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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.

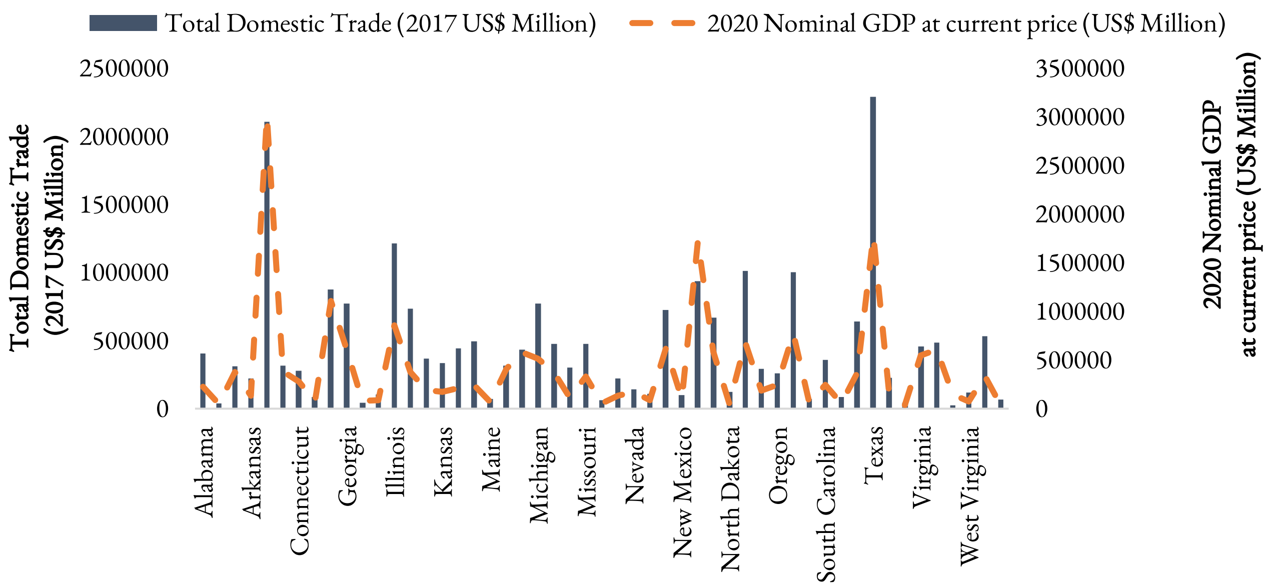
As per the latest FAF data, the value of total Domestic Flows of goods in the US for the years 2017 to 2019 are tabulated as under:

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

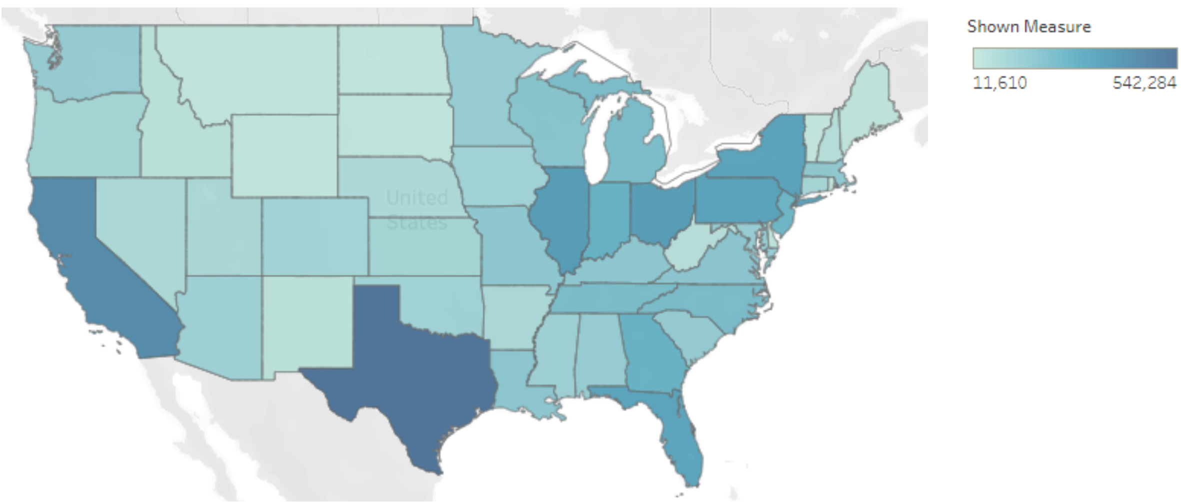


From the above it may be noted that quantum of trade in most states broadly corresponds with the size of the economy of the state. This is intuitive. An analysis of the distance of the trade flows indicates that a majority of trade flows happen within 500 miles [800 kms.] of the origin. This is perhaps 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]

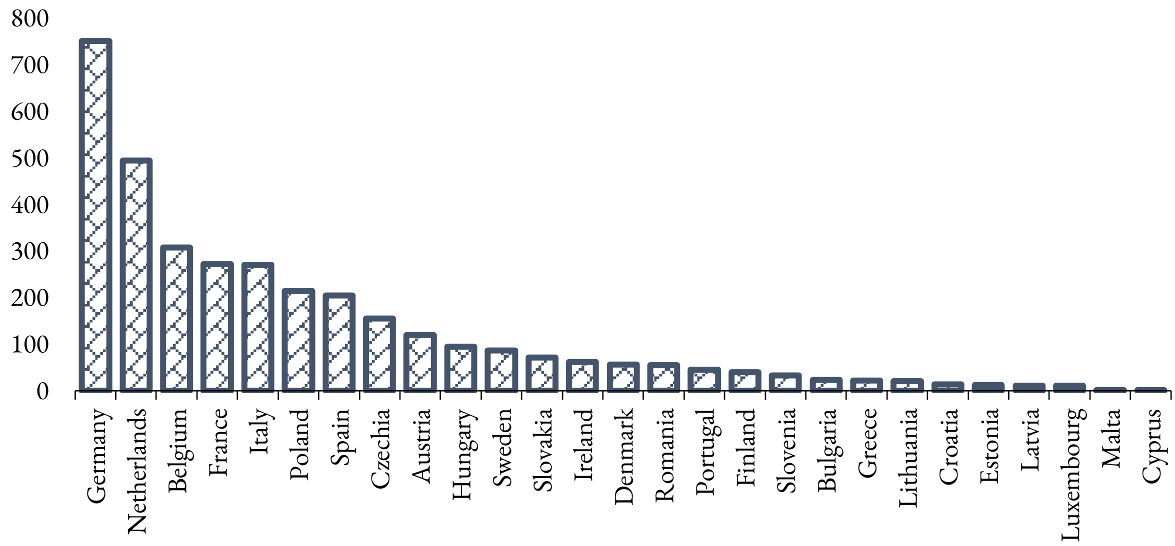


The EU Case

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

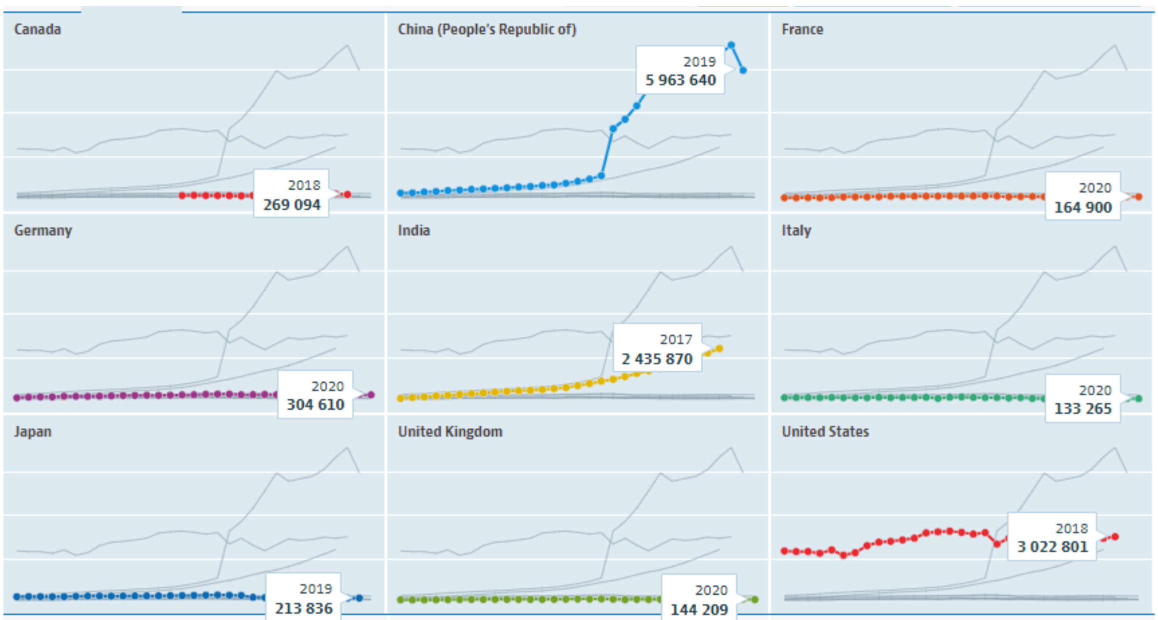
The World Context

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.

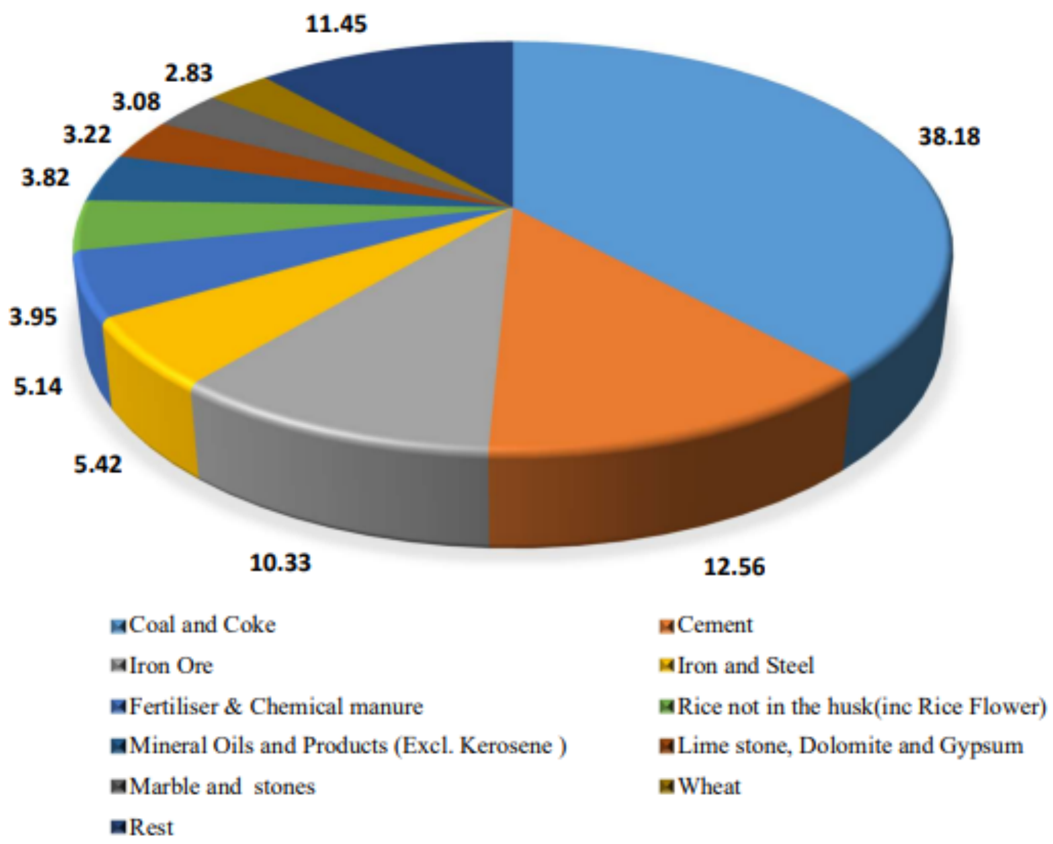
3. How much does India Trade Domestically?

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.

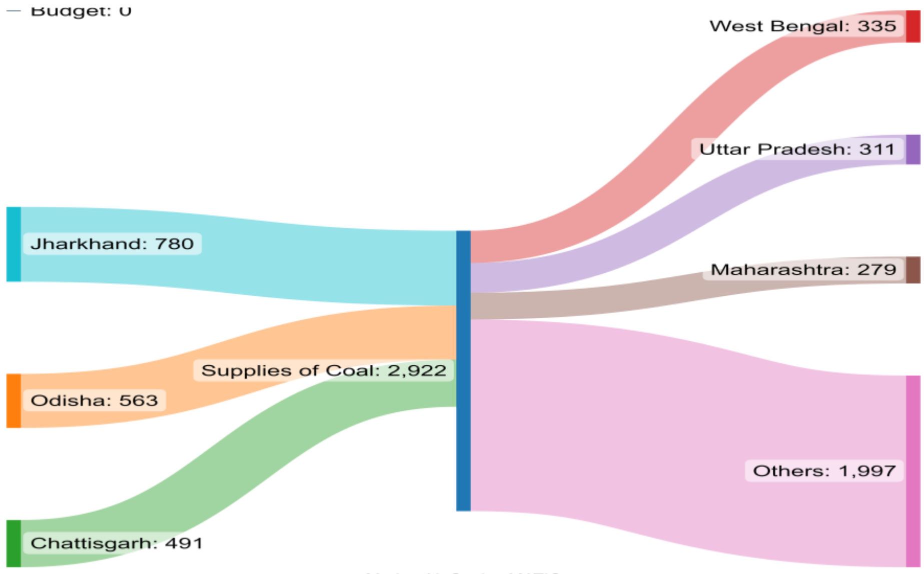
It is perhaps intuitive that the top items transported by Rail include heavy items such as Coal, Cement, Iron Ore, Iron and Steel, Fertilizer & Chemical etc. The share of top 10 commodity groups in state-to-state movement of goods in 2020-21 by rail is depicted as under[19]:

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

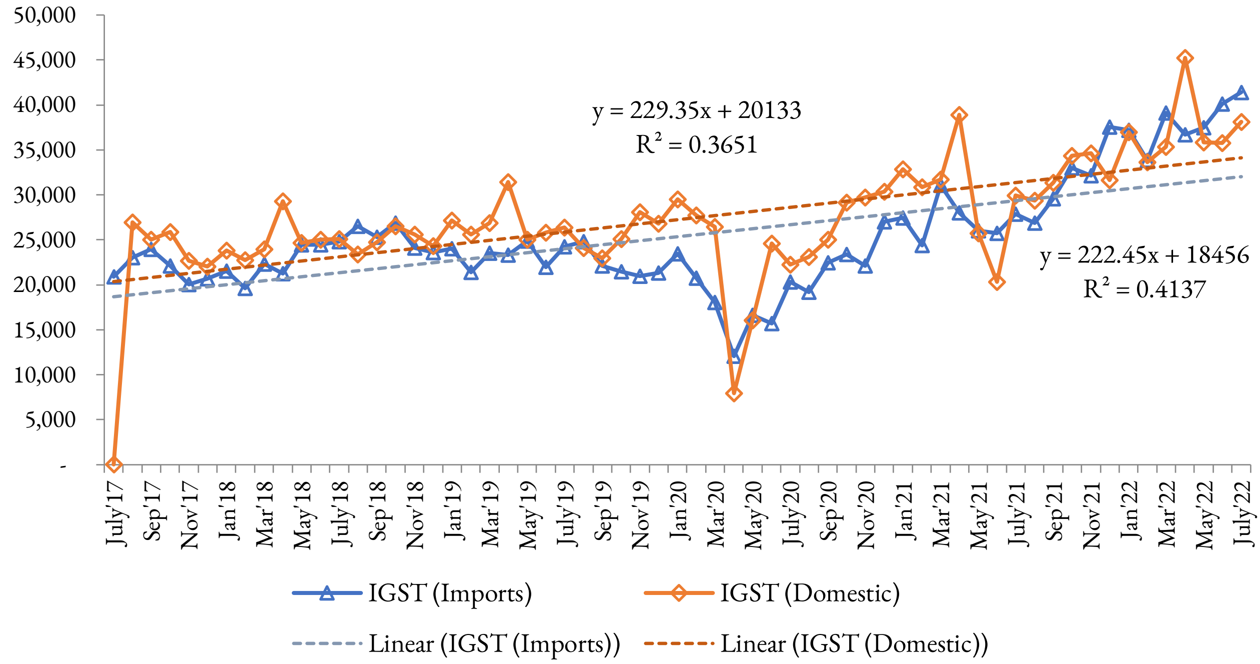
The Goods & Services Tax (GST) introduced in India from the 1st of July, 2017 replaced a large number of national and sub-national taxes and levies, thereby not only uniting India into a truly common market with minimal distortions and tax arbitrages, but also put in place administrative structures which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

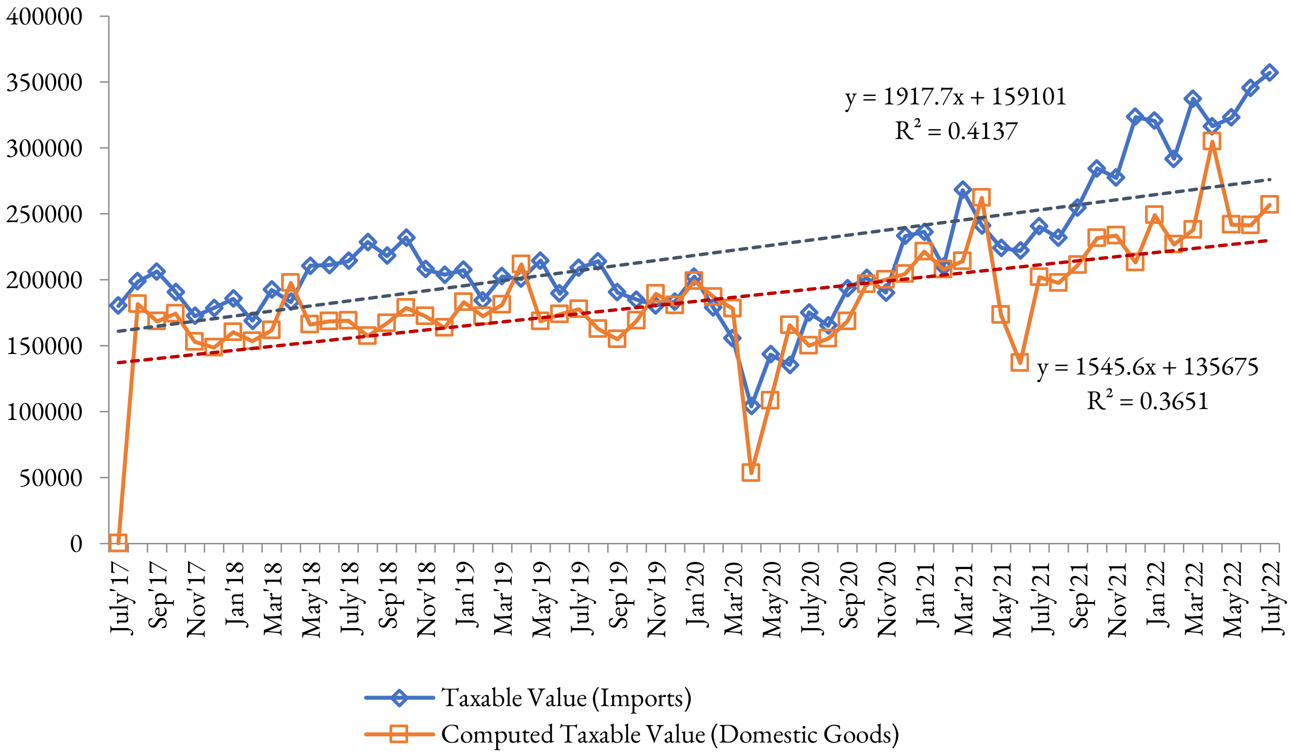
All these adjustments result in an incremental services base (incremental to whatever has already been incorporated in goods) of Rs. 8.5 Lakh Crore [USD 106 billion] and a combined base (goods and services) of Rs. 39.4 Lakh Crore [USD 495.77 billion]. Therefore, removing the incremental services base, 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

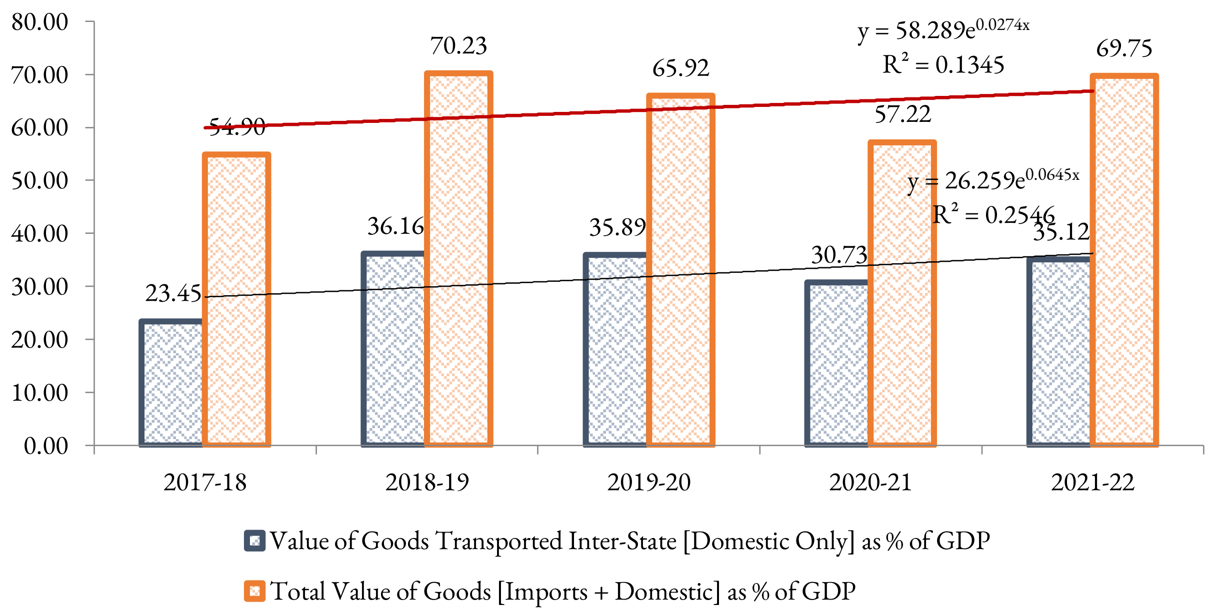
	2017-18	2018-19	2019-20	2020-21	2021-22
Computed Value of Goods Transported Inter-State [Domestic] [USD Billion]	621.72	977.00	1016.09	819.70	1114.24
Total Value of Goods Traded Domestically [Imports + Domestic] [USD Billion]	1455.45	1897.72	1866.30	1526.14	2213.08

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]

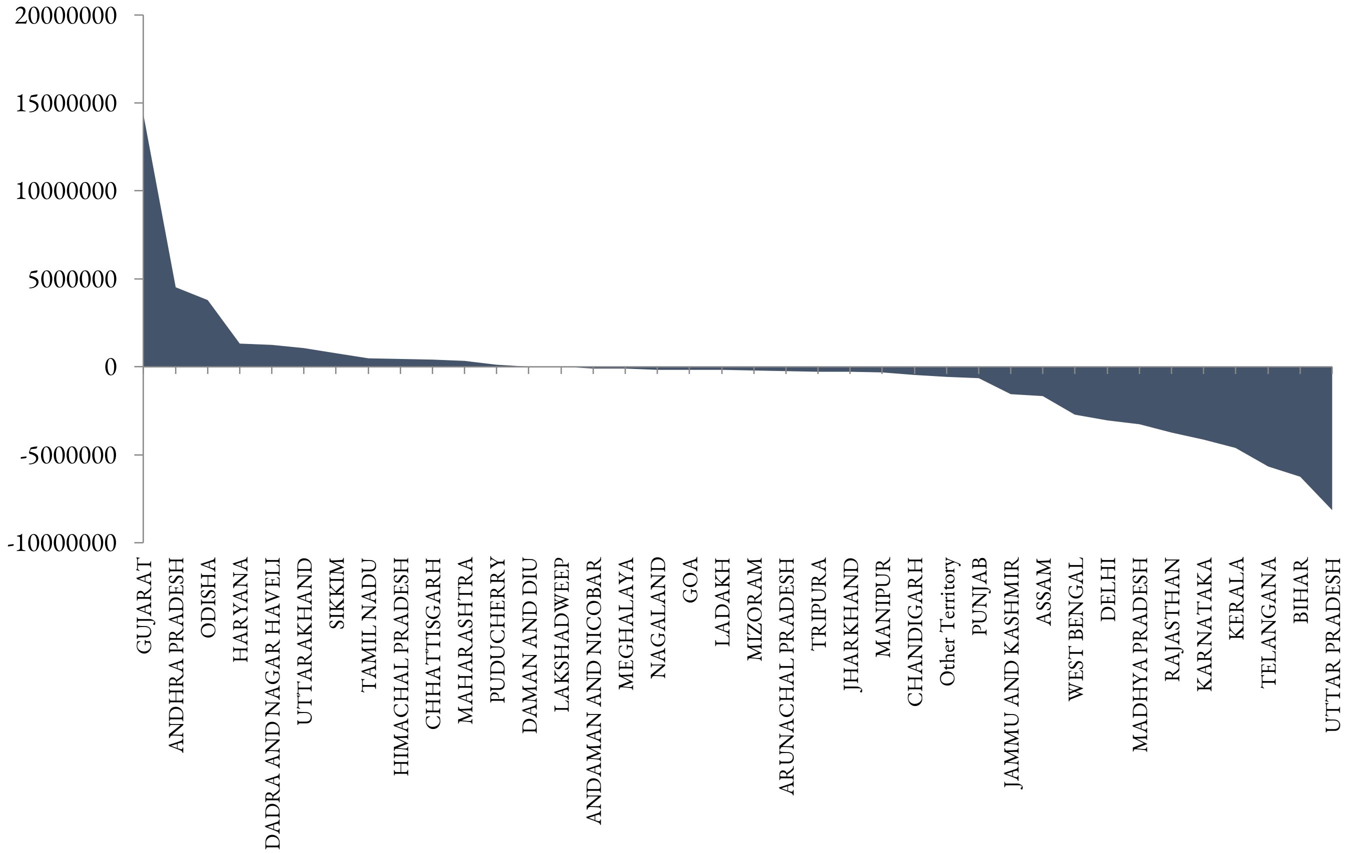
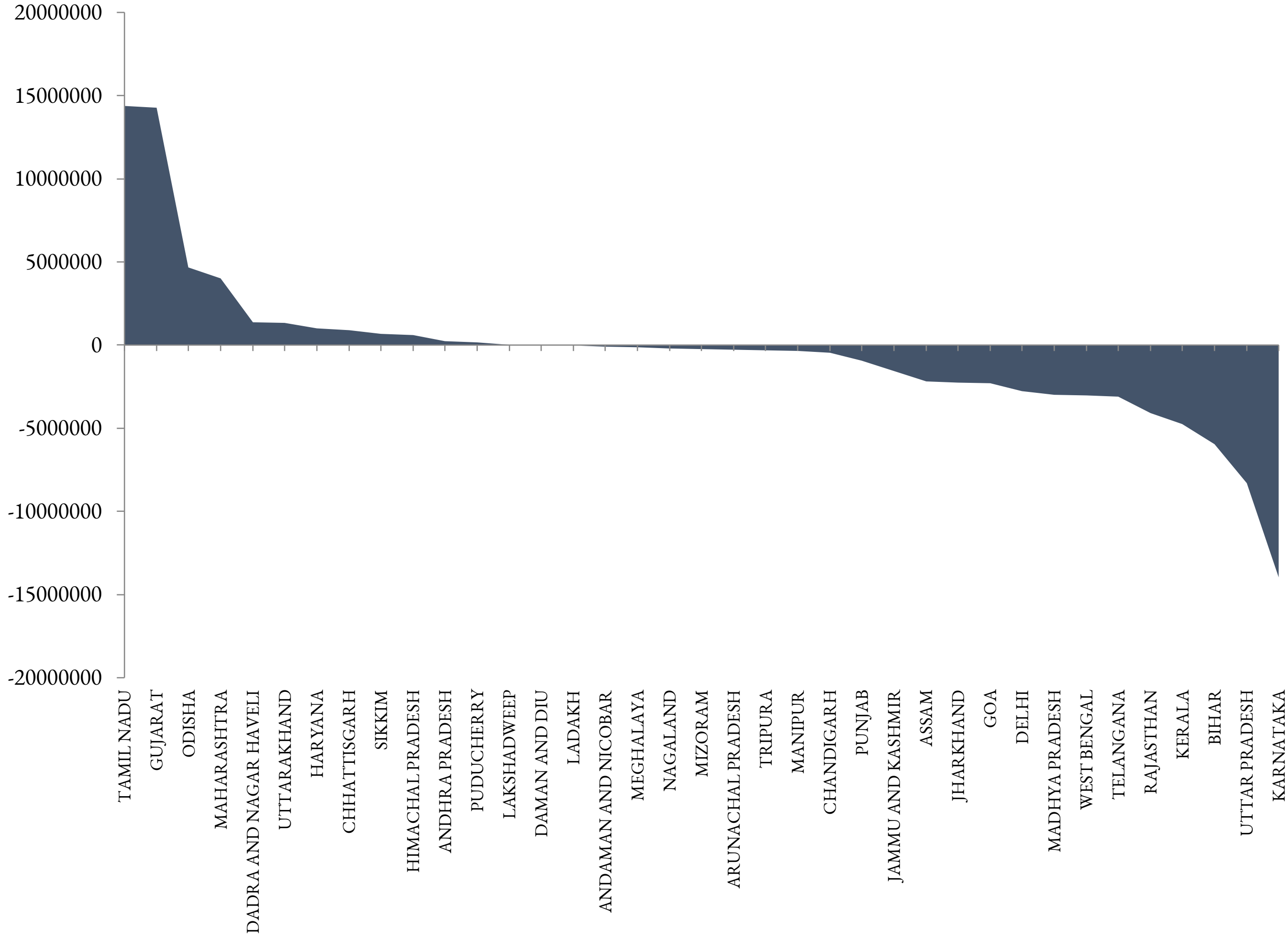


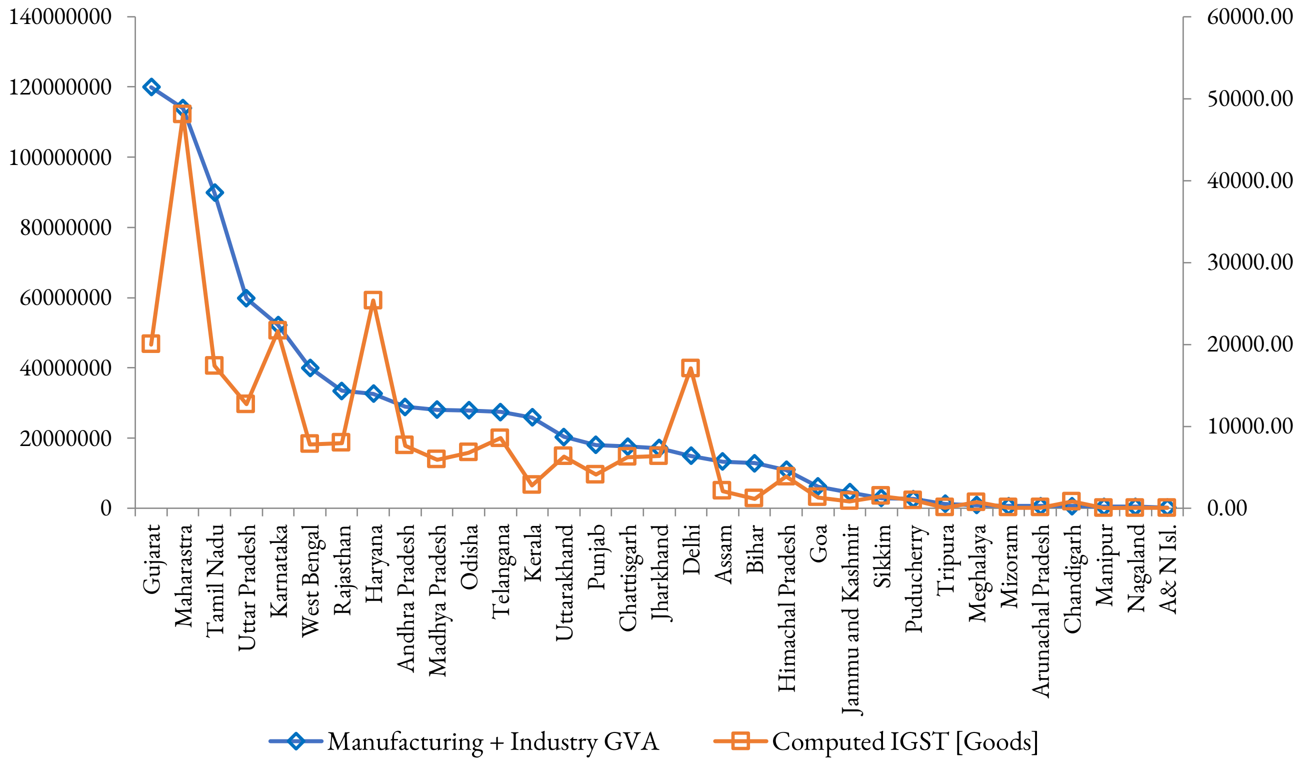
Figure 13: Net Trade Balance of Indian States [Net Outgoing Supplies – Incoming Supplies] 2021-2022



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)

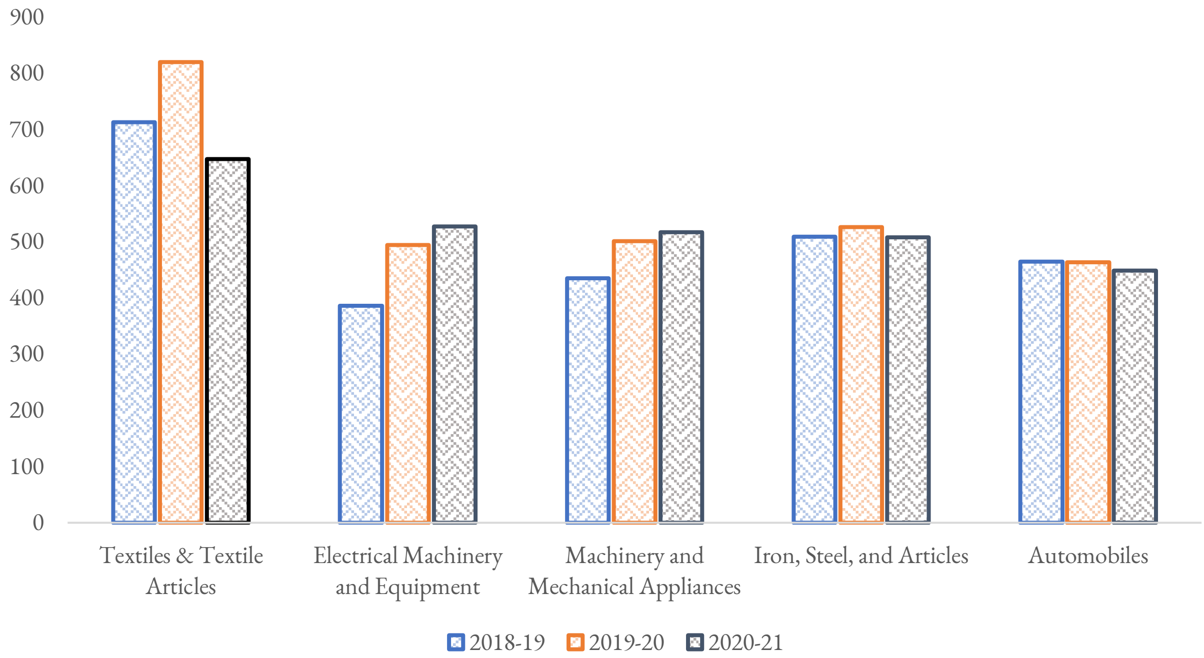


Figure 16: Top 5 States with Inter-state EWB (Nos. In 0.1 Millions)

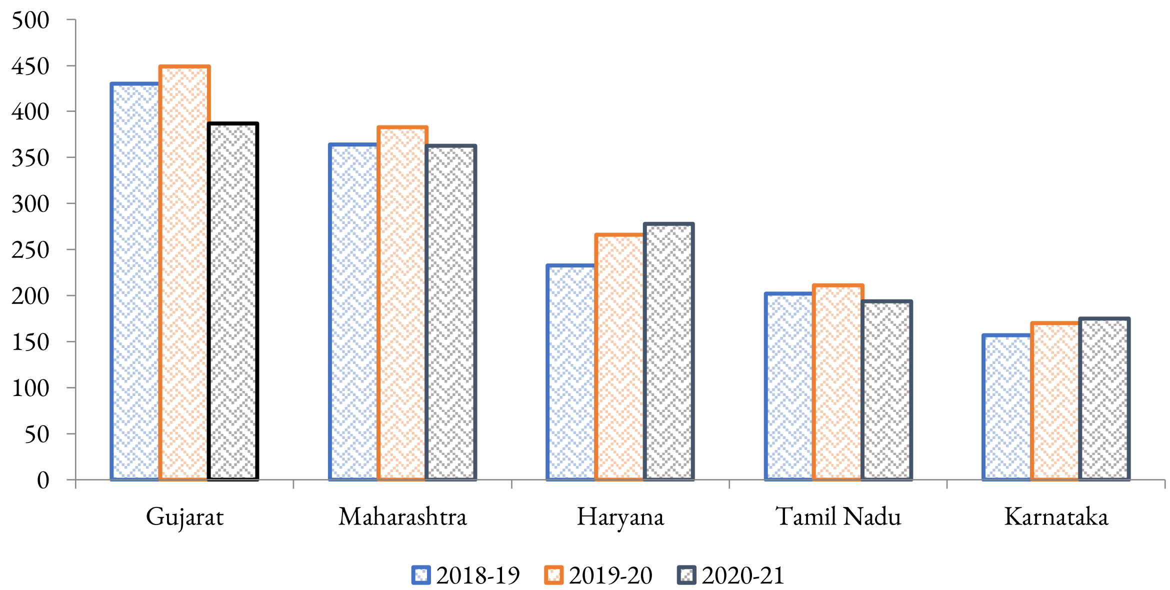
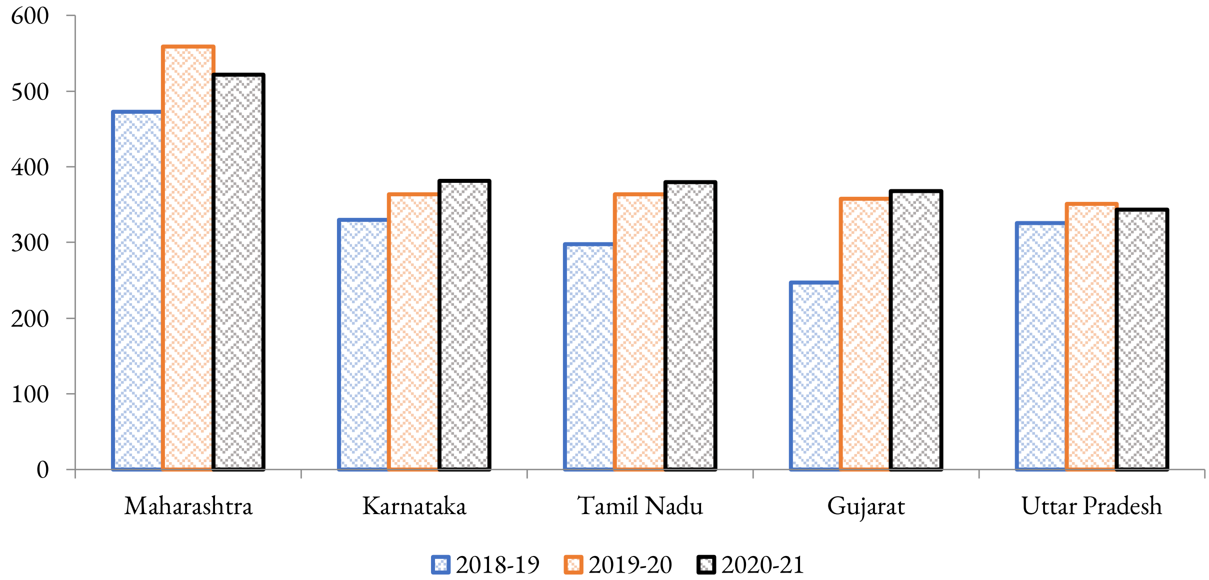
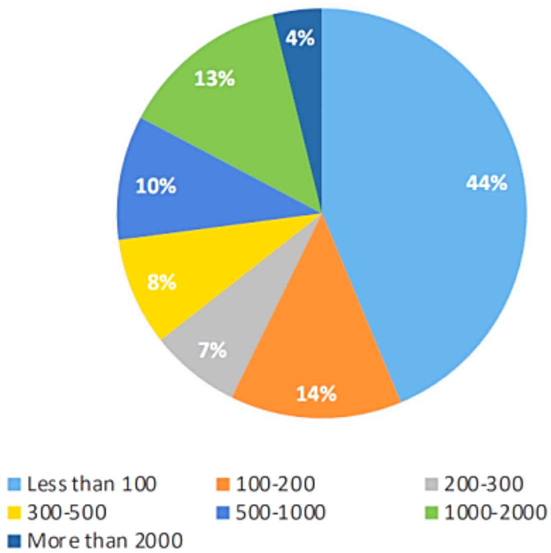


Figure 17: Top 5 States with Intra-state EWB (Nos. In 0.1 Millions)



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																			
Exporting State	MH	GJ	KA	AP	UK	RJ	MP	WB	TN	KL	OR	UP	DL	CG	HP	HR	BR	JH	GA	AS
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

		Importing State																				
		MH	GJ	KA	AP	UK	RJ	MP	WB	TN	KL	OR	UP	DL	CG	HP	HR	BR	JH	GA	AS	Total
Exporting State	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.

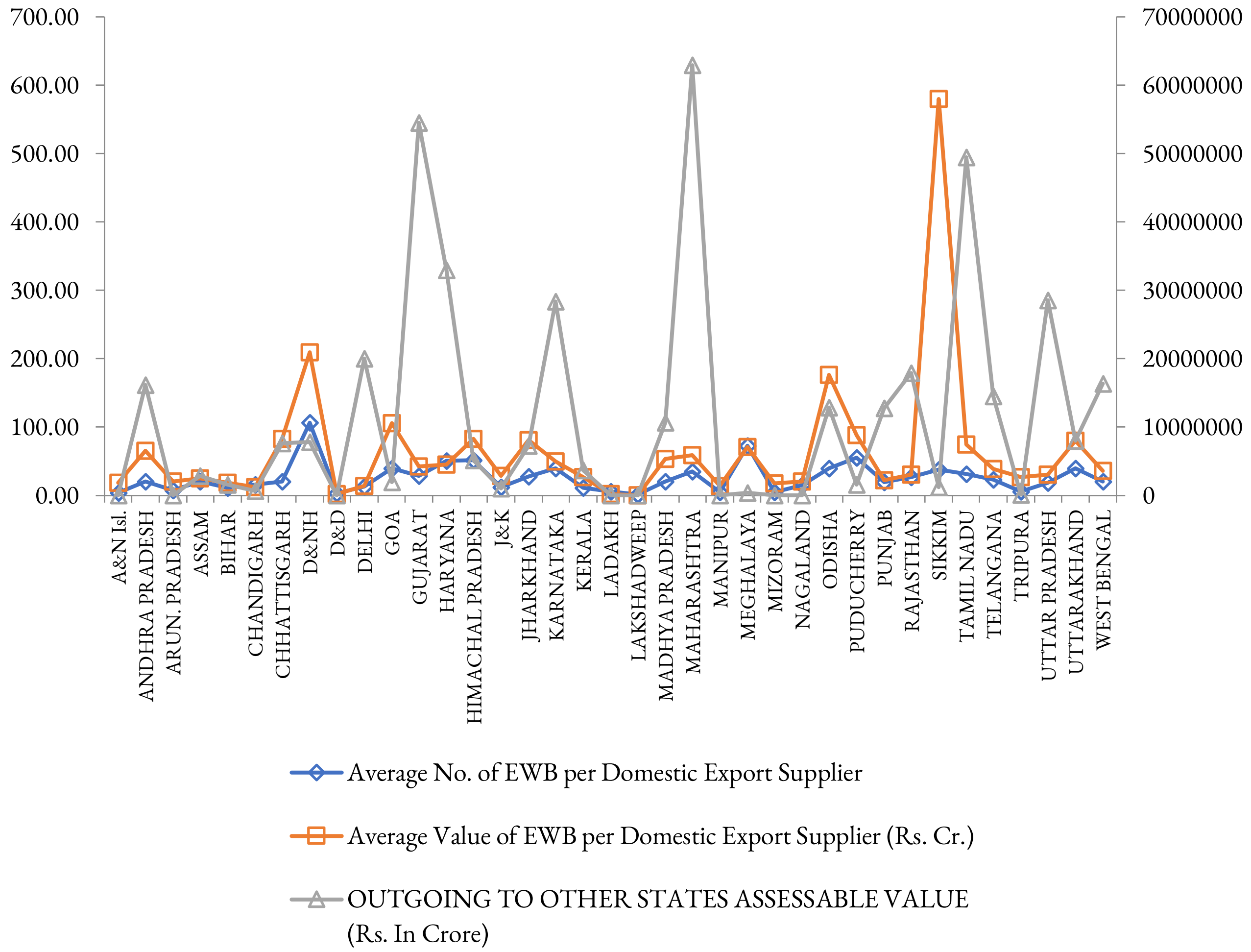
The colour codes indicate the central role of Maharashtra in every other state's trade flow - it is the most important exporting partner for every state and also serves as the predominant importer for goods from almost every other state, with Assam being at the other end of the colour spectrum - it ranks 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.

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IPPR

Does India's Ban on Electronic Cigarettes Improve Public Health Outcomes?

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Abstract

In 2019, India banned Electronic Nicotine Delivery Systems (ENDS) – a broad category that includes electronic cigarettes, vaping devices, and Heat Not Burn (HNB) devices – because of concerns about health impacts, youth vulnerability, and their potential to undermine tobacco control efforts. This is a missed public health opportunity to reduce tobacco consumption, if ENDS actually help reduce and wean users off nicotine dependency in less harmful ways. This paper applies a risk analysis framework to examine whether India's ban on ENDS improves public health outcomes, or whether an alternative approach such as regulation would be more effective. It studies global responses and compares how public health goals are served in the United States of America and the United Kingdom, based on four key parameters of concern – health impacts, normalisation of ENDS usage among non-smokers, appeal among youth, and device safety. This comparison demonstrates that the United Kingdom's regulation-focused approach delivers superior outcomes across all four parameters. Thus, the evidence-based recommendation for India would be to regulate at least HNB devices under the Cigarettes and Other Tobacco Products Act (as they utilise tobacco), as this can help reduce harm and promote innovation in devices that can wean users off nicotine dependence.

Keywords: ENDS (Electronic Nicotine Delivery Systems), smoking cessation, risk analysis, public health

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1. Introduction

In 2019, India enacted the Prohibition of Electronic Cigarettes Act, 2019 which banned a broad category of Electronic Nicotine Delivery Systems (ENDS) including electronic cigarettes, vaping devices, and Heat Not Burn (HNB) products. The government justified the ban on the basis of certain risks, including their potential impact on health, ability to attract youth, and concern that ENDS would undermine tobacco control efforts. This article applies a risk analysis framework to examine whether the ban will improve public health outcomes or whether regulation would be a more effective alternative policy approach.

2. India's E-Cigarettes Ban

2.1 Overview

ENDS were being sold in the Indian market without prior permission from regulatory authorities. Therefore, in August 2018, the Union Ministry of Health and Family Welfare (MoHFW) issued an advisory to state governments to regulate e-cigarettes by stopping approvals for new products and imposing restrictions on sales and advertisements. By March 2019, 12 states acted in compliance with this order (The Wire 2019). The order was challenged in the Delhi High Court, which issued a temporary stay on these restrictions on March 18, 2019.

On February 18, 2019, following reports that ENDS manufacturer Juul Labs was planning to enter the Indian market, the Secretary MoHFW, Preeti Sudan, wrote to the Union Commerce Ministry and the Prime Minister's Office calling for a ban on Juul's entry into India. She argued that "*Novel products such as 'JUUL' are harmful and addictive and could potentially undermine our tobacco control efforts,*" because of their *"...easy availability, disguised appearance and the false notion of being safe*" (Kalra 2019). She added that: "*It is felt that the young generation would be particularly vulnerable to such products and gimmicks.*"

Thereafter, a ban on the broad category of Electronic Cigarettes was introduced through the promulgation of a Presidential Ordinance – The Prohibition of Electronic Cigarettes (Production, Manufacture, Import, Export, Transport, Sale, Distribution, Storage and Advertisement) Ordinance, 2019 – on September 18, 2019 (Press Information Bureau 2019).

The Ordinance targeted both ENDS and HNB devices. ENDS are battery-operated electronic cigarettes that generate dosages of vaporised nicotine or non-nicotine solutions for inhalation. Their ingredients include propylene glycol and vegetable glycerine, and some even contain flavour additives. The United States Food and Drug Administration (FDA) recognises a number of devices under the umbrella of ENDS, including e-cigarettes, vaporizers, vape pens, and hookah pens (U.S FDA 2022).

ENDS are distinct from 'heated tobacco products' (HTPs) or 'heat not burn' devices (HNBs) – HNBs contain tobacco, while ENDS do not. HNBs do not contain nicotine solutions and instead operate by heating a tobacco stick, leaf, or sheet in order to release nicotine. The tobacco is not burned but is heated just enough to release an aerosol. Thus, HNB devices do not produce any of the ash or smoke associated with combustible cigarettes or beedis.

Figure 1: Comparison of Combustible Cigarettes, ENDS, and HNBs.

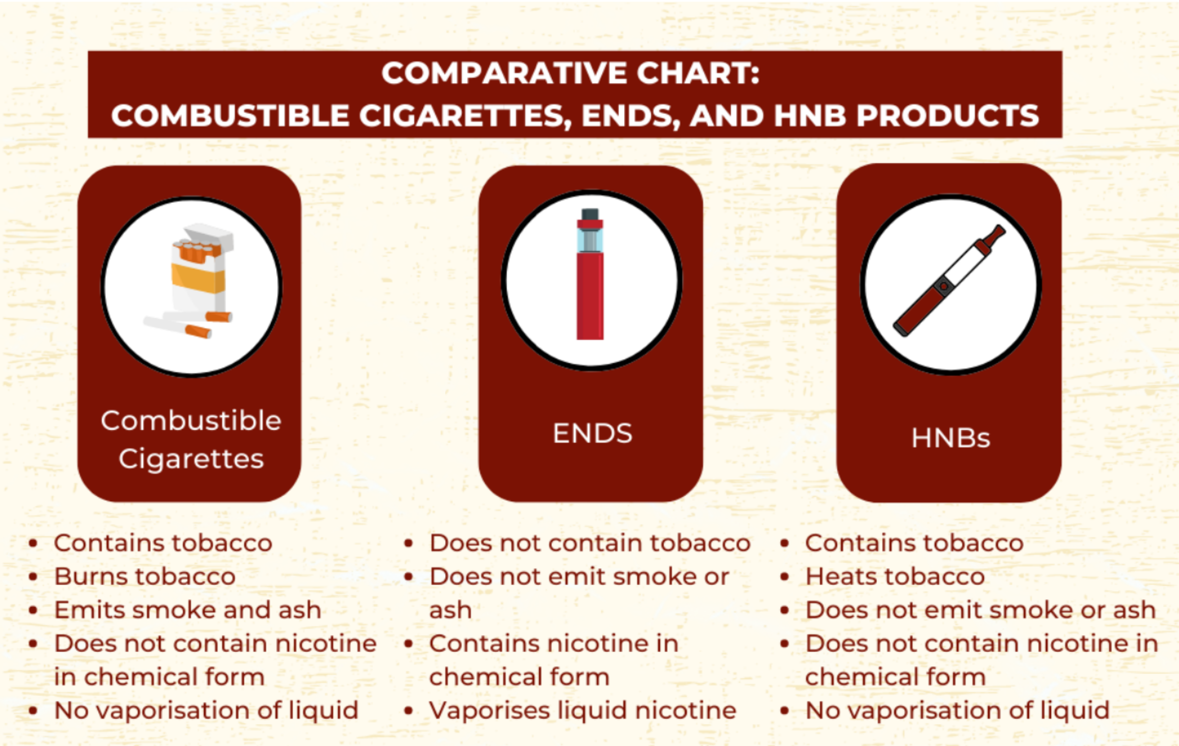


Image Source: Authors

The Prohibition of Electronic Cigarettes Act, 2019, passed on December 2, 2019, replaced the Ordinance. During the parliamentary debates, several Members of Parliament raised concerns about the blanket ban on ENDS devices, emphasising that: (1) The ban would trigger underground markets for ENDS devices; (2) Banning ENDS devices blocks the innovation of products that could be less harmful sources of nicotine, and which could help reduce or end users' dependence on combustible tobacco; (3) HNBs use tobacco; hence they should instead be regulated under the Cigarettes and Other Tobacco Products Act (COTPA)[1]; (4) If potentially less harmful ENDS and HTP products are unavailable, youth will likely experiment with more harmful combustible tobacco.(Lok Sabha 2019a; Lok Sabha 2019b; Rajya Sabha 2019).

Conventionally, draft Bills are expected to be opened for public comments and to be examined in detail by the appropriate Parliamentary Standing Committee. In this case, although the Bill was put forth for public consultations, it was enacted by Parliament without addressing the suggestions received.

The motivation for the ban's urgency can be discerned from the views of the then Secretary, MoHFW, Ms. Preeti Sudan, and the then Union Minister for Health and Family Welfare, Dr. Harshvardhan. In a newspaper opinion article, Sudan wrote that when she served in the Ministry of Youth Affairs and Sports, she once noticed teenagers in her neighbourhood smoking cigarettes.

Thereafter she pushed successfully for criminalising the sale of tobacco to minors through an amendment to the Juvenile Justice Act, 2015 (Sudan 2020). In the Rajya Sabha, Dr. Harshvardhan stated that it was urgent to pass the Bill because of "very, very strong threat from tobacco companies" preparing to launch ENDS products in the Indian market (Rajya Sabha 2019). He argued that ENDS devices needed to be banned pre-emptively before they develop a major user base among children and youth.

An Expert Committee set up by the MoHFW issued a report in May 2019, recommending a blanket ban on ENDS devices (including HNB products), based on a consideration of harmful health effects reported in other countries, their potential to lure youth toward nicotine consumption, and what it considered to be inadequate proof that they serve as smoking-cessation devices (Chakma, Dhaliwal, and Mehrotra 2019). It did not study the range of ENDS and HNB devices, their differential technologies and impacts, or the use of HNBs as an innovative tobacco harm reduction product.

2.2 Implications of the Ban and Its Current Status

Historically, bans on products trigger the emergence of underground markets, and of criminal elements seeking to profit from such illicit commerce. India's experiences with alcohol prohibition demonstrates how bans lead to thriving black markets, such as in Gujarat where liquor worth an average of Rs. 34 lakhs per day was seized across 20 months (Choudhary and Sharma 2021). Bans also result in a significant loss of revenue to the exchequer. Maharashtra is estimated to have lost Rs. 2,570 crores between 2015-2020 owing to a liquor ban in select districts (Ibid). Beyond the economic costs, there are also unintended public health risks. Spurious liquor has killed more people in India than drugs. In 2020, there were 947 accidental deaths due to consumption of illicit/poisonous liquor, against 514 from drug overdoses (National Crime Records Bureau 2021).

Similarly, India's ban on e-cigarettes may not have prevented the consumption of ENDS but only driven these products underground, while simultaneously driving away responsible ENDS and HNB brands (Soni 2020). Since the ban was enacted in 2019, there have been regular reports of seizures of e-cigarettes whose worth amounts to crores (Press Trust of India 2023; The Hindu Bureau 2022; Basheer 2022; Lalitha 2022; Singh 2022; Times of India 2023). The Directorate of Revenue Intelligence conducted two seizures of e-cigarettes worth Rs. 68 crores in just September 2022 alone (Press Information Bureau 2022).

Reports indicate that ENDS devices can be purchased both online and at neighbourhood cigarette shops. Illegitimate businesses (with possibly dangerous, unregulated products) flourish near schools and colleges (Indian Express 2023), including through WhatsApp groups (Matharu 2023), pointing to continued use of ENDS devices. Advertisements for e-cigarettes in India continue to be broadcast on social media through third-party retailers. The Indian market actually provides customers with covert options for buying e-cigarettes through phone numbers and WhatsApp (Murukutla et al. 2022).

The MoHFW is now working with states and law enforcement to enforce the ban in full. A significant hurdle is that the ban falls under the purview of different ministries, due to the sale of e-cigarettes through both online channels and brick-and-mortar stores (Matharu 2023).

The ban's failure to meet its stated objectives has led to several calls for its reversal and replacement with a more scientific regulatory framework for e-cigarettes, based on the principles of harm reduction (Ray 2022; Press Trust of India 2022). Before deciding whether to impose prohibition on certain goods, governments consider several factors, including revenue, tourism, crime, and unintended consequences on public health. This balance of risk and reward has informed India's regulation of both alcohol and tobacco – products that have impacts on health, but which generate income for the government. It is imperative to examine whether regulation may similarly be appropriate in the case of e-cigarettes.

Finally, in the Finance Bill, 2021, the Union government accepted the classification of novel tobacco and nicotine products as laid down by the World Customs Organization Council, thus acknowledging the difference between cigarettes, e-cigarettes and HNB products for taxation purposes (Government of India 2022). However, this distinction has not been applied in the context of the ban on e-cigarettes.

3. Tobacco Risk Management

3.1 Scale of India's Risks from Tobacco

India is the second largest consumer of tobacco globally (World Health Organisation, n.d.). According to the Global Adult Tobacco Survey India, 2016-17 (GATS 2), 266.8 million adult Indians above the age of 15 use tobacco – both smokeless tobacco products such as khaini, gutka, and zarda, and smoked products such as beedis and cigarettes (Tata Institute of Social Sciences and Ministry of Health and Family Welfare 2018).

Tobacco is among the largest threats to public health in India, accounting for as many as 3,500 deaths per day (Ministry of Health and Family Welfare, Government of India, n.d.; Sinha et al. 2014; Jha et al. 2008). In 2018, WHO estimated the number of tobacco-related deaths at 1 million, which accounted for 9.5% of total deaths (Foundation For A Smoke-Free World 2020). Overall, tobacco use in India has decreased life expectancy by 11 years among women, and by 12 years among men (Economic Times 2021).

Official government data estimates that, in 2011, the cost to the economy attributed to deaths and diseases related to tobacco use stood at Rs. 1,04,500 crores (Ministry of Health and Family Welfare, Government of India, n.d.). This rose to Rs. 1,77,341 crore in 2017-18, accounting for 1% of India's GDP (Press Trust of India 2020). More recent data estimate that 5.3% of India's health expenditure is spent on treating tobacco-related diseases, and that both treatment and loss of productivity has cost India Rs. 13,500 crore annually (Jo 2022). In 2023, the burden of tobacco-related health care expenditure was estimated at 1.04% of the GDP (Economic Times 2023).

Smokeless tobacco is largely preferred by specific demographics – users from rural areas, those with lower education and income, and from socially disadvantaged groups (Boyd 2021). The harms from smokeless tobacco are compounded by the availability of unregulated products in the market. In 2017, 43% of smokeless products were illegal (i.e., with out-of-date health warning labels) and 2% were illicit (i.e., no health warning labels or without Indian health warning labels) (Welding et al. 2021).

While more Indians consume smokeless tobacco, combustible cigarettes are more harmful, due to chemicals in the smoke generated by burning tobacco. 4% of Indians smoke combustible cigarettes, with beedis being the most popular product (Tata Institute of Social Sciences and Ministry of Health and Family Welfare 2018). Beedis produce five times more tar compared to manufactured combustible cigarettes (Mohan, Lando, and Panneer 2018, 2).

Beedi production is largely informal as manufacturers often seek to circumvent tax and labour laws, and products from unregistered entities do not carry health label warnings (Boyd 2021). Beedis are popular among users with lower education and income, and from socially disadvantaged groups, while commercial combustible cigarettes are preferred by those with higher levels of education and wealth (ibid). 55% of beedi packs and 25% of manufactured combustible cigarettes were illegal, while 10% of commercial combustible cigarettes were illicit (Welding et al. 2021).

3.2 India's Policy Measures to Reduce Tobacco-Related Risks

Historically, India's regulation of tobacco began with a light touch, providing statutory warnings about the potential harm of tobacco consumption on health. As evidence of greater harm from tobacco consumption came to light, and society took note of the impact of second-hand smoke and consequently discouraged tobacco consumption, the government's approach to regulating tobacco products became more aggressive. It mandated graphic images of health impacts on cigarette packs, imposed bans on smoking in public spaces including on public transportation, and banned advertisements.

The 2003 COTPA was a landmark comprehensive tobacco control law in India which brought together the various facets of regulation under one framework. Another milestone in tobacco regulation is the National Tobacco Control Programme (NTCP) which funded tobacco control initiatives at the state level.

In addition to ratifying Global Tobacco Control treaties, including the WHO's Framework Convention on Tobacco Control (FCTC), India also uses other instruments for tobacco control including economic incentives like high taxes, regulates the content of tobacco products, promotes awareness about the harms of smoking, and has set up free helplines / 'Quitlines' for users looking to quit (Mohan, Lando, and Panneer 2018, 4-5; Sudan 2020). The Union Budget 2023-24 increased the National Calamity Contingent Duty (a surcharge on excise duty) on specified cigarettes by 16% (Press Information Bureau 2023).

The evolution and range of tobacco-control measures demonstrates how the government has adopted a scientific cause-and-effect and evidence-based approach to tobacco regulation, rather than a blanket ban, as in the case of the prohibition on e-cigarettes. The government has also not adopted differential regulatory interventions for ENDS and HNB products based on scientific evidence.

4. Risk Balancing as a Benchmark to Evaluate Policy

Rather than the 'quit or die' approach typically used in smoking cessation policies, a third option is to enable those who are unable to reduce their consumption of tobacco to access nicotine in less harmful ways (Rodu and Godshall 2006, 2). This is especially significant since India has the second-lowest quit rate among the countries surveyed under GATS 2 (Economic Times 2021). Smokers who made a quit attempt in the past 12 months remained stagnant at 38.5% under GATS 2 (2016-17), compared to 38.4% under GATS 1 (2009-10) (Tata Institute of Social Sciences and Ministry of Health and Family Welfare 2018).

Tobacco harm reduction strategies can help achieve the National Health Policy 2017 target of reducing tobacco use by 30% by 2025 compared to 2009-10. Innovative non-tobacco (ENDS) and non-combustion products (HNBs) can supplement existing tobacco cessation strategies, which are presently largely confined to nicotine replacement therapies (NRT) (Misra 2022). Adopting harm reduction strategies at scale through national policies can also lower costs and increase access to safer alternatives by lower-income groups (Economic Times 2021).

The diverse range of tobacco and nicotine products available in the market today and innovative products in the pipeline present an opportunity to adopt risk-proportionate regulation based on scientific evidence. Treating all such products as equally harmful will only protect existing products, and deny consumers the right to access safer alternatives (Cummings, Ballin, and Sweanor 2020, 11).

A risk balancing framework allows the government to protect non-smokers and discourage tobacco use overall, while simultaneously protecting tobacco consumers by providing access to innovative, lower-risk products. By imposing a ban and refusing to consider the possibility of using e-cigarettes as a tool to reduce tobacco-related harms, the government may also have deprived tobacco consumers of safer alternatives and their right to make informed decisions.

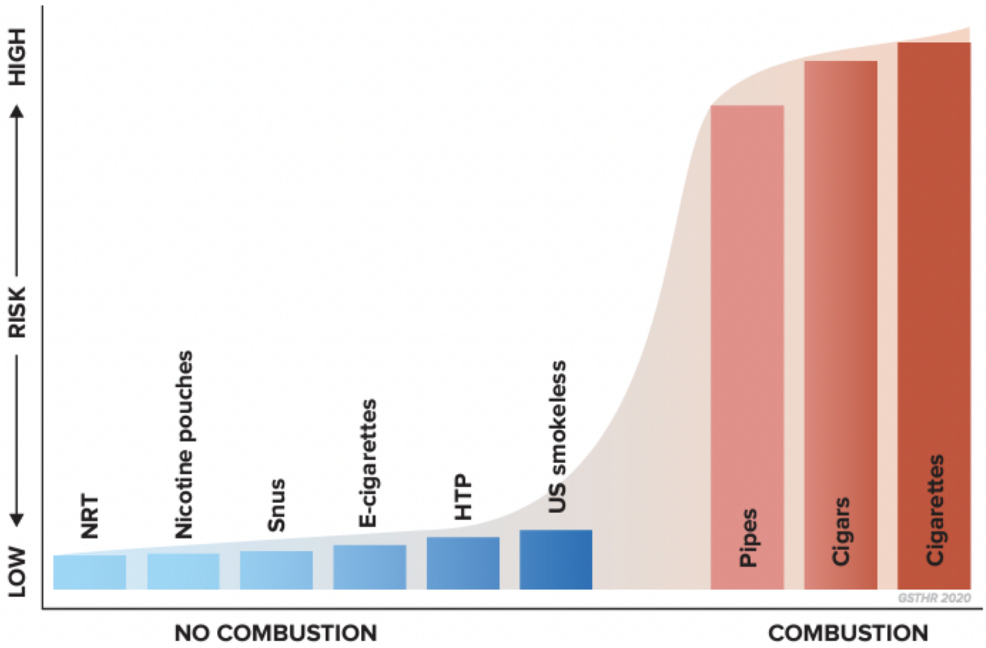
The FDA conceives of a risk continuum in tobacco regulation (Cummings, Ballin, and Sweanor 2020, 9) where different products carry different levels of risks, and public health goals can be met by increasing or reducing access to them appropriately. Reducing levels of nicotine in combustible tobacco products, high product standards for ENDS and HNBs, public awareness campaigns, education for medical practitioners, taxation policies, and incentives for manufacturers to invest in low-risk products are other key aspects of a risk-proportionate tobacco regulation framework (Cummings, Ballin, and Sweanor 2020, 13; Hatsukami and Carrol 2020, 10).

As per the FDA's risk continuum, protecting high-risk tobacco products like combustible cigarettes while prohibiting lower-risk products like ENDS and HNBs is counterproductive; it risks more tobacco-related death and diseases. This would be contrary to the government's fundamental duty to improve public health. Tobacco-related deaths are estimated to rise to 70% by 2030, and vulnerable communities will be disproportionately impacted due to their higher tobacco usage (Economic Times 2021). Risk-proportionate strategies therefore assume even more importance in the larger fight against tobacco.

4.1 ENDS and HNBs are Lower Risk Products on the Tobacco-Risk Continuum

A WHO report establishes that while there are potential risks associated with toxic chemicals from ENDs and Non-Nicotine Delivery Systems (NNDS), these vary with the device, the e-liquid, and how users operate them (WHO Regional Office for Europe 2020). It further found that the risks from unadulterated ENDS and NNDS under normal conditions are lower compared to combustible tobacco smoke. While the report also flags potential risks associated with heating and inhaling certain flavour additives, such risks can be mitigated by restricting additives and flavourings under a harm reduction framework.

Figure 2: Harm Continuum in Nicotine Products



Source: Global State of Tobacco Harm Reduction 2021

Scientific evidence suggests that the primary cause of smoking-related diseases is not nicotine per se, but instead the harmful chemicals formed while burning tobacco, including tar, carbon monoxide (National Health Service 2022), burnt paper, and other pollutants, all of which can potentially cause long-term damage. Tobacco smoke carries more than 7,000 chemicals, of which at least 250 have been identified as harmful (e.g., carbon monoxide and ammonia); of these 250, at least 69 have been identified as carcinogenic (e.g., arsenic, benzene, formaldehyde) (National Cancer Institute 2017).

The Global State of Tobacco Harm Reduction report (2021) shows how combustible tobacco products pose a far higher risk than non-combustion alternatives like e-cigarettes (ENDS) and HTPs/HNBs. ENDS and HNBs enable users to simulate the behavioural experience of inhaling nicotine aerosol, while avoiding the tar and other hazardous consequences associated with tobacco smoke, and are estimated to be 95% safer (Public Health England 2015). In the short to medium-term, repeated exposure to Propylene Glycol and Glycerol from e-cigarettes is considered to be of low concern, and second-hand exposure to these chemicals have been found unlikely to be a risk to bystanders either (Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment 2020).

Thus, while all tobacco products carry health risks, non-combustible products such as HNBs reduce tobacco-related harms (U.S. FDA 2020). The study of a specific HNB device showed strongly reduced harmful and potentially harmful constituents (HPHC) levels, as well as strongly reduced levels of typical toxicants in the Total Particulate Matter (TPM), as compared to combustible cigarettes (Mallock et al. 2018, 2146).

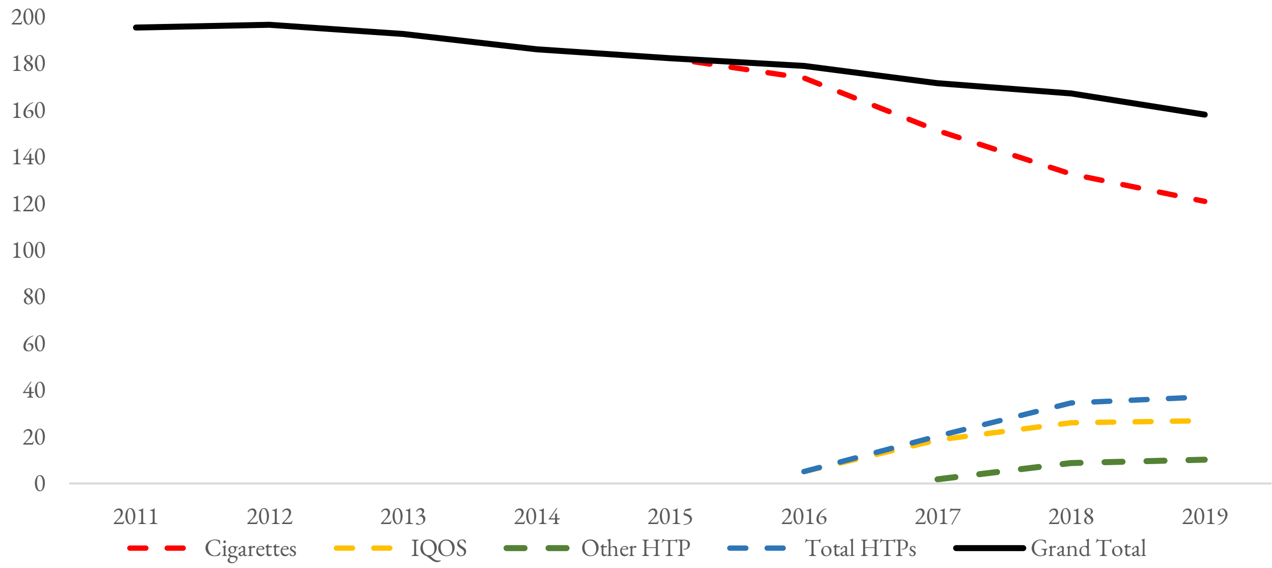
Recognising that non-combustible cigarettes produce lower levels of certain toxins compared to their combustible counterparts, the FDA authorised the marketing of the IQOS Tobacco Heating System, a HNB device (U.S. FDA 2019). The FDA found that the aerosol produced by IQOS had lower levels of toxic chemicals compared to combustible cigarette smoke (ibid).

Another risk observed by the WHO is exposure to certain metals, most likely found in the metallic heating coils and soldered joints used in ENDS devices, including chromium, nickel, and lead. However, the risk of such exposure depends on the product design and engineering, and patterns of use, all of which can be regulated.

The lower exposure to toxicants from ENDs and HNBs implies that switching to these devices may reduce health risks arising from smoking combustible cigarettes, such as impairment of oxygen transport function of the blood, injury of the vascular endothelium, and other harmful impacts at the cellular level (Kvasha et al. 2017). There are also consistent improvements in respiratory symptoms, exercise tolerance, quality of life, and rate of disease exacerbations in patients with Chronic Obstructive Pulmonary Disease (COPD) who switched to HNBs and those who abstained from smoking (Polosa et al. 2021). If HNBs demonstrably help people make the transition away from combustible cigarettes, then banning them closes the door on an important pathway to harm reduction.

A clinical trial in the United Kingdom (UK) also found that e-cigarettes are twice as likely to help people effectively quit smoking compared to other nicotine replacement products, when used along with in-person expert support (National Health Service 2022). While evidence on the use of nicotine vaping products to quit smoking remains mixed (Gravely et al. 2022), HNBs specifically have demonstrably aided the transition away from combustible cigarettes. After the introduction of IQOS in 2014, followed by several other HNBs, there has been a dramatic decline in the sales of conventional cigarettes in Japan (Stoklosa et al. 2020).

Figure 3: Sales of cigarettes, IQOS, and other HTPs (billion sticks) in Japan 2011-2019



Data Source: (Cummings, Nahhas, and Sweanor, 2020). See note for data explanation on data sources and calculation[2]

In India, a survey of 3000 e-cigarette users found that 30% actually quit smoking after using e-cigarettes, and 41% reduced smoking (Sharan et al. 2020). Some users reported quitting and/or reducing smokeless tobacco use (ibid), suggesting that ENDS and HNBs can also help with smokeless tobacco cessation.

Research is needed to assess the long-term health impacts of ENDS and HNBs, including nicotine addiction and lung damage. It took decades to identify harms associated with combustible cigarettes, because cancer and lung-related illnesses take years to manifest (UCLA Health 2020). Experts also remain uncertain about potential lung damage associated with vaping (Shmerling 2022). It is important to acknowledge this knowledge gap and to ensure that regulatory systems are flexible to respond to scientific evidence as it emerges.

5. Global Policy Responses to ENDS

The WHO FCTC defines "tobacco control" to mean a range of supply, demand, and harm reduction strategies, that aim to improve the health of a population by eliminating or reducing their tobacco consumption and exposure to tobacco smoke (World Health Organization 2003). The UN Focal Point on Tobacco or Health (1997) suggested a triadic approach to achieve a substantial reduction in tobacco-related harms for present smokers and future generations – (1) tobacco-use prevention; (2) smoking cessation; and (3) reduction of exposure to tobacco toxins in people who are unable or unwilling to completely abstain from tobacco (Hatsukami et al. 2007).

In 2017, the FDA Commissioner stated "*... we must recognize the potential for innovation to lead to less harmful products, which, under FDA's oversight, could be part of a solution*" (Gottlieb 2017). In the UK, Public Health England (PHE) has underlined that people should be helped to quit smoking by permitting innovative technologies that "*minimise the risk of harm*" and "*maximise the availability of safer alternatives to smoking*" (Sutherland et al. 2021).

In the European Union, the European Tobacco Products Directive (EUTPD) provides a framework for regulating tobacco and related products, and prioritises public health. It distinguishes Novel Tobacco Products as a separate product category from conventional tobacco products (European Union 2014).

As of February 2021, 73 countries permit the sale of ENDS devices along with restrictions (e.g., United Kingdom, Canada, Malaysia, New Zealand), while 37 banned their sale altogether (e.g., Australia, Singapore, Sri Lanka, Thailand) (Global Center for Good Governance in Tobacco Control 2021). Many countries have adopted harm reduction principles into their tobacco control laws. New Zealand (Government of New Zealand 2020), the Philippines (Republic of the Philippines 2021), Japan (Abramson 2021), Greece (European Union 2014), and Switzerland (Federal Office of Public Health BAG 2023) have all adopted risk-proportionate and differential regulation of ENDS and HNBs.

Norway (Norwegian Directorate of Health 2022) and Uruguay (India Med Today 2021) have both reversed bans on novel tobacco products. The varied experiences of the differing approaches adopted by these countries presents an opportunity to study how India can learn from them to regulate ENDS/HNBs, based on the balance of risk.

6. Comparative Experience of the USA and UK

The nature of evidence that has emerged from different jurisdictions is largely dependent on the model of regulation that has been adopted. In this section, we explore the contrasting approaches and consequent balance of risks within the USA and UK. Based on the evidence available, we attempt to identify lessons that can be applied to the Indian context. The studies referenced below adopt different definitions of e-cigarettes, i.e., they may include both ENDS and HNBs or only ENDS; this distinction will be elaborated wherever possible.

The UK adopted a harm reduction approach, treating ENDS as a safer alternative to combustible cigarettes. Tobacco and e-cigarettes are regulated under the Tobacco and Related Products Regulations, 2016 (TRPR). Vaping devices which do not contain nicotine are regulated under the General Product Safety Regulations, 2005. The TRPR is modelled on the EUTPD and has three main objectives – (1) implementing the EUTPD into UK law, (2) dissuading non-smokers, particularly youth, from developing a smoking habit, and (3) supporting non-smokers in the transition from quitting.

All ENDS devices are required to comply with strict safety standards, as prescribed by the Medicines and Healthcare Products Regulatory Agency (MHRA). This includes limiting the capacity of tanks to 2 ml, limiting the amount of nicotine in e-liquids to 20 mg per ml, and banning ingredients such as specific additives for flavour and colour (Medicines and Healthcare Products

Regulatory Agency 2016). In 2018, the National Institute for Health and Care Excellence also referenced e-cigarettes in its guidelines on interventions designed to stop smoking (Rough 2022, National Institute for Health and Care and Excellence 2021).

The USA, in contrast, adopted an abstinence approach, banning ENDS in some jurisdictions. The FDA, as the nodal regulatory body for tobacco, classified ENDS as regular cigarettes, and required ENDS manufacturers to apply for marketing authorisation within the USA for both new and existing ENDS products. However, such authorisation does not amount to FDA approval or official recognition as being safe.

6.1 Will Regulating ENDS/HNBs Normalise Usage Among Non-Smokers?

A major concern among regulators is that ENDS could become a gateway to smoking of combustible products, particularly among youth. Evidence shows that in both the UK and USA, the usage of ENDS and HNBs among non-smokers has remained low despite the different models of regulation adopted. In particular, there is low knowledge and low usage of HNBs. This suggests that ENDS and HNBs are not a gateway to smoking.

In the USA, data from 2015 (Centers for Disease Control and Prevention, n.d.) and 2020 (Mayer et al. 2020) found that e-cigarettes remain popular among current and former smokers, and the majority of non-smokers who used e-cigarettes were 18-24 years old. A more recent study found that of 5.66 million adults reported to be current e-cigarette users, approximately 23.1% reported themselves as 'never smokers' (ibid).

In the UK, PHE found no evidence on the link between increased e-cigarette use and increased smoking uptake (McNeill et al. 2015). Of the 3.6 million adult population using e-cigarettes between February-March 2021, a majority were ex-smokers and current smokers, with under 200,000 never-smokers (Action on Smoking and Health 2021). Even among UK youth, e-cigarette usage by never-smokers has been largely experimental, with 45.7% of 11-17 year olds citing the reason for their current use as 'Just to give it a try.' (Action on Smoking and Health 2022).

HNB products specifically are not an attraction for never-smokers and former users. These seem to attract one audience – adults who smoke and would otherwise continue to do so. HNB awareness and usage remained low across several jurisdictions, including the USA (Marynak et al. 2018), Japan (Kuwabara et al. 2020), Germany (BZgA-Forschungsbericht 2020), and Switzerland (Jordan et al. 2019).

6.2 Can Restricting Flavours Limit Access and Appeal of e-Cigarettes Among Youth?

The USA experienced a significant increase in the usage of e-cigarettes among high school students between 2011 and 2019 (Owotomo and Walley 2022). A 1000% increase in the usage of disposable e-cigarettes among high school students between 2019 and 2020 caused the FDA to describe the prevalence of youth vaping as an epidemic (Woodcock 2021).

The use of e-cigarettes among youth in the UK is far lower. While there has been an increase in the number of 11–17-year-olds who have tried vaping, the increase is low (Action on Smoking and Health 2022). A 2019 PHE report found that the number of under-18s in the UK who used e-cigarettes weekly or more stood at just 1.7% (McNeill et al. 2019). As of July 2022, as many as 83.8% of UK youth have never tried e-cigarettes, 8.2% are unaware of them, and 10.7% of current youth smokers actually use e-cigarettes to quit smoking (Action on Smoking and Health 2022).

The appeal of e-cigarettes among USA youth could lie in the flavours available, as well as attractive packaging and novel device designs. Flavours range from standards like cinnamon, menthol, and various fruits, to more exotic options like strawberry cheesecake, glazed donuts, cherry cola, etc. The regulatory approaches to catchy flavours and other attractive features in the USA and the UK point to one critical reason why the appeal of ENDS among youth has shown significantly different trends in each jurisdiction.

The USA has not banned flavoured ENDS products as of July 2021. Regulations are limited to a minimum age restriction (21 years) on ENDS products, along with identification requirements, and other FDA guidance on enforcement measures. The FDA has yet to implement its plan for product standards that ban flavours. Between August 2016 and July 2021, the FDA issued more than 11,000 warning letters, and filed more 2,000 civil suits, against retailers who were in violation of its guidance pertaining to ENDS usage among youth. Yet, the number of youth e-cigarette users remains high, at 3.6 million in 2020, and flavoured products are used by more than 8 out of 10 youth e-cigarette users (Centers for Disease Control and Prevention 2020).

In 2015, the UK government made the sale of e-cigarettes to minors illegal, and banned proxy purchase of e-cigarettes by adults for minors. In 2018, the Department of Health and Social Care (2018) stated that regular use of e-cigarettes by youth in the UK is still low, and does not yet merit regulatory intervention.

In the UK, the TRPR prescribes specific regulations to meet its core objective of dissuading young people from smoking. Tobacco products cannot contain ingredients which mask the smell or taste of tobacco, and which are incorporated through additives like fruit, spice, herbs, alcohol, candy, menthol, or vanilla. It prohibits such "characterising flavours" in any component of the tobacco product, as well as additives associated with energy, and which have colouring effects on emissions. Importantly, the TRPR prohibits device features which allow consumers to modify the taste or smell themselves. E-cigarette container packs and refill container packs are also not permitted to reference taste, smell, or other additives except for flavourings or its absence (UK Government 2016).

A 2020 study found preliminary evidence suggesting that the usage of e-cigarettes among the UK's youth may be plateauing, and that products banned in the EU's regulated market are finding purchase in North America where usage persists (Moore et al. 2020). The UK's approach of restricting flavours and packaging may have diminished the appeal of e-cigarettes for youth. In the absence of conclusive data on the potential health impacts of using flavourings in ENDS and HNBs (Rough 2022), it would be objectively prudent to regulate the use of such additives in anticipation of potential risks to users' health.

6.3 Are ENDS/HNB Devices Safer to Use?

In the USA, there were an estimated 2,000 vape pen explosions and burn injuries between 2015-2017 (Horton 2019). The exact cause of explosions is unknown. They likely stem from faulty batteries and faulty chargers, both of which can be regulated by prescribing industry standards.

In the UK, where the design and engineering of e-cigarette products is regulated by law, exposure to such risks is lower. While available official data does not distinguish e-cigarettes as a cause of fire, data from media reports in the UK suggest that e-cigarettes-related fires are low, with only 43 recorded calls in 2013, and 62 between January-November 2014 (McNeill et al. 2015). The government has issued public guidelines on how to safely charge e-cigarette batteries, and its public awareness drive includes social media campaigns in partnership with industry stakeholders (Department for Business, Energy & Industrial Strategy and Office for Product Safety and Standards 2020).

In 2019-2020, there was an outbreak of "*e-cigarette, or vaping, product use associated lung injury*" (EVALI) in the USA. As of February 18, 2020, there were 2,807 cases or deaths recorded across the country, with 68 confirmed deaths (Centers for Disease Control and Prevention 2020). In the UK, however, vaping has only been implicated in 3 cases registered with the MHRA between May 2016 and February 2021 which involved death, and only 1 of these "appeared" to qualify as EVALI (McNeill et al. 2021).

The Centers for Disease Control's (CDC) investigation of the EVALI outbreak in the USA reveals why the UK did not have a similar experience, and demonstrates how regulation can make e-cigarette usage safer. In the USA, 82% of EVALI patients reported using Tetrahydrocannabinol (THC), the psychoactive compound in cannabis, in their vaping devices (Centers for Disease Control and Prevention 2020). Of those who reported the source of their THC, 78% cited informal sources (ibid). The CDC also linked the outbreak to Vitamin E acetate, an additive in ENDS that contains THC. Vitamin E acetate is prohibited for use in e-cigarettes in the UK (Newton 2020).

With respect to HNBs, any kind of adulteration is restricted by default, as these are specific systems that heat processed tobacco in a controlled manner. Since only tobacco sticks are inserted in the heating device, adulteration is restricted, unlike ENDS that vaporise nicotine-solvents for inhalation.

The UK's record suggests that regulation of ENDS and HNB devices is substantially effective in limiting risks to users. While research is still required to identify exact causes of explosions and implications of inhaling additives, a framework with stringent standards and restrictions is a desirable interim measure of regulation.

8. Lessons for India

8.1 E-cigarette Usage is Minimal in India

The scale of e-cigarettes usage in India is limited to a specific demographic, distinct from those who smoke combustible cigarettes. A study of 3,000 Indian e-cigarette users revealed that users are predominantly male, with the minimum education level of an undergraduate degree, and are 29 years old on average (Sharan et al. 2020). Only 17.5% of surveyed e-cigarette users reported these as the first tobacco products they had tried (ibid). This contradicts the assumption that ENDS and HNBs will serve as a gateway to combustible cigarettes.

Additionally, the number of users is significantly lower than users of combustible cigarettes. GATS data for January 1, 2015 to December 31, 2018, i.e. a year before the ban on e-cigarettes was enacted, revealed that the prevalence of e-cigarette use in India was 0.02% (Pan et al. 2022). This is in stark contrast to the 10.7% of adults who smoke tobacco as per GATS data for 2016-2017 (Tata Institute of Social Sciences and Ministry of Health and Family Welfare 2018). Thus, the scale of potential harm from ENDS and HNBs is dwarfed by the harm from combustible cigarettes.

The limited demographic for e-cigarette users makes sense when considering the cost of devices in India. The online catalogues of five ENDS device retailers revealed the starting price of most devices to be Rs. 1000, and these can reach as much as Rs. 5,000. There are fewer models of disposable vape pens for Rs. 500-1000. However, e-cigarettes may now be gaining popularity among students with lower income levels. A forthcoming study found that such youth are splitting the cost and sharing one device among themselves (Matharu 2023).

In India, 86% of e-cigarette advertisements on social media focused on attractive product features such as novel device designs, flavours, touch screen indicators, and product customizability (Murukutla et al. 2022). The study found that compared to Mexico and Indonesia, India had the highest engagement with social media posts that emphasised such product features. The second most common messaging in India was entertainment (13%), which involved users doing various tricks with ENDS devices. There were zero instances of harm reduction messaging observed. Instagram appears to be the most popular platform for marketing e-cigarettes in India. At least 190 Instagram influencers have been promoting these products (Matharu 2023).

While this study does not represent the full landscape of e-cigarette marketing in India, among other limitations, its findings reveal that restrictions on advertising, device features, and e-liquid flavours can significantly curb the appeal of e-cigarettes. Reversing the ban and regulating ENDS and HNBs is therefore less likely to incentivise non-smokers to take up e-cigarette usage. Regulation of e-cigarettes may at least achieve the more pragmatic public health goal of weaning people off tobacco, thus reducing the toll on public health and the economy.

A majority of smokers in India were concerned about their own dependency on tobacco and wanted to quit. GATS 2 revealed that as many as 55.4% of current smokers in 2016-17 were either interested in or planning to quit (Tata Institute of Social Sciences and Ministry of Health and Family Welfare 2018). While evidence is inconclusive on whether e-cigarettes or HNBs are effective smoking cessation tools, other jurisdictions which have regulated these devices have demonstrated how they can be used as a safer alternative to combustible tobacco.

Even in the USA, the Surgeon General recently recommended continued scientific investigations of e-cigarettes as an adult smoking cessation aid, in the context of high usage by youth in the country. (U.S. Department of Health And Human Services). In the UK, e-cigarettes have emerged as the most popular smoking cessation aid tool, with 27.2% of people choosing e-cigarettes to help quit smoking, compared to 15.5% who opted for NRT (McNeill et al. 2021).

Studies show that e-cigarettes may be more effective as a smoking cessation tool than NRT, when combined with behavioural support (Hajen et al. 2019), and that there may be higher quit rates associated with nicotine-containing e-cigarettes compared to both NRT as well as non-nicotine e-cigarettes (Hartmann-Boyce et al. 2021).

Unlike nicotine patches, ENDS and HNBS provide similar behavioural cues as smoking cigarettes and inhaling nicotine, specifically the sensory aspects of obtaining a nicotine hit. This makes it easier for users to adopt them as smoking cessation devices. ENDS and HNBs can also be designed to allow users to gradually reduce the quantity of nicotine, and to eventually quit usage altogether.

8.2 Adapting a Risk-Balancing Framework for India

Given the above data, India can learn from the best practices of jurisdictions which have adopted a risk-balancing framework, and draw lessons from those jurisdictions which have already faced the consequences of the abstinence approach. We therefore recommend the following policy measures going forward:

- Allow HNBs initially, and regulate them under relevant provisions of the existing legal framework for tobacco products, i.e., COTPA, since they contain real tobacco. This would initially restrict the availability of e-cigarette-type products to HNBs only (and not ENDS generally) while still paving the way for harm reduction.
- HNB usage can be further regulated by imposing conditions for responsible usage, such as geo-tagging, age-gating, placing caps on consumer purchases, harm reduction messaging, etc.
- Study scientific evidence, international best practices, and commission studies on how HNBs can be used as a harm reduction tool and smoking cessation aid, including statistical models to compare public health outcomes of different interventions (Levy et al. 2021) and decision-theoretic frameworks (Levy et al. 2022). Overall, this would result in more nuanced policy with greater impacts on public health.
- Criminalise the sale of HNBs (and ENDS generally) to minors, either directly or by proxy, and whether in-person or online, and impose stiff penalties for contravention.

- Adopt a stringent regulatory framework for HNB (and ENDS) products, to avoid health risks from unregulated products on the black market. Restrictions and standards on devices, such as on engineering, design, and materials will ensure health and safety standards, and prevent tampering and misuse of devices through illicit additives.
- If and when e-cigarettes are regulatorily permitted, curb their appeal among youth and non-smokers through restrictions on the volume of e-liquid fluids, number of puffs, making the refill of devices cumbersome etc., alongside restrictions on flavourings, additives, packaging, and advertisements.
- Conduct annual surveys of HNB and e-cigarette usage and trends to ensure proactive, flexible, and evidence-based regulatory responses.

9. Conclusion

Based on the evidence from experiences of evolved markets like the UK, USA, EU, and Japan, and the overall balance of risks and benefits, it would be prudent for the Government of India to lift the ban on ENDS and HNBs and to regulate them instead. Prohibition may appear to protect public health, but the risks of unintended consequences run high.

Abstinence-based policies create thriving black markets where product quality is unregulated, leading to greater threats to public health from spurious and dangerous products. Governments also deprive themselves of legitimate tax revenue. Thus, the risks and opportunity costs of bans outweigh the perceived rewards. Regulation has the additional benefit of limiting the government's interference in citizens' private choices.

A risk-balancing regulatory approach recognises that the government can protect public health by continually taking stock of evidence and revising policies to address emerging risks. By banning ENDS and HNB devices, the government has created a system that will not be able to respond readily to the unintended consequences it has set in motion. Undoing this damage from a legislative perspective is both time and resource consuming, while damage to the health of persons using illegal devices may even be irreversible.

Further, the government may have stifled innovation by summarily banning ENDS and HNB devices. Retaining an opening for products that could demonstrably reduce harm would have been a wiser approach, with greater public health benefits. Indeed, given that HNBs are tobacco products which evidence suggests reduce harm (by helping people switch from more harmful cigarettes), it would be appropriate for the government to regulate HNBs separately from ENDS devices.

Thus, the pragmatic way forward for the government is to add HNB products to the Schedule of tobacco products regulated under COTPA. It can then frame product-specific regulations, and impose conditions for their responsible sale, distribution, and usage. The government can work with medical professionals and HNB product manufacturers to utilise these devices to enable smoking cessation. Such measures would enable users to cease their dependence on nicotine and reduce overall harm from tobacco consumption, thus improving India's overarching public health outcomes.

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NOTES

[1] The Minister's response closed the policy door on innovations in HNB devices which could assist smokers in their cessation efforts. Since the behavioural experience of using HNB devices is closer to the experience of consuming combustible tobacco, they can be useful in weaning smokers off cigarettes. Now, before they can be harnessed for such purposes, a technical distinction between ENDS and HNBs in law will be necessary.

[2] Data sources as mentioned in (Cummings, Nahhas, and Sweanor, 2020): "Conventional cigarette volume comes from the Tobacco Institute of Japan (TIOJ): converted to show the volume of sales in a calendar year in billion sticks. Annual cigarette volume prior to 2016 was obtained from PMI's earnings reports (https://www.pmi.com/investor-relations/reports-filings), which itself is based on the TIOJ data. IQOS sales data comes from Philip Morris International's (PMI's) quarterly earnings reports and were calculated from the reported market share of heatsticks. The other heated tobacco product (HTP) volume is computed as the total market volume less heatstick volume less cigarette volume. We recognize that other HTPs such as Ploom TECH consumables pack consist of five tobacco capsules and one liquid cartridge. Japan Tobacco asserts that one pack of Ploom TECH consumables is equivalent to one pack of 20 combustible cigarette sticks. We used this conversion in the data presented in the table. The total HTP figures shown in the table are determined by adding heatstick volume with other HTP volume."

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IPPR

Nature of agglomeration of the manufacturing sector –a study of Indian Districts

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Abstract

The paper estimates the degree of agglomeration of the Indian organised manufacturing sector and examines its evolution pattern across districts over the period 2000-01 to 2009-10. The estimation of the degree of industrial agglomeration is based on plant-level data from the Annual Survey of Industries. The paper uses the spatially-weighted Ellison Glaser Index to control for the inter-district spillover effect. The overall degree of agglomeration has been moderate and, over time, it registered a declining trend. While analysing the nature of industrial agglomeration, it has been observed that most of the low-tech and medium-low-tech industries are found to be highly agglomerated. 42% of the highly agglomerated industries are also highly polluting in nature. During the period 2000-01 to 2009-10, the second-tier cities observed a rise in the number of plants belonging to the polluting industries. High-tech industries are found to be concentrated in the already industrialised states. In contrast to this, the medium-high-tech industries have been spreading across districts. The distribution of low-tech industries is found to be even across the districts.

Keywords: agglomeration economies, manufacturing, India

JEL Codes: R11; R12

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Introduction

While Indian manufacturing posted an impressive average annual growth rate of more than 7% during the last two decades,[1] the dilemma of achieving manufacturing industry-based economic growth -- as well as its adverse impact on the environment -- has remained an area of concern. Another major challenge in India has been to ensure balanced regional development of industries, such that growth is not restricted to a few districts, but rather has a wide geographical spread. It is critical that the poorer regions are also part of the higher productivity and income growth story, in order to achieve inclusive development.

Regional industrial concentration has persisted in India, despite overhauling of the industrial licensing regime with systematic de-regulation and liberalization since 1991. Even enhanced government capital expenditure has failed to break the trend of escalating regional inequality, although it has had a significant positive impact on the manufacturing output growth of the poorer states (Barua and Sawhney 2015). Absolute income divergence exists at both the state and district levels; however, there is evidence of higher transitional growth in districts with proximity to urban agglomeration –indicating the importance of this geographical factor in development (Das et al 2015).

Agglomeration economies have been found to be significant in the Indian manufacturing sector. The presence of intra-industry spill overs; inter-industry linkages; availability of infrastructural facilities including transport infrastructure (ensuring easy access to input and output markets), electricity, water, etc.; and government policies have acted as centripetal forces in reinforcing agglomeration of industries in Indian organised manufacturing sector (Lall et al 2004).

High-tech industries (e.g. manufacturing of machinery equipment, manufacturing of electronics and computer equipment) are concentrated mostly in urban areas, as opposed to the low-end manufacturing industries (food and beverages, leather processing, and tobacco industries). The high-tech innovative industries have a greater ability to pay high wages and land rents prevailing in densely populated urban areas compared to the low-end manufacturing industries (Lall et al 2004). The externalities arising from the availability of infrastructural facilities, large consumer markets, and the presence of a diversified industrial base or cross-industry economies, have all had a significant positive impact on the productivity of these high-tech industries (Lall et al 2004).

On the other hand, low-end manufacturing industries like food and beverages, leather processing, and tobacco industries have mostly benefitted from within-industry economies (e.g. industry-specific labour pool and technical know-how), and are located in rural areas of the country (Lall et al 2004). While analysing the intra-industry agglomeration pattern of the manufacturing sector, Mukim (2014) found that within an industry there is a close association between formal and informal sector firms. She observed that informal firms are sellers of material inputs and labour to the formal firms within an industry.

There is also evidence that organised manufacturing has begun to spread towards peri-urban and rural areas in India (Ghani et al 2012, Colmer 2014). Moreover, the development of industrial zones, industrial corridors, parks, and financial assistance in the backward regions has led to faster growth of low-density manufacturing districts, as compared to the high-density manufacturing districts in metropolitan areas (Ghani 2014).

The overall expansion of manufacturing activities in India has also raised serious concerns about the environmental problems associated with it. In 2009, the Central Pollution Control Board noted that 48% of the industrial clusters in the country were critically polluted (43 clusters out of 88 clusters monitored) as per its Comprehensive Environmental Pollution Index (CEPI). The CEPI scores, based on several pollutants, reflect the underlying environmental quality of air, surface water, and groundwater.[2] Over the years, the index scores show that pollution in industrial clusters has significantly aggravated in several areas over the years (CPCB 2009, 2011, 2013).

There have been some attempts to prepare a comprehensive environmental mapping for the location of industries ('Zoning Atlas for siting industries') across all districts by the Central and State Pollution Control Boards, on the basis of input requirements (availability of raw materials, labour, water and power supply) and environmental factors (i.e. air, the water quality of a location) in the siting of new industrial units,[3] in order to ensure that these would be economically and environmentally viable. However, results have been mixed, as compliance with the industry-specific emission standards is monitored by the State Pollution Control Board (SPCBs), and the degree of enforcement of environmental laws varies across states.

The analysis of the nature of industrial agglomeration in the existing literature has distinguished between high-tech versus low-tech industries (based on capital intensities of the production process). Less attention has been paid to the polluting nature of industries. While the traditional capital-intensive industries (manufacturing of iron and steel, chemicals, and allied products) are pollution-intensive, all capital-intensive industries are not polluting, for instance, manufacturing of electronics and electrical goods, medical and surgical instruments etc.

There are also certain labour-intensive industries, like the manufacturing of leather, plastic etc., which are highly polluting. Moreover, existing studies on agglomeration across industries have been done at an aggregated level i.e. at the two-digit level of national industrial classification, whereas the polluting nature of industries is discernible at a more disaggregated level of classification.

The present paper fills the gap in the existing literature, ***firstly*** by distinguishing the polluting nature of industrial agglomeration at different levels of disaggregation of spatial units, and tracing its evolution pattern across Indian districts between the period 2000-01 and 2009-10. ***Secondly***, while estimating the degree of industrial agglomeration economies using the Ellison Glaeser Index, we control for the regional spillover effect (spatial weights).

Thirdly, unlike previous studies, we estimate the plant-level agglomeration economies at a finer industrial classification, defined at the 4-digit level of National Industrial Classification (NIC 2008).

Industrial agglomeration at a disaggregated level can better reflect the polluting[4] nature of industries, and would facilitate policy formulation to mitigate the environmental problems arising from the concentration of specific industries. For example, the industry of leather tanneries versus manufacturing of leather products differs in their polluting nature; these can be distinguished at a four-digit level of industrial classification, whereas at the two-digit level they are clubbed together under manufacturing of leather.

We find that close to half the Indian industries (44%) in Organised manufacturing are highly agglomerated, and most of the agglomerated industries are low-tech and polluting in nature. The overall degree of agglomeration of organised manufacturing sector, however, has decreased over time at both state and district spatial scale; indicating that manufacturing has been spreading across the country into other districts and states.

The industrially advanced states remain the hub of high-tech industries. Low-tech and medium-high-tech manufacturing plants are observed to be spreading in the north-eastern states. Moreover, the second-tier cities witnessed a rise in the share of polluting industries as opposed to the first-tier cities, especially in states like Maharashtra and Rajasthan. This indicates that the cost associated with the increase in the concentration of polluting industries over time has initiated the dispersion process. During the period of analysis, some of the laggard states have gained in terms of the share of polluting industries. This is coupled with a decline in the share of polluting industries in some of the industrially advanced states.

The rest of the paper is Organised as follows: Section 2 briefly describes the evolution of several indices used for empirical estimation of industrial agglomeration economies; Section 3 examines the evolution of the agglomeration process across Indian districts between 2000-01 and 2009-10; and Section 4 concludes the study with some policy suggestions to ensure the sustainable development of industries across India.

Section 1. Indices for empirical estimation of Industrial Agglomeration Economies

With the evolution of theories and understanding of factors underlying industrial agglomeration economies, several indices have been developed to empirically estimate the degree of industrial agglomeration across spatial units (Ellison and Glaeser 1999, Maurel and Sedillot 1999, Guimaraes et al 2011, Amirapu et al 2019). It has been observed that the degree of agglomeration varies both across different levels of spatial units, as well as different levels of industrial classification (i.e. agglomeration of industry measured at the two-digit level differs from the agglomeration measured at the four-digit level) (Maurel and Sedillot 1999, Devereux et al. 2004).

The existing indices can be broadly categorised into two categories -- discrete indices of industrial agglomeration, where spatial units are discrete (Hoover's 1936, Krugman 1991, Ellison and Glaeser

1999, Maurel and Sedillot 1999), and continuous indices, where spatial units are considered to be continuous (Duranton & Overman 2005). The continuous indices are distance-based measures, where kernel density function is estimated using the distance between a given pair of plants. This requires accurate location of a plant, which is often unavailable.

The discrete indices can be further grouped into two broad categories*:* raw measures of geographical concentration and plant-based measures of industrial agglomeration. The raw measures of the geographic concentration of an industry, namely Hoover's Location quotient (1936) and Krugman's spatial Gini coefficient (1991), capture the disparity in the distribution of regional employment (or output) in an industry relative to regional distribution of overall employment (or employment) in a region (Hoover's 1936, Krugman 1991).

One of the major criticisms of raw measures of industrial agglomeration is that these indices do not consider the within-industry plant structure, which may drive the degree of concentration of an industry. Suppose we have two industries, industry 1 and industry 2. Industry 1 is characterised by many plants all of which are concentrated in one specific region whereas industry 2 is characterised by a single plant. Despite having dissimilar within-industry structures, both the industries will show a similar Gini coefficient. In industry 1, concentration may be driven by the region–specific external economies; however, in industry 2, concentration is solely driven by the plant structure within the industry, i.e. the entire production is concentrated within a plant. This feature makes these indices irrelevant for cross-industry comparisons of the degree of agglomeration.

While constructing an index to measure the degree of spatial concentration of an industry, the main challenge has been to incorporate the randomness involved in the agglomeration process (some industries may be agglomerated spatially just by chance). Ellison and Glaeser (1999) proposed a 'location choice model' for an industry, where the probability of choosing a location by an industry is dependent on the natural advantages of that geographic area (availability of raw materials, water and electricity supply, large consumer markets, network of inter-industry linkages) and externalities arising from the co-location of plants within the industry. They defined agglomeration as the geographic concentration of an industry in excess of the plant-level concentration within the industry. This is also known as industrial localisation index.

Similar to Ellison and Glaeser Index (EG), Maurel and Sedillot (MS) formulated another index to measure the degree of industrial agglomeration. Both the indices measure geographic concentration of an industry after controlling for the effect of within-industry concentration. However, while calculating the degree of agglomeration of an industry, the two indices differ in the way they give weightage to the concentration of overall economic activity in a region. For example, if an industry is located in a highly industrialised area, the MS index takes on high value, whereas if an industry is located in a less industrialised area, then the value of the index is lower. In case of the EG index, there is no such distinction made -- the value is same in both cases.

The Gini, Location Quotient, EG, and MS indices capture the concentration of an industry, as they quantify the variability in employment (or output) of an industry across spatial units relative to the national average. Arbia (2001) argued that these indices did not capture the actual geographical location of a production unit with respect to the other adjacent regions i.e. the spatial correlation between the economic activities of region *i* and the economic activities of neighbouring regions. Moreover, using the spatial unit data defined by boundaries, the degree of industrial concentration is calculated within a pre-defined spatial unit. In the spatial econometrics literature this is also termed the modified area unit problem (MAUP) (Anselin 1988, Arbia 2001, Guimaraes et al 2011).

To account for both the neighbourhood effect as well as to correct the MAUP, indices of industrial concentration i.e. Gini, Location Quotient, EG, or MS can be weighed by using the row-standardised[5] spatial weight matrix. The spatial weights matrix captures the spatial dependence between the units of observations. The weights can be generated using the number of neighbors (*contiguity-based*) or the distance between the adjacent observations (*distance-based*) (Anselin 1988). The spatially-weighted indices capture the degree of '*spatial*' agglomeration of an industry in the true sense.

Section 2 Agglomeration economies and Indian organised manufacturing Sector

2.1 Data

The spatial concentration of organised manufacturing in India has been estimated based on the Annual Survey of Industries (ASI) factory-level database. It covers all factories registered under sections 2(m)(i) and 2(m)(ii) of Factories Act of 1948. A factory[6] is the primary unit of enumeration in the survey process. It is defined as any manufacturing unit with an employment of 10 or more workers using power and those with 20 or more workers not using power. Other than manufacturing units, it also covers all electricity undertakings, engaged in transmission, generation, and distribution of electricity. Moreover, some of the units engaged in services like repairing of motor vehicles, water supply, and cold storage also comes under the purview of the ASI survey. In this study, our analysis is restricted solely to units engaged in the manufacturing process[7].

The sampling frame of the ASI data has undergone several revisions over the years, in order to expand its coverage in each state, as well as across states. The survey frame of ASI can be broadly divided into two categories *viz*, census sector and sample sector. The census sector consists of large plants, based on the number of workers employed. The threshold to define the census sector plants has varied between 50 and 200 workers over the year, so that plants with 200 workers are always surveyed annually.

However, no threshold is followed while sampling plants located in six industrially less-developed states viz, Manipur, Meghalaya, Tripura, Andaman and Nicobar Island, Mizoram, and Sikkim. All the small manufacturing units, not classified under census sector, are included in the sample. The plants defined under the sample sector are randomly surveyed over the period.

The sampling stratum of a manufacturing unit is defined by its geographical location, viz, state and district[8], industry group (at the 4-digit level of NIC), and sector. The multiplier weights are used to generate estimates at these four sub-sample levels i.e. state, district, industry group and sector. The availability of geographical location of a factory, along with the other characteristics like output, raw materials (including types of fuel consumed), types of fixed assets[9] used in the production process, workers employed in each unit, ownership structure and export share, makes this database ideal for analysing the pattern and the underlying agglomerating or dispersing forces in driving the spatial development process of the organised manufacturing industries in India.

Agglomeration is a gradual process, where changes reflect over time. While analysing the evolution of industrial concentration over time in **Section 3**; comparison has been done between the patterns of industrial agglomeration for the period 2000-01 vs. 2009-10 across districts. The degree of concentration of only 111 industries (defined at the four-digit level of NIC2008) could be compared between 2000-01 and 2009-10.

According to the Census of India, between 2001 and 2011, the district boundaries underwent several changes, wherein many new districts were carved out from the existing ones. The number of districts increased from 593 in 2001 to 640 in 2011. This change is also reflected in the coverage of the ASI unit-level database. The ASI 2000-01 round covered 455 districts, as opposed to ASI 2009-10 round, wherein the coverage increased to 593 districts. While comparing the evolution of concentration of polluting industries across districts between ASI round 2000-01 and ASI round 2009-10, the new districts were mapped with the earlier amalgamated districts. The detailed mapping is summarised in the appendix **Table A.1.**

The agglomeration economies have been estimated using the Ellison Glaeser Index; based on the plant-level employment data,[10] defined at the four-digit level of NIC-2008. It captures the labour pool effect, i.e. the externalities arising from the sharing of labour between plants within the same industry. The paper also uses spatially-weighted Ellison Glaeser Index to account for the regional spillover or *neighbourhood effect* of industrial agglomeration economies.

While estimating the neighbourhood effect, we utilised the Shapefiles of Indian states and districts, as published by the Indian Institute of Remote Sensing (IIRS). The shapefiles are vector files containing geo-spatial information, including the latitude and longitude of each district and state. The information on coordinates was used to calculate the spatial-weight matrix using the GeoDa Software[11]. The detailed technique of spatially weighing the EG index has been explained in the **Appendix** in **Section A.1.**

While analysing the nature of industrial agglomeration in India's manufacturing sector, we have categorised the industries in terms of their technology intensity and polluting nature. The OECD definition of technology intensity[12] of industries has been followed (OECD 2011). The industries are classified into four major groups: Low-tech, Medium low-tech, Medium-High tech and High-tech.

The detail mapping of NIC codes into OECD classification has been mentioned in the **Appendix, Table A.2.**

The CPCB of the Government of India has classified industries into four different categories (Red, Orange, Green, and White) based on the pollution index score of each industry[13]. The pollution index score is dependent on the four criteria:

i. emission from the industries (air pollutants),

ii. effluents from industries (water pollutants),

iii. hazardous wastes generated by industries, and

iv. consumption of resources by industries (CPCB 2016).

In this study, the red and orange category industries are defined as *polluting industry*; Green and White category industries have been defined as *non-polluting industries*. This categorization was initiated by CPCB to regulate the location of some highly-polluting industries in ecologically sensitive areas across Indian states,[14] and curb operations of certain high-pollution industrial processes.

2.2 Estimation of Industrial Agglomeration Economies

We have used the spatially-weighted Ellison Glaeser Index[15] (γ_0^{sw}) to estimate the degree of agglomeration of organised manufacturing industries; defined at the 4-digit level of National Industrial Classification, across Indian districts. In the year 2009-10, the average degree of agglomeration of the Organised manufacturing industries is found to be moderate, with an EG^{SW} of 0.047.

While estimating the degree of agglomeration of 130 Organised manufacturing industries, defined at the 4-digit level of industrial classification, 48% of the industries were found to be highly agglomerated (i.e. γ_0^{sw}>0.05), 33% were moderately agglomerated (i.e. 0.05< γ_0^{sw} ≤0.02), and 19% were found to have a lower degree of agglomeration (i.e. γ_0^{sw} <0.02) across Indian districts in the year 2009-10.

Most of the low-tech and medium-low-tech industries are found to be highly agglomerated across Indian districts. 58% of the highly agglomerated industries are non-polluting, and 42% of the highly agglomerated industries are polluting in nature. The top 10 polluting industries which are found to be highly agglomerated across Indian districts in the year 2009-10 have been listed below in **Table 1**

Table 1. Highly agglomerated polluting industries

Industry Description (NIC)	Technology Intensity	Degree of Agglomeration (γ_0^{sw} >0.05)
Manufacture of knitted and crocheted fabrics (1391)	Low tech	0.442
Manufacture of knitted and crocheted apparel (1430)	Low tech	0.430
Manufacture of tobacco products (1200)	Low tech	0.264
Manufacture of other chemical products n.e.c. (2029)	Low tech	0.216
Tanning and dressing of leather; dressing and dyeing of fur (1511)	Low tech	0.203
Manufacture of other textiles n.e.c. (1399)	Low tech	0.159
Manufacture of articles of fur (1420)	Low tech	0.140
Finishing of textiles (1313)	Low tech	0.129
Manufacture of carpets and rugs (1393)	Low tech	0.118
Processing and preserving of fish, crustaceans and molluscs and products thereof (1020)	Low tech	0.099

Source: Author's calculation based on ASI unit level database

Section 3: Evolution of Industrial Agglomeration

3.1 Overall degree of agglomeration of Organised manufacturing industries has declined during the period 2000-01 to 2009-10.

We find that the overall degree of manufacturing agglomeration has been declining during the period 2000-01 to 2009-10 across Indian districts. This is in line with the phenomenon observed by Ghani et al (2012) and Colmer (2014), who noted that the share of the Organised manufacturing sector in urban areas has declined over time. The degree of manufacturing agglomeration has been moderate ($\gamma_0 \leq 0.05$) during the period 2000-01 to 2009-10.

During the period of our analysis, the manufacturing output of the Organised sector has grown by 15%, accompanied by a sluggish employment growth of 4% in the sector. While analysing the distribution of manufacturing activity across Indian states, the share of the already-industrialised states like Gujarat, Maharashtra, Andhra Pradesh, and Uttar Pradesh constitutes the bulk of the total manufacturing output. States like Maharashtra, Tamil Nadu, Uttaranchal, Gujarat, and Uttar Pradesh have attracted the maximum number of new plants[16] during the year 2009-10. However, during this period it is noteworthy that some of the industrially laggard states, like Jammu and

Kashmir, Meghalaya, Uttarakhand, and Himachal Pradesh, have registered a high growth rate in terms of both manufacturing output as well as employment. This suggests that the congestion costs associated with the agglomeration process act as dispersing forces, leading to the spread of industries across regions.

3.2 Medium-high tech industries are dispersing across districts as opposed to High-tech industries

While analysing the nature of the evolution of industries across space over time, plants belonging to low-tech and medium-high-tech industries are spreading more across the districts as opposed to high-tech plants. **Figure 1** (below) depicts the distribution of manufacturing plants in *high-tech* industries across Indian districts. High-tech plants are concentrated in a few districts in Gujarat, Maharashtra, West Bengal, Karnataka, Tamil Nadu, Andhra Pradesh, Delhi, and Chandigarh. We observed that high-tech plants are spreading out across districts within the same states. Districts like Rann of Kutch of Gujarat, or Faridabad and Gurgaon of Haryana, show a significant increase in the percentage share of high-tech plants in the year 2009-10 as compared to the year 2000-01.

Figure 1 Distribution of High-tech Plants across Indian District 2000-01 vs. 2009-10

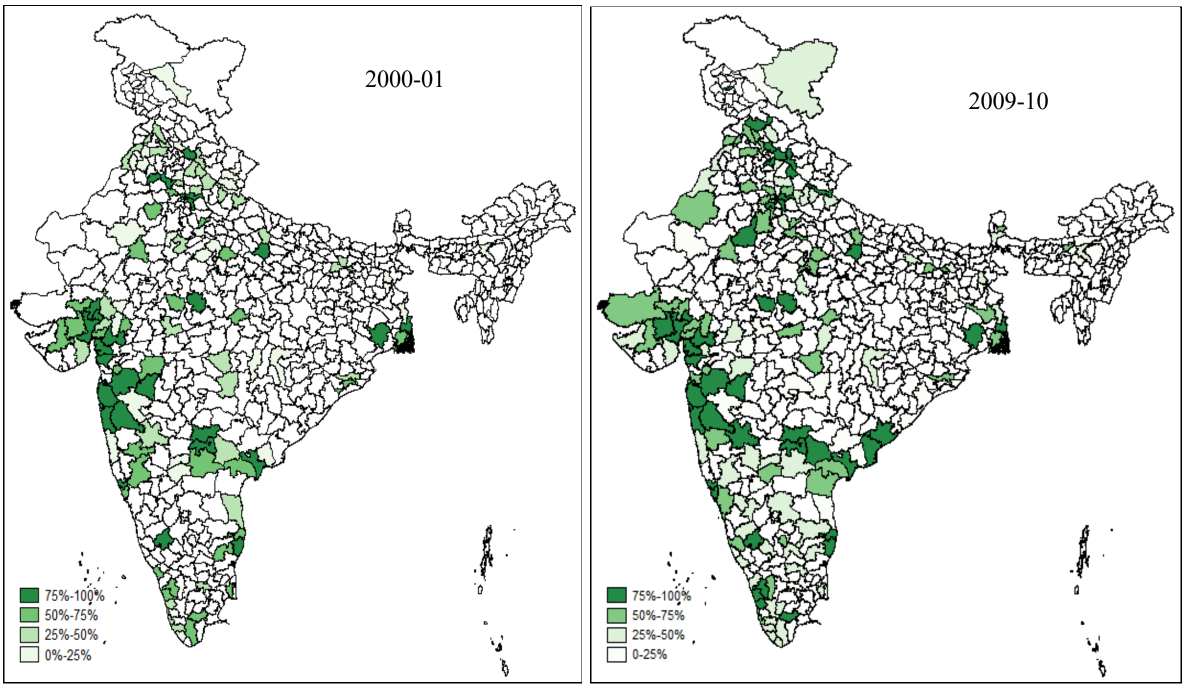

Fig 1a) Distribution of High-tech Plants in 2000-01 Fig 1b) Distribution of High-tech Plants in 2009-10

In Figure 2, the distribution of medium-high-tech plants is seen to be spreading away from the coastal belt to the central and northern districts of India. Some districts in the interior states of Haryana, Punjab, and Delhi show a significant increase in the percentage share of medium-high-tech plants. Within Maharashtra, medium-high-tech industries seem to have spread to districts like

Aurangabad, Satara, and Nashik. Some districts of Karnataka and Goa also seem to have gained in terms of these plants. On the western side, many districts of Rajasthan like Bikaner, Ajmer, Jodhpur, and Jaipur seemed to show a significant rise in the number of medium-high-tech plants in the year 2009-10 as compared to the year 2000-01.

Figure 3, reflects that plants in low-tech manufacturing industries are spreading out across the country over the entire period of our analysis. In contrast to high-tech and medium-high-tech, low-tech industries have also spread to the north-eastern districts of India, which are the least industrialised regions of the country.

Figure 2 Distribution of Medium-High tech Plants across Indian Districts 2001 vs. 2010

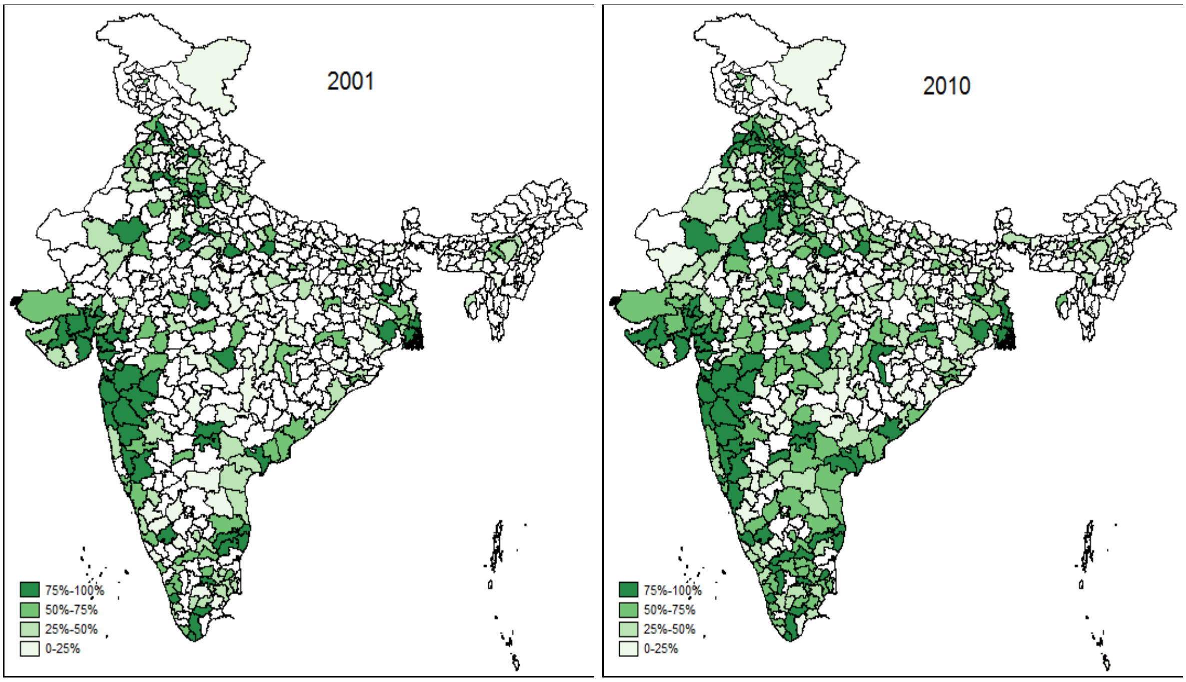

Fig 2a) Medium-High-tech Plants in 2001 Fig 2b) Medium-High-tech Plants in 2010

From the preliminary analysis of the distribution of high-tech, medium-high-tech, and low-tech plants across districts, we can conclude that high-tech manufacturing industries are biased towards high-income states like Gujarat, Maharashtra, Tamil Nadu, and Andhra Pradesh. However, plants belonging to medium-high-tech industries have spread, over time, to northern districts like Faridabad, Ghaziabad, and Gurgaon in Uttar Pradesh and Haryana, which have become hubs of the automobile industry. The low-tech industries show a more even distribution across states, including low-income, least-industrialised North-Eastern states.

Figure 3 Distributions of Low-tech Plants across Indian Districts 2001 vs. 2010

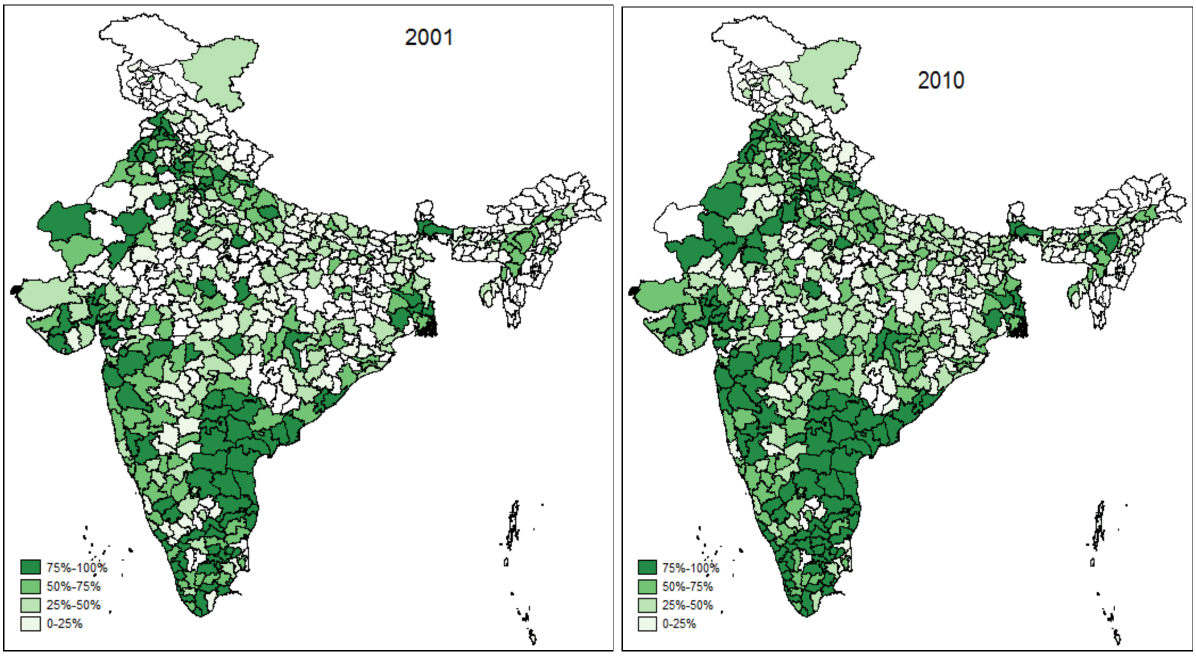

Fig 3a) Distribution of low-tech Plants in 2001 Fig 3b) Distribution of low-tech Plants in 2010

3.3 Second-tier cities have registered growth in the number of polluting industries

While distinguishing between polluting and non-polluting industries, it has been observed that during 2000-01 to 2009-10, the dispersion of polluting industries has been higher as opposed to the non-polluting industries[17]. **Figure 4** (below) indicates the distribution of plants across districts belonging to polluting industries in the year 2000-01 vs. 2009-10. Changes in the distribution of polluting industries can be observed in small pockets, as highlighted by the yellow dotted circles.

Some of the districts of the coastal states in the south have become cleaner, in terms of reduction in the number of polluting plants. Some of the districts of northern states and north-eastern states are observed to have seen a rising share of polluting plants over this time. During this period, some of the second-tier cities like Faridabad, Coimbatore, Ludhiana, Pune, Jaipur, and Rajkot have registered an increase in the number of polluting plants.

The spurt in the process of urbanization in Tier-1 cities has led to a massive outflow of people toward second-tier cities. Moreover, it has been established in the literature that over the last few years, the rising cost of land and other factors of production has led to the shift of the manufacturing industries towards semi-urban areas or rural areas (Colmer 2014). Since manufacturing is associated with emissions, the concentration of industries (especially polluting industries) within metropolitan cities will aggravate the cost of congestion in terms of environmental pollution. This in turn may have further fuelled the process of the shift of manufacturing industries toward the secondary cities.

Figure 4: Distribution of Plants across Districts

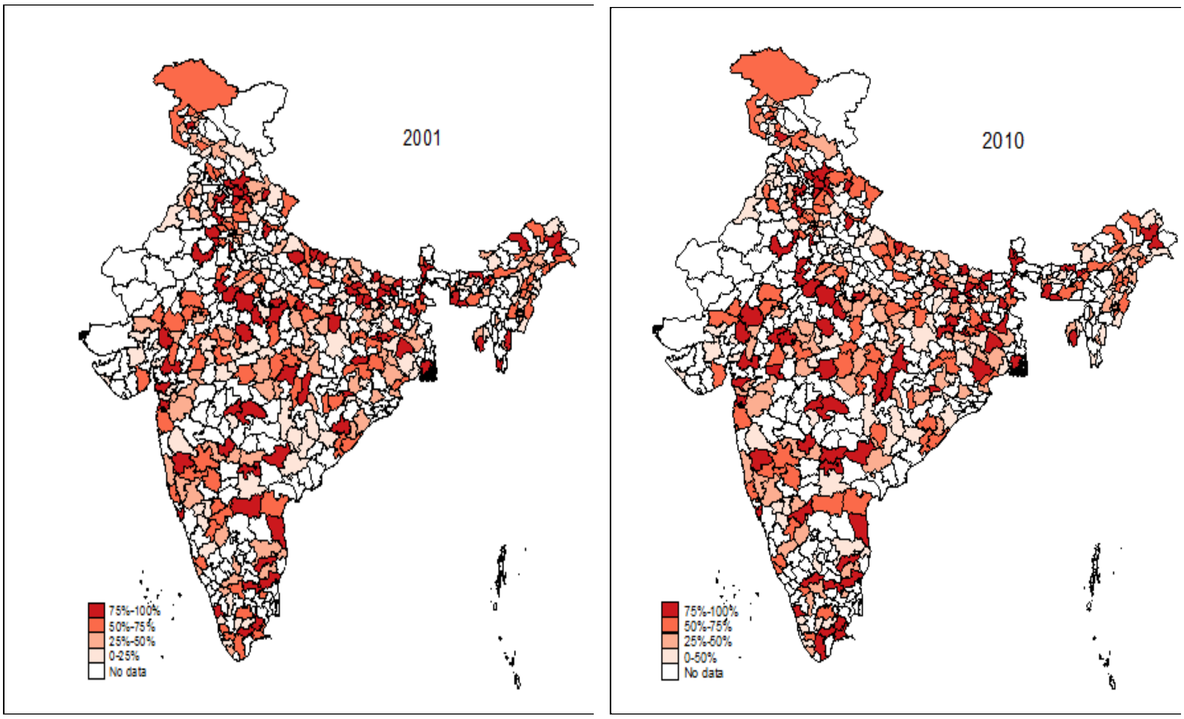

Fig 4a) Distribution of Polluting Plants in 2001 Fig 4b) Distribution of Polluting Plants in 2010

Section 4: Conclusion

This paper tracked the evolution pattern and nature of industrial agglomeration in the Indian Organised manufacturing sector (at a 4-digit level of industrial classification across districts. The agglomeration economies estimated in this paper capture the positive externalities arising due to sharing of the labour pool across plants, reflecting the employment-generation potential of industrial clustering policies.

We find that the Organised manufacturing industries seem to be moderately agglomerated, and over time, showed a decline in the degree of agglomeration at the district level. This indicates the dispersion process of Organised manufacturing activities across districts over time.

While analysing the nature of agglomeration, the low-tech and medium-low-tech industries are found to be highly agglomerated. Some of the highly agglomerated low-tech industries are also polluting in nature. This raises concern about the environmental impacts of the clustering process of manufacturing industries. The diseconomies associated with the process threaten the sustainability of the cluster development programmes, thereby weakening the objective of achieving manufacturing industry-based economic growth and employment generation. Analysing the nature (polluting nature as well as technology-based nature) of the industrial clusters seems to be an inevitable part of the manufacturing-based cluster development programmes.

We also find that medium-high-tech industries and low-tech industries have dispersed across districts, with the latter group spreading to poorer regions in northeast India. Most of the high-tech plants are found to agglomerate in the districts of high-income states. The technological difference may be one of the factors behind fostering regional income inequality across Indian districts. This needs further empirical analysis and can be a future research area.

During the period of analysis, the polluting industries are also found to be dispersing across Indian districts. It appears that, over time, some of the districts of the industrially laggard states have gained a higher share of plants belonging to polluting industries. This is coupled with the observation that some of the high-income districts have seen a drop in the share of plants belonging to polluting industries. It will be interesting to examine the role of (the degree of) environmental stringency in driving this dispersion process, after controlling for other agglomeration externalities. The testing of the 'pollution haven effect' across Indian districts in presence of agglomeration externalities can similarly be a potential future area of research.

The paper also observes that the spillover of economies (or diseconomies) across Indian districts cannot be limited by pre-defined district boundaries. While estimating the degree of agglomeration of industries, it is imperative to consider the degree of agglomeration of industries in adjacent regions. A recent initiative of the Government of India -- to develop a Comprehensive Zoning Atlas at the district level for new investors, which incorporates both economic as well as environmental parameters -- may ensure the long-term sustainability of cluster development programmes in India.

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APPENDIX

Table A.1 Mapping of New Districts[@]

State	Name of the New Districts (2009-10)	Earlier Amalgamated Districts 2000-01
Punjab	Sahibzada Ajit Singh Nagar	Rupnagar and Patiala
Haryana	Mewat	Gurugaon
Bihar	Arwal	Jehanabad
West Bengal	East Medinipur	Medinipur (West Medinipur)
Jharkhand	Simdega	Gumla
	Jamtara	Dumka
	Saraikela-Kharsawan	Paschim Singhbhum
Madhya Pradesh	Anuppur	Shahdol
	Burhanpur	East Nimar
Tamil Nadu	Krishnagiri	Dharampuri

@ Mapping of districts only covered under the ASI 2000-01 round and ASI 2009-10 rounds has been tabulated above

Section A.1

Ellison-Glaeser industrial agglomeration index

While estimating the degree of agglomeration of an industry, Ellison and Glaeser (1999), constructed a discrete probability model (following Bernoulli distribution) to analyse the correlation between the location choices of two plants belonging to the same industry. The two plants within the same industry may locate near each other due to the presence of externalities or spillovers. The benefits from locating near other plants arises from exchange of labour pool or of technological know-how within the same industry, or inter-plant trade in intermediate inputs.

In our analysis, we focus on the labour pool channel. Since a plant chooses to locate in a region where it can gain maximum profit, the profit function of a plant belonging to industry i located in region m is affected by two factors: a) employment share of region m in aggregate employment, and b) location of other plants within the same industry owing to the presence of spillovers.

Let there be N number of plants in industry i and $q_1, \ldots q_j, \ldots, q_N$, are the shares of these plants in the total employment (or output) of the industry. The Herfindahl index of industry i $H_i = \sum_{j=1}^{N} q_j^2$, captures the plant size distribution within industry i.

The model assumes that the location choice of plant j to set up its operations is an independent identically distributed random variable, so the regional share of industry i can be re-written as, $s_i = \sum_{j=1}^{N} q_j u_m$, where u_m is the Bernoulli random variable (which takes a value of 1 if a plant j locates in region m, and 0 otherwise).

Ellison and Glaeser modelled the interaction between the location decision of two plants *j* and *k* within the same industry *i* owing to the presence of spillovers. The interaction between the location decisions of two plants within the same industry in region *m* is defined as,

$$Corr(u_{mj}, u_{mk}) = \gamma_0 \quad for\ j \neq k \qquad (1a)$$

Where γ_0 captures the degree or the strength of spillover between two plants belonging to the same industry, located in the same region. The probability that plant *j* and *k* will locate in the same area *m* is given by,

$$p(j_m k_m) = E(u_{jm} u_{km}) = Cov(u_{jm}, u_{km}) + E(u_{jm})E(u_{km}) = \gamma_0 x_m(1 - x_m) + x_m^2$$

The probability P that plant *j* and *k* locate in any of the *M* locations is given by

$$P = \sum_{m=1}^{M} p(j_m k_m) = \gamma_0 x_m(1 - x_m) + x_m^2$$

$$P = \sum_{m=1}^{M} p(j_m, k_m) = \gamma_0 (1 - \sum_{m=1}^{M} x^2{}_m) + \sum_{m=1}^{M} x_m{}^2 \qquad \text{(ii)}$$

Ellison and Glaeser explained (using the example of throwing a dart in space) that the location choice of a plant is a two-stage process. In the first stage, natural advantages of a region drives a fraction of the plants to locate there. In the second stage, some plants choose to co-locate in the same region owing to the presence of spillover among them. The strength of the spillover is captured by parameter γ_0.

$$\gamma_0 = EG_i = \frac{G_i - (1 - \sum_{m=1}^{M} x_m^2) * H_i}{(1 - \sum_{m=1}^{M} x_m^2) * (1 - H_i)} \qquad \text{(iii)}$$

where, G_i is the measure of raw concentration of the industry as defined by equation (2)

Spatially-Weighted Index of Industrial Agglomeration

The Ellison-Glaeser index has been criticised for capturing the degree of concentration irrespective of its geographical position relative to other areas within the country, i.e. spillover from adjacent regions was not considered in the estimation process.

Guimareas et al. (2010) index of industrial agglomeration has been modified to incorporate the spillover effect of the neighbouring regions. The spillover effect of economic activity of adjacent regions has been captured by weighing the regional share in equation (iii) by using the spatial weights matrix, W.

The modified Ellison-Glaeser Index of agglomeration can thus be re-written as

$$\gamma^{SW}{}_i = \frac{G_s - (1 - W\sum_{m=1}^{M} x_m^2) * H_i}{(1 - W\sum_{m=1}^{M} x_m^2) * (1 - H_i)} \quad \text{(iv)}$$

Since, W is a spatial-weight matrix, the equation (iv) can be re-written in the vector form as

$$\gamma^{SW}{}_i = \frac{G_s - (1 - x_m{}'Wx_m)H_i}{(1 - x_m{}'Wx_m)\sum_{m=1}^{M}(1 - H_i)} \quad \text{(v)}$$

where, $G_s = (s_{im} - x_m)'W(s_{im} - x_m)$ is the Spatially weighted Gini Index of equation (2)

Table A.2 Technology classification of industry

ISIC Rev.4/ NIC 2008	Industry Description	OECD tech classification
10	Manufacture of Food Products	Low
11	Manufacture of Beverages	Low
12	Manufacture of Tobacco Products	Low
13	Manufacture of Textiles	Low
14	Manufacture of wearing apparel	Low
15	Manufacture of leather and related products	Low
16	Manufacture of Wood and Wood Products	Low
17	Manufacture of Paper and Paper Products	Low
18	Printing and Reproduction of Recorded Media	Low
19	Manufacture of Coke and Petroleum Products	Medium-low
20	Manufacture of chemicals and chemical products	Medium-high
21	Manufacture of basic pharmaceutical products & preparations	High
22	Manufacture of Rubber and Plastic Products	Medium-low
23	Manufacture of Other Non-Metallic Mineral Products	Medium-low
24	Manufacture of Basic Iron and Steel	Medium-low
25	Manufacture of Fabricated Metal Products	Medium-low
26	Manufacture of computer, electronic and optical products	High
27	Manufacture of electrical equipment	Medium-high
28	Manufacture of machinery and equipment	Medium-high
29	Manufacture of motor vehicles, trailers and semi-trailers	Medium-high
30*	Manufacture of other transport equipment: aircraft & spacecraft	High
30*	Manufacture of other transport equipment - railway equipment	Medium-high
301	Building of ships and boats	Medium-low

* excluding 301 - Building of ships and boats
Source: UNIDO-World Bank definition based on OECD classification

NOTES

[1] Calculation based on data from World Development Indicator database.
[2] The CEPI score has a scale of 0-100, where a score of 70 and above indicates the region is critically polluted, and a score of 60-70 indicates a severely polluted area. The criteria pollutants include (i) Sulphur dioxide, nitrogen dioxide, fine particulate matter (PM_{10}, $PM_{2.5}$), lead, ozone, carbon monoxide, benzene, etc for ambient air quality; and (ii) Dissolved oxygen, biological oxygen demand, chemical oxygen demand, pH, faecal coliform, phosphorous, ammonia, arsenic, heavy metals including lead, cadmium, mercury, etc for surface and groundwater quality. The calibration of CEPI was revised in 2016, so the index scores are not quite comparable with the earlier years.
[3]http://www.cpcbenvis.nic.in/cpcb_newsletter/ZONING%20ATLAS%20FOR%20SITING%20OF%20INDUSTRIES.pdf
[4] While categorizing an industry as polluting or not polluting, we follow the Red list, Orange list, and Green list of industries as defined by the Ministry of Environment, Forests, and Climate Change. The categorization is based on the emission/effluent load of the industries and consumption of resources.
[5] Each element in the row of the spatial weight matrix is standardised by the row total. This is a standard exercise in spatial econometrics literature to assign equal weightage to all the neighbors of a particular spatial unit.
[6] The owner of each factory identified under some industry group has to file a return annually to the statistical office of the regional offices of NSSO. However, owners with more than two factories identified under the same industry group and located in the same state are allowed to file consolidated or joint returns.
[7] According to the NIC2008 classification, all units categorised under divisions 10 to 32 are included in the study.
[8] The information on the district codes has been suppressed beyond the year 2009-10 owing to the confidentiality issue.
[9] Book value of fixed assets is reported in the Annual Survey of Industries data.
[10] Alternatively, as a robustness check, output data has also been used to estimate the industrial agglomeration economies.
[11] GeoDa is a free and open-source software tool and is widely used for spatial data analysis. The software has special features for spatial data modelling *viz* calculation of spatial weight matrix, spatial auto correlation statistics, spatial regression analysis, Moran-I statistics, etc.
[12] The definition of technology intensity of industries is based on the expenditure on research and development.
[13] The Red category is defined as industries with a pollution index score >60; the Orange category is defined as industries with a pollution index score greater than or equal to 41 but less than 60; the

Green category is defined as industries with a pollution index score greater than equal to 21 but less than 41; the White category is defined as industries with pollution index score less than equal to 20.
[14] The ecologically sensitive areas are protected areas for the conservation of Biodiversity; for example, Doon Valley in Uttarakhand, and Sultanpur in Uttar Pradesh.
[15] EG index (γ_0) captures the degree or the strength of spillover between two plants belonging to the same industry, located in the same region. Further, spatially weighted EG also corrects for the spillover effect of the adjacent regions. the detail of the index has been illustrated in the **Appendix**. The value of the index ranges between $-1 < \gamma_0 < 1$. If the value of the index is 0 then it indicates a *lack of agglomerative forces*. If the value of the index for an industry is greater than 0 then the industry is localised. The thresholds to classify different industries- If the value is below 0.02 but positive then the industry is *not very agglomerated*. If the value varies between 0.02 and 0.05 then the industry is *moderately agglomerated* and if the value of is above 0.05 then the industry can be categorised as *highly agglomerated*. The negative value indicates that the industry is *dispersed.*
[16] We define new plants an age of less than equal to three years i.e., their year of incorporation is between 2007-08 and 2009-10
[17] Dispersion is also visible in case of some non-polluting industries. However, there are also some non-polluting industries that have become agglomerated over time.

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IPPR

SAARC – Time To Change

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Abstract

This paper examines SAARC's performance and failures as a regional cooperation forum, since its establishment with the signing of the SAARC Charter in Dhaka on 8 December 1985. First, it briefly reviews the recent geopolitical situation in South Asia. Against the backdrop of the evolving geopolitical situation, the paper reviews South Asian integration in a nutshell. It then examines the progress and failures of SAARC as a regional forum in four key areas of regional cooperation and integration: trade, money and finance, and people-to-people contacts. From the available empirical evidence, the paper deciphers that regional integration under SAARC has progressed at a far lower momentum than what was expected at the time of its formation. Progress in regional cooperation under SAARC also compares poorly with similar regional forums in both Europe and Southeast Asia. Against this backdrop, this paper synthesizes the existing studies on SAARC, and comes up with ambitious yet pragmatic policy options for fast-tracking the forum's economic integration.

Keywords: SAARC, Regional Cooperation, Regional integration, South Asia

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# The views expressed in the paper are those of the authors and need not necessarily reflect those of the institutions with which he is associated.

1. Introduction

The South Asian Association for Regional Cooperation (SAARC) was established with the signing of the SAARC Charter in Dhaka on 8 December 1985. As of now, SAARC consists of eight member states and nine observer states. The eight member states are: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The nine observer states are Australia, China, the European Union, Iran, Japan, South Korea, Mauritius, Myanmar, and the United States of America (U.S) (SAARC Secretariat Website). In 2021, SAARC comprised 3.5% of the world's land area, 21% of the global population of nearly 8 billion, and 5.2% of global income.

SAARC is perhaps the only regional association in the world, which has more observer members than full-fledged members. China is presently an 'observer member' in SAARC but has expressed interest in being upgraded to a 'dialogue partner' first, and to full membership status subsequently (Ahmar, 2020).

Observer states are invited to participate in the inaugural and the closing sessions of the SAARC Summit. Member states could also invite the SAARC observers to productive, demand-driven projects in the following sectors: (i) communication (ii) connectivity (iii) agriculture (iv) public health (v) energy (vi) environment and (vii) economic cooperation. At present, there is a moratorium on the admission of new observer members (SAARC Secretariat Website).

In the 37 years since its inception, SAARC Summits have been held only 18 times, with the last one taking place in Kathmandu in 2015. Pakistan was supposed to host the 19th Summit in 2016; however, India refused to attend the Summit, in the wake of a terrorist attack on an Indian military camp in Uri; Bangladesh and Bhutan also withdrew from their participation (Wikipedia, accessed on 31 December 2022). If anything, Indo-Pak hostility has risen since then.

SAARC's achievements to date seem to fade in comparison to the original objectives enunciated in its Charter. The very first line of the SAARC Charter states the objectives to be: "*...promoting peace, stability, amity, and progress in the region*." SAARC has very little to show in each of these areas. As per media reports, in 2017, the then Foreign Secretary of India, Jaishankar, was quoted as saying: "SAARC is a 'jammed vehicle' (The Economic Times, 2017, 26 October). About a year later, Nawaz Sheriff, the then Prime Minister of Pakistan, was quoted as saying: 'SAARC has 'survived', not 'triumphed' (The Economic Times, 2018, 12 July). Some have even wondered if SAARC is a viable block at all (Hasan, 2001).

That said, a divided South Asian region would be a major roadblock for Asia playing a significant role in global economic governance (Madhur 2012). Against the backdrop of these perceptions, this paper examines SAARC's performance and failures as a regional cooperation forum.

The paper first synthesizes the existing work on the performance and constraints of SAARC and comes up with ambitious yet pragmatic policy options for fast-tracking the region's integration. Section 2 provides a quick look at South Asia's geopolitical configurations; Section 3 takes a bird's-eye view of South Asian integration. Section 4 evaluates South Asian trade integration. Section 5 examines the prospects and problems of monetary integration among SAARC members. Section 6 provides the current status of and future prospects for people-to-people contacts in SAARC countries. Section 7 sums up and provides the key conclusions of the paper.

2. Geopolitical Configurations

The current political situation in Afghanistan is a key impediment to South Asian economic integration. There is still no consensus, not just in South Asia but across the world, about recognizing the Taliban as the legitimate government of Afghanistan (Waheed, 2022).

The Taliban takeover of Kabul on 15 August 2021 has left China also in a dilemma. China now shares a border with a country ruled by a terrorist group. Geopolitically, China is also one of the closest strategic allies of Pakistan. As the rest of the world withdrew from Afghanistan, China now finds itself in an influential position, handling a number of interregional relationships (Pantcci, 2022).

The relationship between Pakistan and Afghanistan itself has been undergoing tumultuous changes. In the initial months of the Taliban's takeover, Pakistan appealed to the international community not to impose harsh sanctions on Afghanistan. That honeymoon period was short-lived; subsequently, relations between Pakistan and Afghanistan have soured. Thus, Pakistan had to reassess its attitude towards its once ally, as the number of terrorist attacks in Pakistan itself rose substantially in the years since the Taliban took over Afghanistan (Waheed, 2022).

The Taliban is now vying for increased autonomy from Pakistan and has shown an inclination to improve ties with India. Taliban seems to have shown interest in India training its troops. As a result, Pakistan now has an additional challenge of thwarting the potential of India establishing a presence in Afghanistan (Waheed, 2022). Moreover, Taliban's support for the Chabahar Port Project in Iran has the potential to reduce the relevance of Pakistan's China-funded Gwadar port (Waheed, 2022).

The global economic and political landscape is also changing rapidly. In the words of Word Bank President, David Malpass: *"The world is facing dangerous crises that are hammering developing countries, hitting the poor and vulnerable, and worsening global inequality. High inflation, war in Ukraine, large macroeconomic imbalances, and shortages of energy, fertilizer, and food have caused the sharpest global economic downturn in 80 years, compounding the death tolls, economic shutdowns, and school closures of the COVID-19 pandemic."* (Malpass, 2022).

About a year earlier, the Indian Prime Minister, Narendra Modi had expressed similar views. He had very emphatically said that the post-pandemic world would witness a vastly different geopolitical scenario, for nations and people alike. Kevin Rudd, former Prime Minister of Australia, refers to the post-Covid era as "the dangerous decade ahead", with China becoming a much more dictatorial and unpredictable power (Rudd, 2022).

Others have observed that the post-pandemic world will be a heterodox one, as geopolitical sands begin shifting in unexpected directions. "Not *only will the virus usher in behavioural, social and political modifications at a micro level and trigger indelible domestic changes, it will also impact nation-states at a macro level. Economic vulnerabilities will be exposed, and the shifting of geopolitical sands will be accelerated.*" (Talukdar, 2020).

Just as the world economy seemed to be recovering from the 'virus halt', Russia's invasion of Ukraine has come as an added headache for global leaders. In addition, Iran seems to be on the verge of a revolution. As the 27th November 2022 issue of the Economist Magazine very aptly explained, most revolutions reach a point where the regime under threat moves from trying to control the crowd without spilling too much blood to sending in the army to crush the revolt. Iran may be nearing that point. In some parts of the country, women are on the roads protesting against the repressive regime, helicopters fly overhead, and circling drones broadcast martial songs (The Economist, 27 November 2022). To cap it all, as per a recent BBC news report, Iran has just announced the first execution of a protester convicted over the recent anti-government unrest.

China is also undergoing considerable political turmoil, perhaps the most significant since the 1989 Tiananmen Square incident. True, China still remains the manufacturing factory of the world (Mann and Singh, 2020). However, protests have erupted in Beijing, Shanghai, and Urumqi, amidst popular fury over the repeated lockdowns. (The Economist, 2022, 27 November). Unfortunately, China enforced draconian lockdowns from time to time, rather than effectively vaccinating its people (Cha, 2022). It appears that China's near-term growth will be far less than the rate the country had posted for decades before the Covid outbreak potentially thwarting the country's social stability (Cai, accessed on 23 February 2023).

A time of such significant changes across the world is a good time for SAARC to change too. India's Prime Minister, Narendra Modi, is well placed to sort out many of the bilateral differences among the SAARC countries, since he enjoys unprecedented political stability at home. India should then be better able to sort out bilateral issues and help SAARC to fast-track its regional integration agenda. A troubled neighbourhood is neither good for India nor for its neighbours. India should, therefore, take the lead in expeditiously sorting out the bilateral issues and making South Asian integration a reality.

Taking leadership of institutions and guiding their objectives, especially during times of crisis, is something that India is not unfamiliar with. As soon as the virus broke out, Prime Minister Modi urged greater cooperation among the SAARC nations. It was indeed creditable that by holding the first SAARC Summit after a gap of many years, though a virtual one, he sent a comforting message to the region. Subsequently, he took the initiative in creating a Covid Emergency Fund and pledging $10 billion – more than half of the total contribution to that fund (Pattanaik, 2020).

India has exhibited a highly cooperative attitude in the aftermath of the Corona Virus breakout, by voluntarily sharing its vaccines among the neighbouring countries under the 'Vaccine Maitri

Program'. If 'China is the factory of the world', Prime Minister Modi is rightly marketing India as the 'pharmacy of the world' (Taneja and Singh, 2021).

India's timely help to Sri Lanka earlier this year was another admirable example of how India took regional leadership in times of a crisis. Sri Lanka was already negotiating with the International Monetary Fund (IMF) for a financial program to tackle its financial crisis. Meanwhile, Sri Lanka was seeking some bridge finance to meet the costs of importing essential imports of food, fuel, and medicines. At that time, India was indeed the first responder to Sri Lanka (Wignaraja, 2022). In the first seven months of 2022, India provided Sri Lanka with a concessional aid of about $.4.0 billion – through credit lines, deferred loans, grants, and currency swap arrangements. India

3. South Asia's Integration in a Nutshell

In terms of an overall index of regional integration, presented by the Asian Development Bank's February 2023 Asian Integration Report, South Asia is almost at the bottom of the table (along with central Asia) in the (ADB, 2023). The components of the regional integration index presented in this report are trade and investment, money and finance, infrastructure connectivity, production networks and supply chains, technology and digital connectivity, environmental cooperation, and institutional arrangements.

The region has very little intraregional flow of goods, capital, and ideas. Moreover, SAARC is even behind the Central Asian Regional Economic Cooperation (CAREC). Earlier studies also came up with similar results (Dubey, 2007; Kumar, 2007; Kumar, 2015; Madhur, 2016). "*The cross-border investment, royalty payments, movement of people, purchase and exchange of technology and innovation, or even the number of cross-border telephone calls are all faint in South Asia*" (Neupane, 2022). This reflects the snail's pace at which regional cooperation has proceeded under SAARC, despite SAARC having a relatively robust institutional base (Bhattacharyay, 2010).

Even among geographically contiguous countries of SAARC, connectivity is highly inadequate. Even the much-touted regional rail corridors within SAARC suffer from inadequate standardization of technologies and operation and maintenance practices, including different types of gauges, braking systems, incompatibility of rolling stock etc. (ADB, 2009; World Bank, 2022). Other barriers include lack of loop lengths, some missing links of shorter lengths in the borders areas, lack of physical infrastructure at points of intersection, load restrictions on bridges, lack of coordination for gauge conversion programs on different railway systems, and capacity constraints in certain sections of the identified corridors (ADB 2009; Kumar, 2015; Kathuria, 2018).

Although South Asia is home to 25 ports, maritime transportation remains constrained. 10 of the 25 ports are considered as gateways of regional significance. Key constraints to the effective functioning of these ports range from capacity constraints at many of the gateways, to heavy siltation at channels where depths fluctuate with tide. Cargo and ship handling equipment too were found to be quite outdated in many gateways. (ADB, 2009; Kumar, 2015; Kathuria, 2018).

As per a 2022 World Bank study, it is about 15-20% cheaper for an Indian company to trade with Brazil or Germany than with neighbouring Bangladesh (World Bank, 2022). The same study estimates that the unexploited potential trade is nearly 93% for Bangladesh, 76% for Nepal, and 50% for India. Take the case of Bangladesh's imports of cotton from Pakistan. A consignment of cotton can take anywhere up to 40 days to move from West Punjab to Chittagong via Karachi, with transshipment in either Colombo or Singapore. If a container of cotton could be put on a freight train leaving Lahore and moving across India, this could possibly reach Dhaka within 4 days (ADB 2009; Kathuria, 2018; World Bank, 2022). That is a stark example of the extent to which the region would potentially benefit from better integration.

Placing all the constraints on SAARC together makes it resemble a cobweb of intricate issues, crisscrossing across its member countries. Are there any reasonable solutions to dovetail the cobweb of constraints on SAARC? What would those pragmatic solutions be? What are the options that could be used to address those constraints, so that the Regional Forum remains meaningful to its member states and its people? As the largest and strongest member of the subregion, how best could India help the forum to take key policy decisions at the regional level?

If the SAARC countries could agree on a set of pragmatic answers to these questions and implement these with sincerity, SAARC could still be revived to benefit the region's 1.7 billion people. It is well known that the process of regional integration promotes equity within the region. Just as with globalization, regional integration helps less developed countries gain more than the more developed countries within the region. It is thus a great equalizer for the participating countries. A recent study on Indian Ocean Rim Association, once again, reconfirms this equalizing effect. " *The overall results indicate that the middle and low-income countries in IORA would benefit more than the higher-income countries in terms of welfare, GDP, and trade expansion.*" (Ankitola et.al., 2022, p.727)

4. Boost Intraregional Trade

The idea that higher the trade between countries, the lower the probability of countries going into wars between them is now more than a century old. As early as the beginning of the 20th century, John Stuart Mill, the well-known British economist, so eloquently wrote in his Principles of Political Economy: " *The great extent and rapid increase of international trade, in being the principal guarantee of the peace of the world, is the great permanent security for the uninterrupted progress of the ideas, the institutions, and the character of the human race*" (quoted in Lee and Pyun, 2009, p.2). Using a large sample of data and information, Lee and Pyun found robust empirical evidence to this theory. " *Trust promotes trade, and trade fosters trust, interdependency, and constituencies for peace*" (Kathuria, 2018).

The SAARC constitution too recognizes this age-old principle; yet in practice, some member states have turned this basic principle right up on its head. Trade among the SAARC member countries has been limited by several factors: highly protective tariffs; inadequate road, marine, and air transport; and above all, a huge trust deficit between India and Pakistan. According to a 2016 estimate by the World Bank, intraregional trade accounts for barely 5% of South Asia's total trade, compared to the ASEAN region where intraregional trade accounts for 25% of the region's total trade.

Article 10 (2) of the SAARC charter poses the biggest obstacle to integration in the subregion. This article excludes bilateral and contentious issues from any discussion, whatsoever, among the SAARC members. About 35% of the value of intraregional trade in South Asia is subject to this sensitive list, undermining the very purpose of a free trade agreement (Kathuria, 2018). Indeed, the South Asian Preferential Trade Agreement (SAPTA) can work if, and only if, Article 10 (2) is trimmed substantially, if not eliminated altogether.

Trade among South Asian countries is far below its potential. According to a 2016 World Bank estimate, at less than 5%, SAARC's intra-regional trade compares poorly to East Asia's 35% and Europe's 60%. A 2016 study by ESCAP also found that intraregional trade in South Asia was less than one-third of its potential (ESCAP, 2016). Using a gravity model approach, the same study placed that the region's potential intraregional trade at $81.2 billion, with the potential to more than double by 2020 to an estimated $172 billion.

The low level of intraregional trade is explained by a number of factors, such as high costs of intraregional trade, poor supply capacities in member countries, poor trade facilitation at borders, and prevalence of a variety of nontariff barriers (Dubey, 2007: Chandan, 2013; Taneja (1999); Kumar, 2015; ESCAP, 2016; Kathuria, 2018). It is 20% cheaper for India to trade with Brazil than with its neighbouring Pakistan (Kathuria, 2018).

SAARC must be the only attempt at regional cooperation in the world that maintains higher trade barriers among the member countries than with the rest of the world. An index measuring the tariff equivalent of a country's tariff and nontariff barriers, shows that the indices are two to nine times higher for most South Asian countries if countries import from their next-door neighbours than from the rest of the world (Kathuria, 2018). In the two largest economies in the region, India and Pakistan, the indices of protection are nine and six times higher, respectively, for importing from the South Asian region than for importing from the rest of the world (Kathuria, 2018).

Put simply, many South Asian countries trade on better terms with distant economies than with their own neighbors. Indeed, the costs of intraregional trade are much higher within South Asia compared with other regional trade blocks across the world (Kathuria, 2018). Besides undermining tariff liberalization, these non-transparent para-tariffs (as Kathuria refers to them), are also not part of the phaseout program under the SAPTA. These para-tariffs thus seem to remain stay put forever. For example, the average costs of trade within South Asia are 20% higher compared to country pairs in the Association of Southeast Asian Nations (ASEAN) and over three times higher than the corresponding costs among the countries of the North American Free Trade Agreement (Kathuria, 2018).

What is more, the cost of intraregional trade within South Asia has risen over time, while the costs of trading with the rest of the world have fallen (Kumar, 2015). High costs of intra-regional trade have hindered the formation of potential production networks and supply chains within South Asia. Even as South Asian countries have reduced tariffs, several countries in the region have simultaneously introduced non-tariff measures. For example, Kathuria (2018) very aptly shows that these para-tariffs have erected huge protection walls among SAARC member countries. With the inclusion of para-tariffs, Bangladesh's simple average tariff (in fiscal year 2016/17) almost doubled, from 13.3% to 25.6%; Sri Lanka's more than doubled, from 10.8% to 22.4%.

For many individual products, the combination of para-tariffs and customs duties results in effective protection rates in the order of 40–80% (Kathuria, 2018). Inadequate air transportation among most of the South Asian countries further impedes intraregional trade in high-value, low-volume goods and services across borders. For example, high-value trade often depends on intercountry airline services, but regional air connectivity is highly restricted in South Asia, except between India and Sri Lanka (Neupane, 2022). As per the original schedule, by 2016 India was set to grant duty-free access to all goods traded among all the SAARC member countries (Neupane, 2022). However, these dates have come and gone.

Just as France and Germany took the lead in European integration, India and Pakistan need to play a critical role in bringing about an attitudinal change, that is required to reduce the trust deficit within SAARC. By all means, keep the troops at the borders to safeguard national sovereignty, but let the shipments of goods and services flow smoothly between the borders.

Introduction of a 'Made in SAARC' product brand/trademark is a practical way of taking fast tracking SAARC's trade integration process. Once again, to begin with, this could first be applied to a certain number of goods produced in the region, that have high complementarity among the SAARC countries. SAARC already has a body for standard-monitoring/setting. Under the guidance and supervision of this regional body, a 'Made in SAARC' brand of products would be an eye-catching and effective way for the region to fast-track its trade integration.

With the risk of doing business in China now on the rise, global companies are likely to reappraise their manufacturing operations in China (Qian, 2022). The overdependence of global supply chains on China is compelling companies around the world to reappraise their business strategies and look for alternative options of relocation. Recent media reports have it that Apple has decided to relocate is iPhone assembling business away from China's Zhengzhou city to India. The political disruptions in China in general and in the Zhengzhou city in particular have been cited as the major reasons for Apple's decision to relocate some of its phone assembly business to India. It is reported that work disruptions in China cost Apple $1 billion a week (CNN- Business News, 6 December 2022). Learning from its experience with China, Apple is unwilling to concentrate its business in any one country. Over time, a well-integrated South Asia could thus be in an ideal position to reap the benefits from such relocations of many more multinationals.

5. Forge Stronger Monetary Ties

The degree of monetary integration among SAARC countries is even lower than their trade integration (ESCAP, 2016; ADB, 2022). Using a gravity model approach, recent studies provide robust empirical evidence that shows that intraregional exchange rate fluctuations adversely affect trade flows within South Asia (Banik and Roy, 2020; Zahid et.al (2021).

The key to monetary integration lies in exchange rate coordination and payment methods for intraregional trade. The first step could be to stabilize intra-regional exchange rates. Is it possible for the SAARC countries to agree on some form of an exchange rate coordination, say, each country tries to maintain a reasonable level of parity with each other's currency values? India is in a good position to take the lead in this process.

There is a vast literature on optimum currency areas, beginning from the initial writings of Robert Mundell, who subsequently won the Nobel Prize in economics. One may ask: does SAARC satisfy the preconditions required for an optimum currency area? The answer is that intra-regional exchange rate coordination itself could help create preconditions for closer exchange rate coordination (Madhur, 2002). In popular terms, this view has also been labelled as 'vehicle theory', because monetary cooperation becomes a vehicle for trade integration (Langhammer, 2007).

Using gravity model simulations, it has been shown that two countries that share the same currency trade three times as much as they would with different currencies (Rose, 2000). Proponents of this view often point to what happened in Italy when it became evident that the country would be among the first-round members of the European Monetary Union (EMU). Interest rates on lira-denominated bonds declined to the level of the other qualifiers; that "free lunch" helped Italy to stimulate its growth, and thus prepared the country for further deepening of its trade integration with the rest of the EMU countries (Langhammer, 2007).

Another option that SAARC countries should consider seriously is that of using their own currencies to pay for intraregional trade. India already allows payment in rupees to its exports to countries like Nepal and Bhutan. SAARC countries may benefit from a system in which each country accepts the other country's currencies in paying for exports and imports. In such a system, if India imports from say, Bangladesh, the payment is made in terms of Indian rupees, and when India exports to Bangladesh, India gets paid through Bangladeshi Taka.

A potential problem with this approach is that each country may engage in competitive devaluation of its currency. Learning from the European experience, SAARC countries should give a reasonable band – neither too narrow nor too wide. An initial period of trial and error cannot perhaps be avoided while implementing the 'Snake in the tunnel' method to make sure that each country keeps a parity of its currency with those of the other member countries – limited flexibility that allows exchange rates move within a band (Mattli, 1999).

A third option is to follow an inflation-targeting monetary policy, with the targeted inflation rate not-to-dissimilar among the SAARC countries. Given the largely similar levels of development among the SAARC countries, the commodity composition (and hence the weights of commodity groups in measuring inflation) is likely to be similar across the countries (Chandan, 2013). Except in rare cases, an inflation-targeting monetary policy in each of the SAARC member-countries could then lead to a largely similar monetary policy path across the subregion. Exchange rates would then move more or less in the same direction among the member-countries.

Once again, countries could join such a system of monetary policy regime at their own pace, subject to a mutually agreed timeline/deadline. Such an intraregional payment mechanism could also help countries to open up their capital accounts for intraregional capital flows – both inflows and outflows. Certainly, there will be some short-term adjustment costs that such a payments system may impose on countries. There will thus be a period of learning-by doing and doing-by-learning, while implementing such a regional exchange rate regime.

India, as the largest country in the region could help member countries foot the adjustment costs (of intervening in the foreign exchange market to sustain the inflation-targeted monetary policy path). Or else, the SAARC countries may use an existing pooled fund (or create a separate regionally pooled fund) to cushion the short-term adjustment costs of implementing such an intraregional exchange rate regime.

There certainly is a need for making the "SAARCFINANCE" much more effective in stabilizing intra-regional exchange rates. "SAARCFINANCE"– a network of Governors of Central Banks, Finance Secretaries, and Finance Ministers was established in 1998, received formal recognition in 2002 at the 11th SAARC Summit held in Nepal (Patra, 2022). It has helped to cushion some of the adverse effects of the breakout of Corona pandemic, with India extending credit lines to neighbouring countries. More recently, in 2020-21, SAARCFINACE introduced a portal named "SAARCFINACE SYINC" with the objective of networking among the Central Banks (Patra, 2022).

The immediate objective of SAARCFINANCE should be to stabilize intra-regional exchange rates. The process should gradually lead to the unification of the currencies into a single currency for the region over the medium term, say, by 2025-27. As India's Reserve Bank of India's Deputy Governor Patra very recently so aptly put it: "*SAARC has great potential for economic expansion with abundant natural resources, human capital and market access... We must rise up to this challenge and seize the window of opportunity even as we recover from the debilitating effects of the pandemic and geopolitical developments... The Roadmap of Regional Cooperation which was framed in 2016 needs to be revised to reflect the current realities and focus areas, with quantifiable milestones and timelines within the mandate of SAARCFINANCE*" (Patra, 2022).

Encouragingly, RBI remains committed to expanding cooperation in the field of digital banking and finance. Its Payment Vision 2025 envisages global outreach of its real time gross settlement (RTGS), the National Electronic Funds Transfer (NEFT), the Unified Payment Interface (UPI) and RuPay Cards. For instance, Bhutan and India have built cooperation around RuPay cards so that Bhutanese banks can issue RuPay Cards to their citizens (Patra, 2022).

6. Facilitate People-to-People Contact

South Asian countries were much more integrated under the British colonization era, but have disintegrated since then. People used to move around much more freely then. A complicated post-independent experience, including the wars between India and Pakistan, have perpetuated insufficient people-to-people interactions "*In South Asia, …a conflict-ridden history has eroded trust between countries. This has given rise to negative stereotypes which are exacerbated by a lack of people-to-people contact.*" (Kathuria, 2018).

That said, SAARC countries should forgive and forget the past and revive the commonalities among the South Asian nations and people. The region would benefit substantially from a SAARC visa program. There are good models to emulate either from the European experience or nearer home from the ASEAN way. Establishing direct flights connecting each of the SAARC countries with the other should be the first step. Today, there are no flights directly connecting all the capitals/countries among the SAARC countries. This poses a major constraint on people's movement across the member countries. There is much merit in introducing direct flights connecting each of the SAARC countries with the other, as demonstrated by how India and Sri Lanka have facilitated movement of people through establishing air connections.

This huge improvement in air-connection between India and Sri Lanka occurred as a part of the Free-Trade Agreement between India and Sri Lanka in 2000 (Kathuria, 2018). Although a SAARC Visa exemption was introduced by SAARC in 1992, the scheme has been limited to a very select category of dignitaries. Indeed, the lack of air-connection also impedes regional foreign investment, production networks, and supply chains (Kumar, 2007; Jain and Singh, 2009). It also adversely affects intraregional trade in services, tourism, education, and medical services (Neupane, 2022). Due to the huge restrictions on people movement across countries, SAARC countries cannot attract much international tourism too.

After establishing direct flights between the SAARC countries, there is much merit in introducing a SAARC Visa that can be obtained from any of the member countries of SAARC countries. By all means, keep a tight leash on security at the immigration and emigration, but give an opportunity to people to travel across the neighbouring countries. Building people-to-people contact could hugely reenergize SAARC's integration process. International tourists would also find it interesting to visit a region that is inter-linked through a vast landscape that is home to some of the historical monuments, rich rivers, vast plains, and huge mountains.

A model of free border trade between India and Bangladesh amply demonstrates how people-to-people contacts promote better integration. All that the two governments had to allow was free trade at the land borders of the two countries. The trade began through 'haats' --- local border markets that allow trading among local communities on both sides of the border (Taneja, 1999; Kathuria, 2018). Not only did this allow better trade between the countries but it also reduced illegal trade between the two countries.

Moreover, it also helped develop goodwill among the peoples of the two countries. A survey conducted for the study shows that more than half the Indian respondents have a positive view of Bangladeshis, and an overwhelming proportion of Bangladeshi respondents have a positive view of Indians at the 'haats', views they attributed to their exposure to their Indian neighbours (Kathuria 2018). 'Haats' are a good example for other countries to try out. Based on more experience, it is possible to build good will among the other members of SAARC.

The South Asia Economic Students' meet, which has brought, together students from colleges and universities across the region for the last 15 years has been a laudable program. This annual students' conference allows young leaders to engage on development issues and form friendships, perhaps lifelong, without barriers (Kathuria, 2018). This could help develop people-to-people contact between the SAARC countries and help reduce the trust-deficit so badly needed among the member nations and their people.

7. Summing Up

Overall, reviving SAARC and its economic integration agenda has much to be desired. This paper has taken a relatively comprehensive look at the many issues that need be addressed expeditiously by the SARRC member countries.

The key findings that emerge from the analysis are: (i) SAARC is perhaps the only attempt at regional integration with more observer states than member states; (ii) it is also a regional integration project which maintains higher trade barriers among the member countries than with the rest of the world; (iii) those intraregional trade barriers – both tariff and nontariff - have risen (not fallen) over time; (iv) when tariff barriers were reduced, non-tariff barriers were raised, causing the protectionist wall among the members stay high enough to deter intraregional trade; (v) monetary integration within SAARC has been even lower than trade integration; (vi) member countries have also erected near-draconian restrictions on the movement of people across national borders.

While all these findings may discourage efforts at revitalizing SAARC, they also point to the huge unexploited potential that SAARC can utilize to benefit the region's nearly 1.7 billion people. Indeed, based on experiences elsewhere in the world, regional integration is a self-enforcing mechanism: countries that trade with each other don't go to war with each other; countries that share a common currency (or a stable intraregional exchange rates) trade more; countries that share a common currency or stable intraregional exchange rates would reduce the trust deficit with each other, and more so if the countries involved share similar cultural links too. South Asia fits this bill very well. That said, India and Pakistan will have to play a major role in reducing the 'trust deficit' and moving SAARC towards an economic union.

Reviving SAARC rather than trying to substitute it with initiatives like BIMSTEC is well worth the effort. Initiatives such as BIMSTEC, with their focus on a few projects, cannot be an alternative to the comprehensive policy-based integration agenda enunciated in SARRC (Paul, 2020). They could, at best, assist SAARC but not replace it.

Nepal has consistently expressed its view that SAARC, which has stayed frozen for long, needs reanimation. Sri Lanka too has expressed similar views: " *We have already gone a considerable distance in building SAARC and that should be continued,*" in an interview in February 2020 (quoted in Bhatia, 2020). Soon after taking office, India's external affairs minister, S. Jaishankar had very diplomatically cast doubts on BIMSTC, as he saw a mix of "energy, mindset, and possibility" in BIMSTEC (quoted in Bhatia, 2020).

Some believe that China's elevation to a full-fledged member of SAARC could energize the flagging regional organization (Ahmar, 2020). There may be some merit in this suggestion. However, India has rightly rejected the demand on the ground that the existing eight members of SAARC themselves need to deepen their own integration before considering China's upgradation to a full member. This seems to be a practical way of looking at China's upgrade to a full membership position: not a no, but not now, when SAARC itself is struggling to complete its own internal integration. As this paper has articulated, SAARC has enough on its plate at present, and thus it should be given enough time to address its own internal challenges, before considering the upgradation of China's membership.

Reviving the SAARC is critical for South Asian economic integration and development. As India's Prime Minister Modi recently said: "*If the 21st century is to be the Asian century, it cannot be without greater integration among the countries of South Asia and Indian Ocean island countries.*" (Quoted in Hindustan Times, 2021). Indeed, Prime Minister Modi has exhibited a highly cooperative mindset. There is a need for moving from that very thoughtful mindset into action. Relying on this basic principle, integrating SARRC could be a critical step towards achieving the 'universal brotherhood' that he has professed as the theme for the ongoing G20 Meetings under India's Presidency.

All said and done, if SAARC cannot somehow resolve the troubled conundrum of Pakistan and Afghanistan, then there is much merit in other 6 members establishing a forum on their own. This should be the very last option, though. Such a modified forum may be named South Asian Regional Integration Forum (SARIF). Much of the original SAARC objectives enunciated in the SAARC Charter could be adopted in the Charter of the new forum.

At the same time, learning from SAARC's rather long experience since 1985, the Charter could be made more pragmatic, including either vastly trimming SAARC's Sensitive List, or eliminating the Sensitive List. Other mutually agreed modifications could also be introduced, as needed, by the 6 members of this newly formed forum. The inclusion of the term 'integration' in the place of 'cooperation' signifies that the new forum shall aim at deeper integration among the 6 member-states and their people, rather than relying just on 'regional cooperation'. Big changes are imminent, and one way or another, it is time for SAARC to change.

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India's Reforms Through the Lens of Dr. Rangarajan

A book review of *Forks in the Road: My days at RBI and Beyond* by C. Rangarajan

N R Bhanumurthy*

Recent crises in most of the economies in the world, and especially in India's neighbourhood, remind us of the difficult times that the Indian economy had passed through during the 1991 balance of payment crisis. While the present crisis is leading some economies to default on their payments -- some approaching the IMF for aid, and a few others going for bilateral aid -- India came out of the crisis less scathed.

Since then, with a wide range of reforms, the Indian economy has not looked back; despite a black swan episode in the form of Covid-19, and even with intermittent shocks such as Y2K and the 2008 global financial crisis, India has become a 'bright spot' in a troubled global economy. It remains one of the fastest growing large economies in the world. This suggest that, in the three decades since the 1991 crisis, India must have put in place prudent policies, that made the economy less vulnerable to shocks compared to other economies.

It is important to put in one place all the policy changes that have been implemented since the 1991 crisis. However, as the reforms happened in many spheres –fiscal, monetary, financial, external, trade, regulations, banking, technology, statistics, etc., - it is quite a task to document and discuss all these changes in one place or by one individual.

We are glad that now, after three decades, we have a volume that narrates the journey of India's regime changing economic reforms, and also how the Indian economy has performed through these reforming years. This could have been possible perhaps only by two individuals – Dr. C Ranagarajan and Dr. Manmohan Singh. The volume under review is written by Dr C Rangarajan, and dedicated to "*Dr. Manmohan Singh, whose vision and courage opened up new vistas and opportunities for India.*"

"Forks in the Road: My days at RBI and Beyond" was supposed to be a (long-awaited) memoir. As noted in the introduction, however, Dr. Rangarajan consciously made it more into a chronicle of events and the processes behind those events, rather than focusing on personal elements and

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anecdotes. (Only in chapter 13, 'Raj Bhavan Days', does the book highlight a few very interesting anecdotes).

The major part of the book covers Dr. Rangarajan's days at RBI - first as Deputy Governor and later as the Governor. Out of 16 chapters, excluding the concluding one, 12 chapters focus on his RBI days, while four chapters cover his contributions as Governor of 4 Indian States, his contributions to fiscal policy as the Chairman of 12th Finance Commission, his time as a member of Rajya Sabha, and his long innings as Chairman of Economic Advisory Council to the Prime Minister. The chapter on 'Advice to Government' covers his contributions to public policy as Chairman of various committees, ranging from savings/investments, financial inclusion, petroleum taxation, Jammu & Kashmir, HIV AIDS in Asia, sugar, National Food Security Act (NFSA), poverty estimates, etc.

This review does not aim to summarise the book. Rather, an attempt is made to highlight the critical role Dr. Rangarajan has played in a few major policy decisions, that have permanently changed the shape and destiny of the Indian economy. Here Dr. Rangarajan cautions, especially to fellow economists, that policy recommendations and decisions are the result of a confluence of analytics flowing from theory, data, and -- importantly -- judgement, and not about being slaves to one or the other school of thought.

On monetary policy, Dr. Rangarajan's major contributions start from his association with the famous Sukhomoy Chakravarty Committee, which -- the book says -- in some sense paved the way for smooth transition for RBI and monetary policy in the post-1991 period, with an array of proposed reforms in all the aspects that are under RBI's preview. The introduction of Open Market Operations (OMOs), the historic agreement between RBI and Government of India to dismantle the automatic monetization of ever-growing fiscal deficits, and the adoption of the monetary targeting regime are the outcomes of the Chakravarty committee.

In all writings on inflation and monetary policy, Dr. Rangarajan has focused on the money supply growth, and his beliefs on stability of demand for money are well-known. Indeed, Dr. Rangarajan is a staunch believer that inflation can be managed only by managing money supply growth. The book quotes Milton Friedman's famous statement – "inflation is always and everywhere a monetary phenomena". Indeed, those who have read Dr. Rangarajan's recent (post-Covid) writings would know that he attributes the current bout of inflation in the global economy to excessive money supply growth, leading to sharp interest rate hikes by the advanced economies.

In the last chapter on 'Some Ruminations', Dr. Rangarajan highlights excess liquidity as the root cause of inflation in India as well. He disagrees with some of his critics about whether the policies pursued during his Governorship can be termed 'monetarist' (p.112), arguing that pure monetarists believe in fixed rate of growth of money supply, while RBI was following a flexible money supply targeting, and this has actually laid the foundations for what we follow now as flexible inflation targeting.

While the relation between money supply and inflation are empirical issues, and these relations are time varying (whether to target M1 or M3), one aspect that is important to highlight is the way RBI under Dr. Rangarajan had a great co-ordination with the Finance Ministry under Dr. Manmohan Singh. it is no wonder this book is dedicated to Dr. Singh; if one wanted to understand why this co-ordination between fiscal and monetary authorities is very important for macro stability, one may want to read the books published by successive RBI Governors. Indeed, only after many years are we now seeing better co-ordination between fiscal and monetary authorities.

The outcomes of such smooth relationships are clearly visible in how India managed the 1991 crisis, as well as the Covid and post-Covid crisis, in ways that resulted in macro-financial stability. After reading this book, and also looking at recent developments, one can easily conclude that fiscal-monetary co-ordination is a public good.

On the question of rules versus discretion, which is a major area of research in monetary economics, the book (p.212) makes it very simple, concluding that rules cannot be too rigid, while discretion reduces accountability. The book ends by saying "*...in the final analysis, we need both rules and discretion.*"

On banking and the external sector, RBI under Dr. Rangarajan has introduced various reforms to make both interest rates as well as exchange rates increasingly market determined. There was considerable opposition for these policies, and even a bomb threat! In the words of Dr. Rangarajan "*...the shift to a market-determined average rate system was nothing short of a silent revolution.*" (p.134). Statutory Liquidity Ratio (SLR) was brought down drastically, from 38.5% to 25%. Cash Reserve Ratio (CRR), that was at 15%, was also brought down substantially, with a long-time goal of bringing it down to 3%.

The episode of exchange rate devaluation, that had a code name 'Hop, Skip and Jump' (p.56), is a must read for all students of public policy as well as policy makers. The way RBI jumped the decision before the then-Prime Minister thought otherwise, in retrospect, worked out well for the external sector. In addition to these changes, other reforms on the external sector brought stability on the Balance of Payments (BoP). Indeed, the IMF, which was forcing India to go for full capital account convertibility, now has different thoughts, and appreciates the way India has managed its external account and its stability. The foundations for this were laid in the early 1990s.

Another aspect of the external sector that needs to be highlighted is the RBI's conscious decision, since Dr. Rangarajan's period, to reduce the proportion of external debt in the overall public debt. This is a major reason why India is largely immune to various global shocks, even in recent times. Now the Government says India has a very low share of external debt and is thinking to borrow from abroad. But this is a hard-earned distinction, all due to the efforts of RBI for over three decades, under successive Governors; it was rightly criticised by all the former Central Bankers, and it appears that idea is shelved for now.

There is one full chapter on social responsibility of banks. Dr. Rangarajan talks about how the Rural Infrastructure Development Fund (RIDF) is established for enhancing rural credit. On financial inclusion at the grassroots level, it was during Dr. Rangarajan's period that the foundation for SHG-Bank credit linkage was built, by providing Rs. 10,000 as Community Investment Fund (CIF). This has paved the way for making National Rural Livelihood Mission (NRLM) a movement in the rural areas, contributing significantly to people's livelihoods.

The book also talks about the autonomy of central banks, mostly keeping in view recent developments (p.214). Here the book argues that there is a need for clear demarcation of who will have final say and in what areas, and cites the new monetary policy framework as a good example for such arrangements. Dr. Rangarajan suggests "*...when all is said and done, a spirit of dialogue and accommodation must prevail.*" -- a sage's advice.

This advice was clearly displayed, now looking to Dr. Rangarajan's contribution beyond RBI, when Dr Rangarajan could work with seven Chief Ministers (in four states) without much tussle. If one has to understand this smooth bonhomie between Governor and CM, we have to look at what is happening in some states at present. Indeed, as Dr. Rangarajan says, "*A public spat between a Governor and a Chief Minister is undesirable. Whoever starts it makes a serious mistake.*" (p.244). The book cites some interesting anecdotes while he was the Governor of undivided Andhra Pradesh, including part of a ceiling falling on him (p.240), and one Chief Minister wanted to meet him at 11.13 AM, as he considered that an auspicious time!

One major contribution of Dr. Rangarajan, referred to only in passing in the book (p.236), is his contribution to the statistical system, where he produced a two-volume report of the National Statistical Commission. It appears that he is not fully satisfied with the way successive governments have implemented his recommendations, including the setting up of the National Statistical Commission. The committee suggested that this be a constitutional body, while the government created it through an executive order; although there was an assurance that it would be made into constitutional body in a year's time, this was in 2005!

We are still waiting for the action taken report from the Ministry of Statistics and Program Implementation (MoSPI), even after two decades. Dr. Rangarajan's Committee on Poverty estimates is another example of a report or recommendations on which the government has not taken further action. This committee was asked to relook at the Tendulkar Committee poverty estimates. Now, it is still not clear what the official poverty line is, and hence what current poverty estimates are.

On fiscal policy, the 12th Finance Commission under Dr. Rangarajan has made many significant changes. One important aspect that may be highlighted is the 3% fiscal deficit target, as set in Fiscal Responsibility and Budget Management (FRBM) Act of 2003. Many think it has been influenced by the Maastricht treaty; however, it was Dr. Rangarajan who suggested this based on the household financial savings.

Another issue that 12th Finance Commission suggested was how to improve the efficiency of public expenditures. As there is much less support from the states for this, it was not addressed by successive Commissions. Indeed, the 15th Finance Commission did raise this issue more recently, but shied away in bringing it in as part of devolution formula, possibly due to Covid. We do believe that public expenditure efficiency should become part of the devolution strategy in some form or another.

Dr Rangarajan ends the book with an interesting para (p.309), where he reveals the 'rumor' that he was considered for the position of Finance Minister; he says that it was not without foundation. This was in the later part of 2008, following the terrorist attacks in Mumbai. The journalist Puja Mehra wrote a book describing the time between 2008 to 2018 'a lost decade' for the Indian economy. If there were no hurdles for Dr Rangarajan becoming Finance Minister in 2008, India's destiny would have been quite different.

For instance, one major misstep that was made during the UPA-II is the introduction of retrospective taxation, and that was the beginning of the downturn of the economy. As written in the book, Dr. Rangarajan, as Chairman of PMEAC, says this was not discussed with the Council either by the Finance Minister or the Prime Minister. Later, Dr. Rangarajan did oppose this move. but by then the damage was already done. As he says in many places, *"...like many other things in life, this also a game of chance*" (p.241); in retrospect, his appointment as Finance Minister is a chance that not just Dr. Rangarajan but India has missed.

To sum up, as the book narrates, Dr Rangarajan's contributions to public policy is wide-ranging, and has had a deep impact on the Indian macroeconomy and its stability. As he says, it was never a smooth ride, and there were hurdles all the way. In his words, "*...public policy in general, in particular central banking, is neither a science, nor an art, but a craft*". Dr. Rangarajan's contributions to central banking, monetary policy, external sector, fiscal policy, statistical systems, etc., are so significant that anyone who is going to read or write about independent India's economic history would naturally, term the post-1991 years as 'Rangarajan-Manmohan Singh Period'.

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