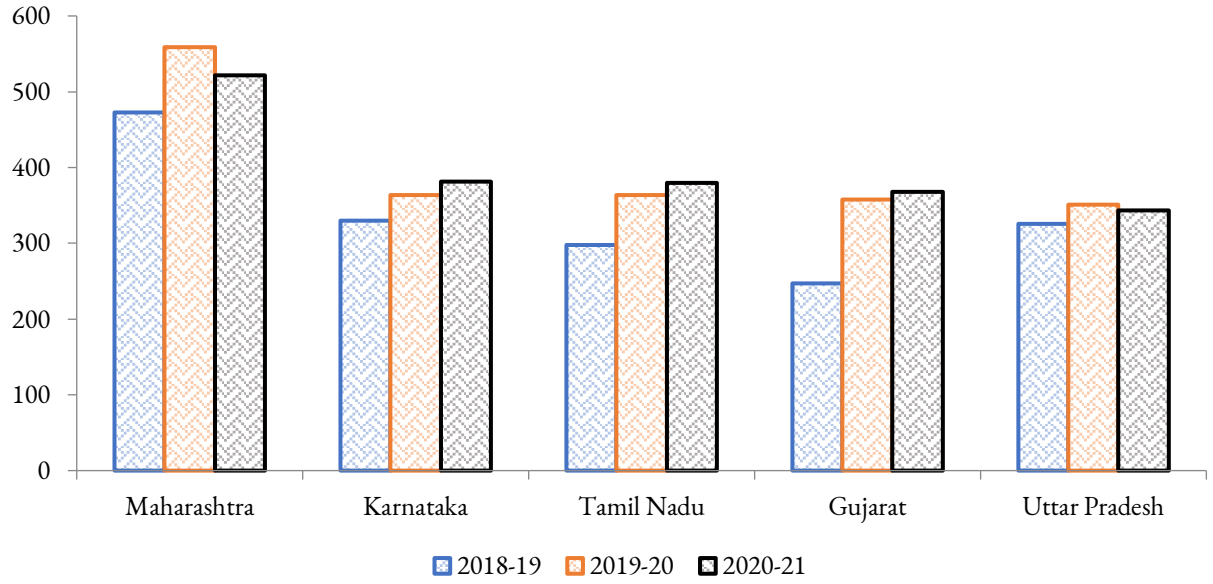
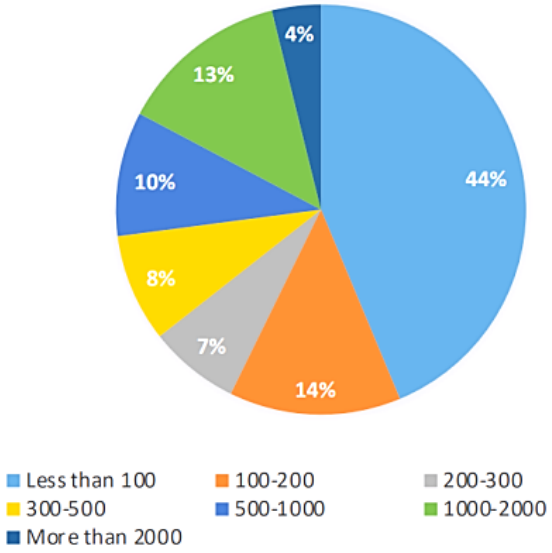


Figure 17: Top 5 States with Intra-state EWB (Nos. In 0.1 Millions)



Analysis of distance travelled by the goods as per E-waybill data indicates that a large percentage of E-way Bills (58%) travel within 200 kms. This is in line with the postulate discussed earlier regarding the gravity effects of trade, and has implications for the possible location of manufacturing/trading hubs (which could be located closer to the centres of consumption). It is also noted that 17% of the E-Way Bills pertain to goods that travel more than 1000 kms. There is a likelihood that these may relate to export goods from the hinterland, enroute to major ports on the eastern/western seaboard.

Figure 18: Distance segregation of E-Way Bills (Figures are Distances in kms.)



Discerning the Routes: Pairing Origins and Destinations

An analysis of the computed and smoothened taxable base [based on IGST Goods Data] gives us a good starting point for estimating aggregate levels of internal trade in India. Analysis of E-way Bills gives an insight into the flows into and out of the states. The question of who trades how much with whom, however, remains to be answered.

Knowing the contours of this internal trade can have applications in logistics, location of industry and movement of factors of production. While the data is captured in E-way Bills, given that it is not available in the public domain, a proxy has been resorted to.

Once again, we stand on the shoulders of giants! In order to construct state-to-state dyads, an exercise was undertaken as part of Government of India's Economic Survey, 2016-17. In the study, the estimates for interstate trade values and trade balances were calculated using the Tax Information Exchange System (TINXSYS), which recorded the Central Sales Tax (CST) collections. The TINXSYS dataset contains CST tax invoices for trades occurring between two states. The dataset is populated by the states individually uploading different CST-related forms – i.e. the trade values reported are imports into a state because CST forms are issued by the importing states.

In the ideal case, each reported transaction is expected to have the Tax Identification Numbers (TINs) of the importing and exporting firms, the invoice date and value, date of issue of the CST form, the nature of these firms, a code for the commodity, and the commercial tax office at which the firms are registered. The data is however not always reported in this consistent format, with the most crucial data point – the name or the code of the exporting state or the TIN of the exporting firm – often being found misreported in the dataset.

Given that the name of origin and destination state for any trade flow is key to understanding interstate trade patterns, several techniques were applied by the Survey, to impute exporting state identifiers for missing observations. First, an attempt was made to purge the exporting firm TIN numbers of special characters or simple typographical errors that might have occurred during the data uploading process. For the resulting 11-digit TIN numbers, the Survey was able to correctly identify the exporting state using the first two digits of the TIN (which correspond to the state's census code).

For the remaining set of missing data transactions, the unique serial number and series number of these missing observations were queried on the GSTN website to explore if states may have manually entered the exporting firm's address. For these addresses, a fuzzy string match was conducted with census names for district, sub-districts and towns. For the matched observations, the corresponding state names were then identified from the Census.

In the third round, for the observations that still continued to be missing, Geographic Information Systems (GIS) mapping APIs were used to identify the geolocation for these firms as best as possible. These geolocations were then taken to QGIS (GIS software) and spatially merged with state data to arrive at the exporting state name.

In the final round, to trim outlier trade values that seemed to be typographical errors, a filter of 1% of GSDP was applied on individual transactions. This implied that all transactions of value greater than 1% were excluded from the dataset. This strategy is not comprehensive in correcting the data for all errors (or minimising misclassification errors) but gives a reasonable picture of the flows. The CST collection covered at the end of the above exercise represented 85% of the States' reported CST collections.

The Survey had then used these dyads to discern trade flows. The study had been carried out just prior to the introduction of GST. In the present study, the same dyad proportions have been applied to the outgoing supply values, as captured by the E-Way Bill data, in an attempt to understand the contours of the trade flow. The results of the examination are as under:

Table 6: 2020-21 Percentage Trade flows [as per exporting States] between states [Green indicates higher trade]; model weights 2015-16

		Importing State																			
		MH	GJ	KA	AP	UK	RJ	MP	WB	TN	KL	OR	UP	DL	CG	HP	HR	BR	JH	GA	AS
Exporting State	MH		40.31	25.40	21.83	18.83	9.09	21.93	12.02	22.68	16.08	10.84	8.86	13.39	17.15	16.94	10.67	10.39	11.61	33.11	10.00
	GJ	27.81		8.13	13.98	9.73	31.72	20.91	10.18	14.05	13.84	12.94	13.07	7.88	10.58	10.39	21.58	4.40	5.72	23.26	6.21
	TN	13.60	6.80	25.29	18.62	3.19	4.44	7.35	6.87		25.88	8.74	4.32	5.86	6.93	3.54	3.77	3.25	7.82	5.30	7.37
	HR	8.56	7.21	7.28	6.16	11.72	14.21	6.54	7.79	5.75	8.82	5.78	12.90	19.26	5.23	19.52		8.98	7.39	4.56	19.39
	KA	11.02	4.62		14.76	2.85	3.08	7.64	5.99	23.29	17.71	6.64	4.49	4.31	4.50	2.75	4.75	2.77	6.03	16.01	4.96
	AP	8.50	2.99	11.95		1.74	8.70	4.19	4.91	12.81	6.90	13.76	3.49	2.32	6.38	4.26	1.84	3.40	2.85	6.00	3.58
	UP	3.68	4.01	2.55	2.29	22.33	4.96	5.55	4.36	2.24	1.97	2.89		11.90	3.05	8.28	12.98	6.13	3.80	1.27	3.61
	RJ	3.83	15.87	2.21	2.59	6.40		4.52	5.33	2.69	2.32	3.05	6.37	6.85	2.23	5.01	7.39	5.78	4.33	1.45	5.14
	DL	2.78	4.66	2.85	1.88	14.04	6.31	2.49	3.04	1.96	2.86	2.75	17.78		3.33	15.76	17.92	3.62	1.63	1.02	4.34
	WB	3.29	3.14	1.89	3.23	1.48	1.94	3.77		2.65	1.59	16.83	3.07	2.85	10.86	1.91	2.43	20.05	26.04	0.61	21.17
	MP	3.79	3.22	1.43	2.31	2.20	6.43		9.00	2.66	0.91	2.57	6.08	4.24	6.83	2.39	1.93	3.00	2.84	4.97	1.22
	UK	2.95	1.65	2.53	2.05		2.59	2.92	3.25	1.81	1.27	2.52	6.45	11.49	2.61	6.30	4.76	5.60	4.77	0.88	3.23
	OR	2.47	1.12	1.53	3.06	1.11	0.84	1.94	9.86	0.69	0.47		1.89	0.71	15.06	0.41	0.83	4.51	8.53	0.16	4.16
	CG	3.75	2.01	1.53	3.95	0.42	2.55	5.50	1.72	0.83	0.54	5.30	1.50	1.31		0.78	0.92	0.98	3.35	0.56	3.34
	JH	0.71	0.48	0.85	0.99	1.45	1.17	1.09	11.52	0.57	0.39	3.58	5.53	1.05	3.65	1.00	3.15	13.37		0.16	1.07
	HP	1.12	0.74	0.86	0.75	2.00	1.33	0.85	0.97	0.58	0.40	0.60	2.48	4.86	0.54		4.15	1.59	0.54	0.25	0.51
	KL	0.96	0.49	2.41	0.98	0.22	0.16	0.39	0.44	4.30		0.44	0.42	0.69	0.16	0.38	0.24	0.21	0.32	0.42	0.11
	GA	0.93	0.34	1.15	0.39	0.15	0.25	0.38	0.43	0.32	0.88	0.24	0.22	0.54	0.15	0.25	0.24	0.24	0.23		0.31
	AS	0.20	0.33	0.13	0.15	0.06	0.14	1.65	1.87	0.04	0.03	0.34	0.54	0.38	0.52	0.05	0.42	1.74	0.38	0.00	
	BR	0.04	0.02	0.03	0.03	0.09	0.08	0.39	0.44	0.08	0.00	0.17	0.54	0.12	0.21	0.08	0.04		1.82	0.00	0.27
	Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 6: 2020-21 Percentage Trade flows [as per exporting States] between states [Green indicates higher trade]; model weights 2015-16

Exporting State \ Importing State	MH	GJ	KA	AP	UK	RJ	MP	WB	TN	KL	OR	UP	DL	CG	HP	HR	BR	JH	GA	AS	Total
MH		28.08	13.19	10.07	7.43	3.35	7.75	3.74	6.16	4.04	1.78	1.44	2.16	2.55	2.34	1.31	1.19	0.97	2.31	0.15	100
GJ	31.71		4.98	7.61	4.53	13.77	8.71	3.74	4.50	4.10	2.51	2.50	1.50	1.85	1.69	3.13	0.59	0.56	1.91	0.11	100
TN	21.80	7.86	21.78	14.25	2.09	2.71	4.31	3.54		10.79	2.38	1.16	1.56	1.71	0.81	0.77	0.62	1.08	0.61	0.18	100
HR	16.51	10.01	7.54	5.66	9.23	10.43	4.61	4.83	3.11	4.42	1.89	4.17	6.19	1.55	5.38		2.05	1.23	0.63	0.57	100
KA	23.98	7.25		15.32	2.53	2.56	6.07	4.19	14.23	10.02	2.46	1.64	1.56	1.51	0.85	1.31	0.71	1.13	2.51	0.16	100
AP	23.70	6.00	17.90		1.98	9.23	4.27	4.41	10.03	5.00	6.52	1.63	1.08	2.74	1.70	0.65	1.12	0.69	1.21	0.15	100
UP	11.64	9.15	4.33	3.46	28.87	5.98	6.42	4.44	2.00	1.62	1.56		6.28	1.49	3.74	5.23	2.30	1.04	0.29	0.17	100
RJ	12.36	36.90	3.83	3.98	8.43		5.32	5.53	2.44	1.94	1.67	3.44	3.68	1.11	2.31	3.04	2.21	1.20	0.34	0.25	100
DL	9.81	11.84	5.41	3.16	20.23	8.48	3.21	3.45	1.95	2.63	1.65	10.52		1.81	7.94	8.05	1.51	0.50	0.26	0.23	100
WB	14.27	9.79	4.40	6.68	2.62	3.20	5.97		3.22	1.79	12.40	2.23	2.05	7.24	1.19	1.34	10.29	9.74	0.19	1.40	100
MP	18.96	11.61	3.85	5.52	4.49	12.26		14.49	3.73	1.18	2.18	5.10	3.54	5.26	1.71	1.23	1.78	1.23	1.79	0.09	100
UK	17.41	7.01	8.03	5.79		5.83	6.30	6.18	3.00	1.95	2.53	6.39	11.31	2.37	5.32	3.58	3.92	2.43	0.38	0.29	100
OR	16.72	5.47	5.56	9.86	3.06	2.15	4.79	21.45	1.32	0.82		2.14	0.80	15.66	0.40	0.71	3.61	4.98	0.08	0.43	100
CG	26.64	10.27	5.83	13.38	1.22	6.90	14.27	3.94	1.65	0.99	6.40	1.79	1.56		0.79	0.84	0.82	2.05	0.29	0.36	100
JH	6.00	2.95	3.86	3.98	5.02	3.78	3.37	31.36	1.35	0.85	5.15	7.84	1.49	4.75	1.21	3.39	13.40		0.10	0.14	100
HP	16.22	7.73	6.73	5.22	11.86	7.34	4.52	4.52	2.37	1.52	1.49	6.05	11.76	1.20		7.68	2.73	0.67	0.27	0.11	100
KL	18.55	6.82	25.04	9.06	1.71	1.20	2.76	2.76	23.33	0.00	1.45	1.36	2.22	0.48	1.05	0.58	0.47	0.54	0.59	0.03	100
GA	30.71	7.98	20.25	6.15	1.97	3.18	4.51	4.51	2.95	7.56	1.35	1.20	2.96	0.77	1.18	1.00	0.95	0.66		0.16	100
AS	8.25	9.53	2.78	2.91	1.03	2.15	24.36	24.36	0.45	0.30	2.32	3.65	2.58	3.24	0.29	2.17	8.33	1.32	0.00		100
BR	5.10	1.85	1.77	1.60	4.63	3.58	17.57	17.57	2.82	0.13	3.58	11.25	2.49	4.04	1.35	0.63		19.55	0.00	0.51	100

In the above heatmaps [ordered for exports from States and into States], the intensity of colour shade indicates the intensity of the trading partnership between the two state pairs. The darker green/yellow shades represent the fact that the states rank high in the other's trading distribution. The darker red shade represents the opposite fact, that is, the relevant states ranks quite low in the other's trading share.

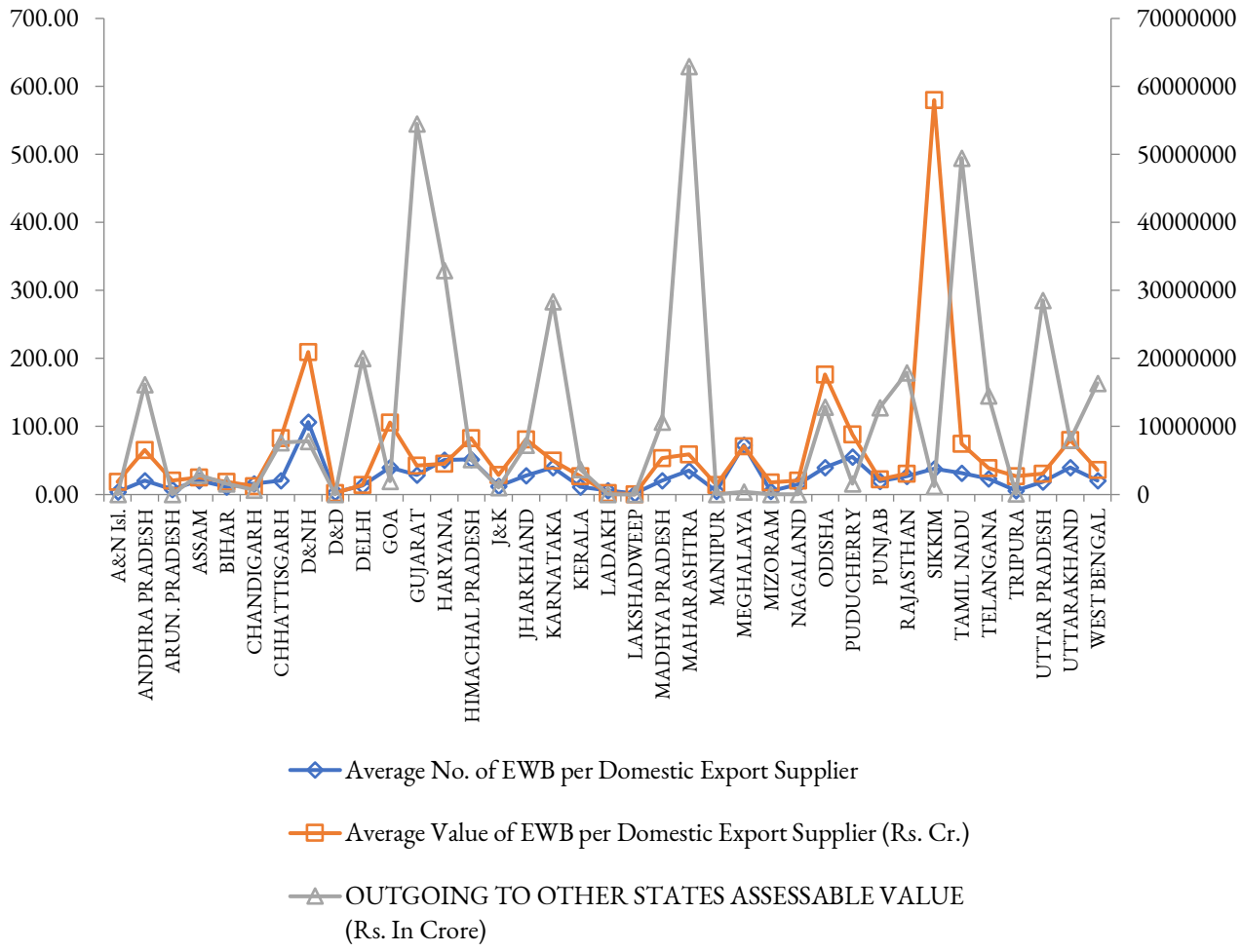
The colour codes indicate the central role of Maharashtra in every other state's trade flow - it is the most important exporting partner for every state and also serves as the predominant importer for goods from almost every other state, with Assam being at the other end of the colour spectrum - it ranks low in both exporting as well as importing relationships with all other states. More generally, states that are close to each other tend to trade more with each other, and states that are richer trade with each other more than with others – again underscoring the gravity effects of trade.

It may be noted that the underlying structure for this model is dated just prior to the introduction of GST. Subject to availability of more recent disaggregated E-Way Bill data, the model could undergo a revision.

As a corollary, based on analysis of E-Way Bills data, the average number and average value of E-Way Bills issued per outgoing Supplier was also examined. The hypothesis being that higher averages indicate fewer suppliers and fewer supplies, and thus a bias towards a few big industries.

Plotting this against the total value of outgoing supplies shows that in cases where the total supply value is greater, the average numbers indicate both a higher number and a higher value of E-Way Bills per supplier, implying a greater spread of industrialization/formalization of the state's economy.

Figure 19: Total value of outgoing supplies (2021-22, Rs. in Crore) & average number and average value of E-Way Bills issued per outgoing Supplier



6. Conclusion

The instant study began with an attempt to understand and quantify the volume and directions of the flow of goods within the country. To do so, primarily data from India's national value added tax i.e. the Goods & Services Tax (GST) was used. The major findings from the study are summarized as under:

- The study was able to quantify interstate trade flows to amount to about 69% of the GDP when domestic movement of import goods are included, and about 35% of the GDP when only domestically-produced goods are taken into account.
- In the period under examination i.e. 2017-18 to 2020-21, India's GDP grew from USD 2651 Billion to USD 3173 Billion, a growth of 19.7%. In the corresponding period, the Value of Goods Transported Inter-State [Domestic Only] increased by 44%, and the Cumulative Value of Imports and Domestic Goods increased by 34%. In many ways, this is indicative of the transportation efficiency gains that have accrued after the introduction of GST, as well the enhanced economic integration of Indian States.
- Barring a few exceptions, GVA and IGST collections indicate a broad correlation. One hypothesis for outliers with higher proportionate GVA as compared to the IGST collections (eg. Gujarat, Tamil Nadu etc.) is that it could be on account of a higher proportion of zero-rated supplies - essentially exports. On the other hand, the cases of IGST collections proportionately being higher could indicate states with a higher proportion of trade.

NOTES and REFERENCES

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