400 Million Dreams!

Examining volume and directions of domestic migration in India using novel high frequency data

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Abstract

Movement of people is a fundamental economic activity. Understanding the trends and patterns of internal/domestic migration is therefore of vital importance for public policy formulation.

Typically, studies on migration have relied either on the decennial Census or irregular Surveys. While the Census exercise is conducted once every ten years however, publication of detailed data tables often takes another 6-7 years. Therefore by the time the data is put to use, it is already dated.

This delay limits the utility of the data. Further Census data, though comprehensive and granular, is an enumeration of a stock and consequently has limited utility for applications such as analysis of seasonal variations.

This paper seeks to address this gap by harnessing three high frequency and granular datasets – Indian Railway Unreserved Ticketing System (UTS) data on passenger volumes; mobile telephone subscribers roaming data from the Telecom Regulatory Authority of India (TRAI) and district level banking data to understand the likely impact of migration at the places of origin. A related companion paper also uses the same models to examine trends in urban growth in select cities of India.

Our findings indicate that overall domestic migration in India appears to be slowing. Since Census 2011, the number of migrants has reduced by about 11.78%, to ~40 Crore and the migration rate has also reduced to 28.88%. We hypothesize that this is on account of improved conditions and opportunities at the places of origin.

Further, spatial trends in migration appear to be in line with gravity models of migration with short distance migration accounting for the largest share. We go on to use the data to identify popular destinations, major districts of origin and to build dyads of popular State-to-State and District-to-District routes.

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Introduction

Migration is amongst the most studied phenomena in the social sciences[3]. As complex as it is dynamic, migration has demographic, economic, sociological, spatial, legal, behavioural, cultural and a myriad other dimensions[4].

Given the relatively easier availability of cross border immigration/emigration figures coupled with data on international travel and remittances, the study of international migration, legal or otherwise, has received substantial scholastic and research attention.

On the other hand, tracking domestic movement of people can be significantly more difficult[5]. In the Indian context, the primary data source that most domestic migration research relies on is the decennial population Census[6].

Although there are other data sources such as surveys carried out from time to time - for example the Ministry of Statistics & Programme Implementation (MoSPI) *Migration in India 2020-21 Report*[7] or the Ministry of Housing and Urban Poverty Alleviation (MoHUPA) *Report of the Working Group On Migration (2017)*[8] - to be able to track the volume, direction and trends in migration on a regular basis remains a challenge.

The primary reason for this is **time lag** between data collection, collation, publication and eventual analysis - by which time the trends may have changed significantly. This paper seeks to address this issue by making use of novel high frequency, granular datasets to develop a model to examine the trends in domestic movement of people on a more regular basis.

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[3] Leloup, Fabienne (1996); Migration, a Complex Phenomenon. International Journal of Anthropology. 11. 101-115. 10.1007/BF02441416

[4] Lech K. (2020) Claiming Their Voice: Foreign Memories on the Post-Brexit Stage. In: Meerzon Y., Dean D., McNeil D. (eds) Migration and Stereotypes in Performance and Culture. Contemporary Performance InterActions. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-39915-3_12 Online Link

[5] Obeng-Odoom, Franklin, 'Internal Migration', Global Migration beyond Limits: Ecology, Economics, and Political Economy (Oxford, 2021; online edn, Oxford Academic, 20 Jan. 2022), https://doi.org/10.1093/oso/9780198867180.003.0004, accessed 11 June 2024

[6] Patterns in Internal Migration and Labour Market Transitions in India (Chandrasekhar, Sharma); 2022

[7] https://www.mospi.gov.in/sites/default/files/publication_reports/Migration%20in%20India%20RL16082023.pdf

[8] https://mohua.gov.in/upload/uploadfiles/files/1566.pdf

We also explore related topics such as the **impact on urbanization** - especially the **growth of cities**, **commuter zones** and popular **movement dyads**. Further, given that most migration is borne out of a desire for better opportunities and is seen as having an impact in improving incomes[9], we also make an attempt to discern the extent of **impact that out-migration has** in the places of origin.

This paper also works as a companion piece for our previous work titled "*India on the Move: An examination of the volume and direction of internal trade in India*" which used Goods and Services Tax (GST) data to examine the volume and direction of the flow of goods within the states of India[10].

Hitting a moving target: Tracking people on the move!

On account of its coverage, sheer volume and the richness of data there can hardly be a more comprehensive dataset than the decennial Censuses for tracking population and migration trends. We base our preliminary findings on the last Census i.e. the 2011 Census and the data tables published subsequently[11].

However, in order to get a more updated insight and to develop a high (higher!) frequency indicator of the movement of people, we use a massive dataset with more than a billion data points of *Unreserved Ticket bookings* sourced from the Indian Railways, Centre for Railway Information Systems (CRIS)[12].

Amongst the many systems that CRIS runs is the *Unreserved Ticketing System (UTS)*. On an average, the system serves over 21 million passengers, issuing over 8 million tickets across 100 variations [concessional, seasonal, etc.] and involving revenue in excess of Rs. 500 Million – every day[13]!

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[9] The Impacts of Neighbourhoods on Intergenerational Mobility I: Childhood Exposure Effects (*Chetty & Hendren*), 2016

[10] India on the Move: An examination of the volume and direction of internal trade in India (Debroy, Misra; 2023)

[11] Registrar General & Census Commissioner, Ministry of Home Affairs, Govt. of India - https://censusindia.gov.in/census.website/data/tables

[12] Established in 1986, the Centre for Railway Information Systems (CRIS) is an organization under Ministry of Railways tasking with developing/maintaining software for key functional areas of the Indian Railways. CRIS secure file transfer communication dated 13.02.2024 and 03.05.2024 refers

[13] https://cris.org.in/loadpage?page=proUTS

The UTS is the backbone that serves passengers using the *Unreserved* or *General* Tickets – typically the most affordable tickets on the Indian Railways network. We analyse this large and high frequency dataset to give us interesting insights into the movement of people within the country.

While it is rich and nuanced, the dataset is not without its limitations – for example it has Station-Station dyads and not City-City dyads – therefore we use it with certain caveats. The details of the dataset and the model used to analyse it for migration patterns is discussed in the Section titled, "*Using high frequency railway reservation data to track migration!".* The model builds on and extends some of the metrics discussed in the 2016-17 edition of the Economic Survey[14].

The other major dataset we use is the monthly Telecom Subscriptions Reports, published by the Telecom Regulatory Authority of India (TRAI)[15]. This publicly available dataset contains the number of Active Wireless Subscribers (or Visitor Location Register (VLR) Data) listed according to their respective *telecom circles* or service areas defined by the Department of Telecommunications[16].

There are 22 *Telecom Circles* in the country, out of which, the cities of Delhi, Mumbai, and Kolkata are each defined as telecom circles. Therefore tracking the Visiting (Roaming) Telecom Subscribers can give a sense of the number of people coming into or '*visiting*' the aforesaid three cities. An analysis of movement of people, especially, in the backdrop of the pandemic using telecom data was attempted by Nizam, Sivakumar & Irudaya Rajan[17].

However, the major drawback in using TRAI/VLR data is that the dataset does not help build dyads i.e. who is travelling from where? Moreover, a home or visiting subscriber is defined with regard to the place where the Subscriber Identity Module (SIM) data is procured. This may not be the place of origin of our putative traveller. However, this dataset does help us understand seasonal trends in movements of people for certain

[14] https://www.indiabudget.gov.in/budget2017-2018/es2016-17/echapter.pdf

[15] https://trai.gov.in/release-publication/reports/telecom-subscriptions-reports

[16] https://dot.gov.in/sites/default/files/list%20of%20unifiedaccess%20licensees_0.pdf?download=1

[17] https://journals.sagepub.com/doi/abs/10.1177/09731741221122000

cities. We discuss our methodology and findings in Section titled, "*Using Roaming to track trends in Migration*".

We move on to examine the impact of outward migration on the places of origin. This is done by analysis of publicly available banking data published by the Reserve Bank of India (RBI)[18] and disaggregated at the District level.

Further, we use publicly available Geospatial Datasets both for visualizing the movement of people as well as for examining the impact of migration. This is an area that is rapidly evolving with newer and more innovative applications of high resolution satellite imagery and earth observation data coming out by the day.

In the interest of brevity and in order to maintain our focus on the analysis and interpretation of the data on hand, discussion of the theoretical underpinnings of migration and of previous work in the area has been kept to a minimum. There are however, many excellent resources that comprehensively cover these areas and also have references to other outstanding academic work on the topic[19, 20].

The questions we ask/the answers we seek

In the study of migration the **questions** are typically broadly clubbed into four broad groups – **who** migrates (gender, age, professions); **from where-to where** do they migrate (between/within cities, from rural to urban); **why** do they migrate and **what are the economic benefits**/ consequences of this migration (for the migrants, the geographies that they migrate to and for the place that they migrate from).

The following frameworks provide a theoretical underpinning of study of the phenomenon of migration:

[18] https://m.rbi.org.in/Scripts/QuarterlyPublications.aspx?head=Quarterly%20Statistics

[19] Patterns in Internal Migration and Labour Market Transitions in India (Chandrasekhar, Sharma); 2022

[20] Internal Migration Challenges and Perspectives for the Research Infrastructure (Farwick), 2009

Ravenstein's *Theory of Human Migration* (1834 – 1913) that proposed a set of *9 observations* - every migration causes a return/counter migration; migrants who move long distances primarily do so for economic reasons; rural residents tend to be more migratory than their urban counterparts; working-age males are more likely to migrate as compared to other demographic subsets[21] and that migration often happens gradually – a process he referred to as *step-migration*.

Sir Arthur Lewis' *Dual Sector model*, or the *Lewis model* (1954) which proposed that over time labour shifts from traditional primary sectors such as agriculture, typically characterized by low productivity, low wages and labour intensity to the modern industrial sector which has higher marginal productivity, better wages and at least initially, has a greater demand for labour[22].

John R. Harris and Michael Todaro's *Harris–Todaro* model (1970) which holds that migration is based on expected income differentials between rural and urban areas rather than actual wage differentials. This implies that rural-urban migration in a context of high urban unemployment can be economically rational if expected urban income exceeds expected rural income[23].

Indians on the Move: Where we were in 2011

Before we begin taking a deeper dive into answering the above questions and examining the volume and directions in domestic migration in India, it would be useful to see where we stood at the time of the last decennial Census i.e. in 2011.

Questions that impliedly captured migration have long been a part of the Census Questionnaire. However, at least since 1961, there have been direct and specific questions on Migration in the Censuses. A handy ready reckoner of Census questions over the years is available at the website of the

[21] Ernest George Ravenstein: The Laws of Migration, 1885; John Corbett; http://csiss.org/classics/content/90

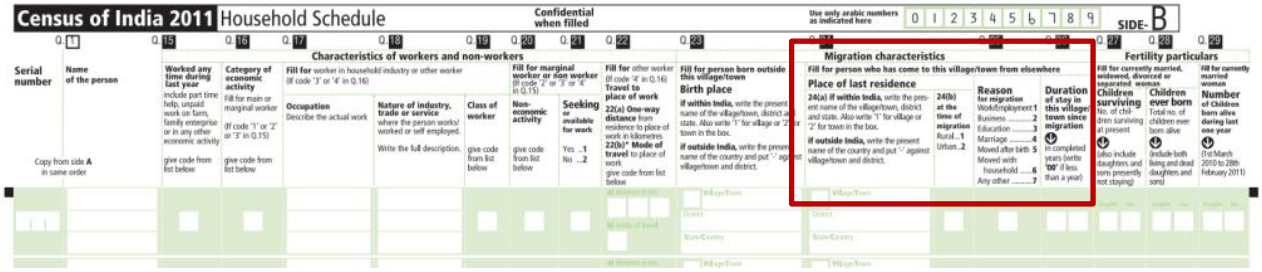
[22] Lewis, W. A. 1954. *Economic development with unlimited supplies of labour* Manchester School; 22: 139-91.

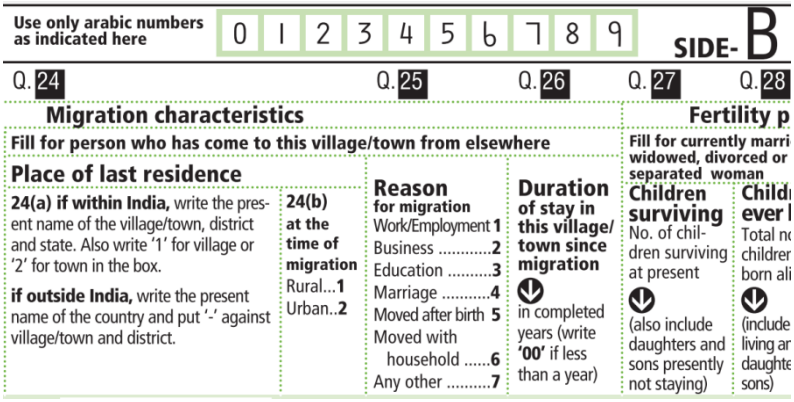
[23] Harris, John R. & Todaro, Michael P. (1970), "*Migration, Unemployment and Development: A Two-Sector Analysis*", American Economic Review, 60 (1)

Registrar General & Census Commissioner of India, Ministry of Home Affairs[24].

In the 2011 Census, *Question 24-26* in the *Household Schedule* captured the metrics related to migration (Figure 1).

Fig. 1: 2011 Census Household Schedule [Side B: Questions related to Migration highlighted]





The analysis of the collated Census Data is subsequently published as Census Tables[25]. Details regarding *Migrants by Place of Last Residence, Age, Sex, Reason for Migration and Duration of Residence* is published as Table D5 [*PC11_D05*].

For Census purposes, *Migration* is of two types – by *Birth place* and by place of *last usual place of residence*[26].

When a person is enumerated in the Census at a place other than her/his place of birth, she/he is considered a migrant by *place of birth*. On the other hand, a person is considered to be a migrant by place of last

[24] https://censusindia.gov.in/census.website/CENSUS_ques

[25] https://censusindia.gov.in/census.website/data/census-tables#

[26] Drop-in-Article on Census of India, 2011 - No.8 (Migration); https://censusindia.gov.in/nada/index.php/catalog/40447/download/44081/DROP_IN_ARTICLE-08.pdf

residence, if their last usual place of residence (UPR), at any time in the past, was different from the present place of enumeration[27].

Here the *Usual Place of Residence* (UPR) of a person is defined as the place (village/town) where the person has been staying continuously for at least six months. Even if a person was not staying in the village/town continuously for six months but was found to be staying there during the enumeration with an intention to stay there continuously for six months or more then that place is defined as being his/her UPR[28].

With that in mind, the Census D5 table lists the **total number of migrants** in the country with segregation by **Rural/Urban origin** and **reason for movement**. The same is captured in Table 1.

Table 1: Migration statistics as per Census, 2011

	Persons	Male	Female
Population of India	**1210854977**	**623270258**	**587584719**
Total Migrants	**455787621**	**146145967**	**309641654**
Migrants from Rural Areas	295114410	73522596	221591814
Migrants from Urban Areas	106355920	45962228	60393692
Migration for Work/Employment	41422917	35016700	6406217
Migration for Business	3590487	2683144	907343
Migration for Economic Reasons	**45013404**	**37699844**	**7313560**
Migration for Economic Reasons [moved within last one year]	**3364993**	**2662350**	**702643**
Participation in Labour Force (% of Population)	39.79	53.26	25.51
Total Workforce	481799195	331953739	149892862
% of Migrants in Workforce	**9.34**	**11.36**	**4.88**
% of Total Migrants who have moved within last one year	**7.48**	**7.06**	**9.61**

Population Figures as per Census 2011; Labour Force Participation Rates as per MoSPI Data[29]

From the above we get an idea of the total number of migrants as well as those migrating on account of economic reasons i.e. those stating that they are moving for *Work/Employment* or *Business*. As per Census, 2011 the **total** number of **persons migrating** on account of **economic reasons** are **4,50,13,404** (*Males* - 3,76,99,844 and *Females* - 73,13,560). The

[27] MoSPI, *Migration in India 2020-2021*

[28] https://www.mospi.gov.in/sites/default/files/publication_reports/Migration%20in%20India%20RL16082023.pdf

[29] https://www.mospi.gov.in/sites/default/files/reports_and_publication/statistical_publication/social_statistics/Chapter_4.pdf

corresponding figures stood at **2.6 Crore** as per **Census, 1991** and **3.27 Crore** as per **Census, 2001**[30].

Therefore in the period **1991 to 2001** the compounded annual growth rate of the number of migrants was **2.7%**. This increased to **3.7%** in the period **2001 to 2011**. Interestingly, in the period 1991 to 2001, India's workforce grew from **3.17 Crore** to **4.02 Crore** [an annual average growth of 2.6%], whereas in the period 2001 to 2011, the workforce grew from **4.02 Crore** to **4.82 Crore** [an annual average growth of 1.99%]. Therefore it is evident that, between 1991 and 2011, the **share of migrants in the workforce increased steadily**.

Census Data also makes it evident that **percentage of migrants in the total workforce** increased from **8.15%** in 2001 to **9.34%** in 2011. We delve deeper into migration figures and take a look at the migration statistics as captured by Census, 2001 (Table 2).

Table 2: Migration statistics as per Census, 2001

	Persons	**Male**	**Female**
Population of India[31]	**1,02,70,15,247**	**53,12,77,078**	**49,57,38,169**
Total Migrants	**31,45,41,350**	**9,33,61,809**	**22,11,79,541**
Rural Migrants	22,66,67,548	5,22,46,555	17,44,20,993
Urban Migrants	5,04,74,068	2,15,32,764	2,89,41,304
Migration for Work/Employment	2,99,04,442	2,62,29,666	36,74,776
Migration for Business	28,26,874	23,82,559	4,44,315
Migration for Economic Reasons	**3,27,31,316**	**2,86,12,225**	**41,19,091**
Migration for Economic Reasons [moved within last one year]	**22,13,720**	**16,83,506**	**5,30,214**
Participation in Labour Force (% of Population)[32]	39.10	51.7	25.6
Total Workforce	40,15,62,962	27,46,70,249	12,69,08,971
% of Migrants in Workforce	**8.15**	**10.42**	**3.25**
% of Total Migrants who have moved within last one year	**6.76**	**5.88**	**12.87**

Population Figures as per Census 2001; Labour Force Participation Rates as per MoSPI Data

[30] https://www.indiabudget.gov.in/budget2017-2018/es2016-17/echapter.pdf

[31] https://www.indiabudget.gov.in/budget_archive/es2001-02/chapt2002/chap107.pdf

[32] https://mospi.gov.in/sites/default/files/national_data_bank/census_data_pro/Work_Participation_rate_Census%202001.pdf

The above discussion is an indicator of the **increasing** numbers of **people migrating for economic reasons** as well as the increase in the **share of migrants in the workforce**. A quick look on the directions of the movement, as per Census 2011 is at **Appendix A**.

We visualize the movement between States using the *DS-0000-D02-MDDS* India Table from Census, 2011 for the data (Table 3). It may be recalled that using Goods & Services Tax (GST) data we had earlier carried out a similar exercise for the domestic movement of goods in the country[33].

Given the width of Table 3, it is split into two parts. RTO Codes are used to denote States. The rows represent the origin states whereas the columns are the destinations. Accordingly, the total at the end of the rows denote the total out-migration from the respective States in the Rows.

33 "*India on the Move: An examination of the volume and direction of internal trade in India*"; Debroy & Misra, 2023

Table 3: Total Migrations between States – Origins in Rows; Destinations in Columns [Part 1 of 2], Census 2011

	AN	AP	AR	AS	BH	CH	CG	DN	DD	GA	GJ	HR	HP	JK	JH	KN	KL	LD	MP
AN	131118	3049	2	93	38	125	312	6	36	323	332	199	47	51	265	1106	2303	39	182
AP	15681	36625573	383	4732	1760	1528	42362	748	386	5652	46784	10386	1933	2085	8661	890697	19228	47	17375
AR	18	239	483725	19486	395	99	166	10	5	22	233	387	1052	105	185	2300	738	4	305
AS	459	7155	88963	10035507	15221	2166	3888	1484	1622	1502	13030	14088	2134	1906	4940	23651	8469	5	4901
BH	1779	48120	18811	147742	25728400	50703	143216	20848	28202	8334	361010	390937	37600	13200	1336048	86083	9904	12	125836
CH	53	1110	11	258	404	30733	310	29	37	100	1603	71890	11136	611	244	2124	423	1	695
CG	2600	28383	138	1162	2655	1123	7554503	343	336	916	12397	11813	5008	9949	42750	7582	2563	2	167340
DN	1	16	1	20	654	7	14	46921	159	27	10779	20	8	17	16	110	27	119	60
DD	11	51	0	3	23	10	32	1080	21927	287	14501	32	31	6	5	57	38	87	287
GA	212	2209	22	52	213	94	177	117	127	853232	1951	571	111	116	274	22190	2557	6	730
GJ	254	23299	94	1271	4149	2082	13704	30177	23072	3720	22761198	11250	1578	1237	5268	38953	10443	56	88702
HR	278	6220	527	3225	3902	93037	12807	304	159	953	32206	6797636	35750	5987	3729	12511	2228	5	19224
HP	55	1757	305	1827	8883	60254	2567	104	96	403	3761	60586	2184176	8609	1345	6763	743	0	5894
JK	100	6583	369	3831	15594	5997	8321	45	57	761	4883	17700	15565	2618467	1677	9326	4293	6	12100
JH	7612	13024	1308	11139	433696	3023	111325	2205	3386	3583	49576	20853	10645	2210	7430091	21064	3109	1	30272
KN	493	466951	191	991	1923	1514	2752	1000	569	116865	30437	8084	1538	1313	2159	23103518	110833	137	7048
KL	4829	40113	1397	1437	1432	1016	10747	1400	792	8218	44356	8302	775	1485	3905	334181	17053517	4379	22566
LD	21	337	4	423	3249	19	648	68	53	20	55	230	102	264	97	602	2026	14170	794
Last residence outside India	3926	138095	10901	110314	398592	13092	62961	1481	1720	15060	87160	160290	60335	35428	31729	105356	153545	131	90291
MP	648	18444	252	2478	6067	3730	276527	4707	7579	2612	274773	56240	6509	7599	10885	22610	8345	23	21894713
MH	1052	263216	421	2557	13544	4999	117487	25860	14738	71943	971975	30907	5752	4722	9727	586864	47464	563	494312
MN	20	1369	1465	12203	326	623	81	30	12	268	531	601	220	227	372	4897	608	0	566
MG	21	499	1143	40755	370	183	107	0	4	49	585	481	197	139	329	1959	410	1	417
MZ	10	228	298	3157	45	47	30	1	0	23	32	115	77	57	134	468	156	1	265
NL	24	331	1218	23707	797	84	136	4	5	91	313	487	172	97	198	1325	1104	0	278
DL	437	16907	311	3040	23412	20889	9266	612	438	2503	28596	468298	18467	5269	7643	35162	15303	26	28597
OD	1244	185872	1613	5153	6014	1600	242404	4339	4590	4389	176072	16280	3295	2233	126320	64032	12223	23	24038
PY	76	7322	6	27	150	32	33	9	6	59	552	233	14	18	83	3222	21352	4	76
PB	429	6861	395	3617	7994	148481	17217	291	165	797	27549	538328	130851	43938	10387	11819	3402	6	31895
RJ	257	72554	1498	27778	8358	9446	21188	6830	4584	4830	747445	611160	8652	6079	10240	150359	8893	8	500481
SK	13	189	234	1077	368	70	68	0	0	31	122	325	844	109	125	1615	196	0	210
TN	18136	266720	305	1193	1293	3223	4879	559	341	4239	28620	7724	668	1842	3373	736821	311347	380	9099
TR	77	349	855	39906	185	73	237	4	32	33	627	1204	131	173	408	1896	232	2	446
Unclassifiable	30	5086	195	2714	5923	397	2943	4053	423	2709	133853	1216	7052	547	2361	6636	1934	23	5783
UP	3114	49889	6054	35441	319887	179574	168385	28719	27657	20136	929411	1113535	66005	20190	107724	92495	12203	11	1090881
UK	255	2306	450	1194	1144	31164	2509	707	405	658	11938	77179	22740	3180	1396	5177	790	2	12253
WB	20998	50218	6966	94724	227809	6951	53766	2962	4872	5342	89040	75893	5897	10164	494609	67639	30470	121	46207
TOTAL [In-migrants in States in Col.]	**216341**	**38360644**	**630831**	**10644234**	**27244869**	**678188**	**8888075**	**188057**	**148592**	**1140690**	**26898286**	**10585460**	**2647067**	**2809629**	**9659702**	**26463170**	**17863419**	**20401**	**24735119**

Source: Census, 2011; DS-0000-D02-MDDS India Table; PC11_D02: Total Migrants; all reasons; all Durations of Stay; RTO Codes for State Names

Table 3: Total Migrations between States – Origins in Rows; Destinations in Columns [Part 2 of 2], Census 2011

	MH	MN	ML	MZ	NL	DL	OD	PY	PB	RJ	SK	TN	TR	UP	UK	WB	**TOTAL** [Out-migrants from States in Rows]
AN	2043	33	3	2	15	677	246	146	253	195	84	6235	7	423	110	1720	**151818**
AP	437034	71	384	92	407	23436	122491	32330	7789	12193	423	286427	167	16060	3565	16707	**38655577**
AR	790	114	1024	195	900	1404	581	19	405	369	515	481	337	931	1232	2322	**521093**
AS	30614	7720	61022	15056	51397	26233	4732	283	11925	12936	2621	7860	29423	30157	5731	166400	**10695201**
BH	568667	2983	14112	1404	17539	1106629	119231	680	352537	134402	13282	29277	12063	1072739	76116	1103757	**33182203**
CH	3576	11	49	8	42	8328	291	30	149591	1961	36	922	14	6028	2850	869	**296378**
CG	168379	10	62	16	138	12634	129371	28	8403	7266	53	2174	52	56676	3239	8071	**8248135**
DN	3066	1	16	0	11	91	75	0	17	127	4	318	10	375	66	403	**63556**
DD	2067	0	0	0	0	38	11	5	6	72	27	38	0	34	45	22	**40833**
GA	68358	14	19	7	21	1193	400	91	435	555	29	1689	7	929	236	484	**959428**
GJ	983653	40	216	13	103	24153	24420	2102	10436	200767	110	21024	150	25459	5344	14563	**24333060**
HR	48673	110	494	83	442	666331	5206	130	545584	533963	661	5172	116	230740	33899	11259	**9113551**
HP	15721	136	294	34	309	79272	1042	36	214213	11325	431	898	88	21072	24089	2911	**2719999**
JK	25774	218	601	113	375	40146	8277	163	70299	19100	974	7221	328	33008	9268	5846	**2947386**
JH	100285	93	544	1149	1283	69196	167377	123	19950	13183	1267	7581	14203	110358	10768	459436	**9134918**
KN	1399591	182	450	90	540	15386	4829	2978	4470	11697	191	289302	131	10455	2330	5536	**25606474**
KL	214889	118	810	269	1165	60297	4763	21345	5910	16128	227	447701	156	17106	1962	7149	**18344842**
LD	1138	45	1	4	6	123	232	8	600	961	2	81	16	2812	328	311	**29850**
Last residence outside India	324654	2702	7648	15370	6433	177900	73609	5938	277287	164361	18470	270353	222431	355488	82198	2005945	**5491194**
MP	824624	139	405	73	294	134867	12725	253	32869	554058	459	10917	161	668537	13268	15815	**24874205**
MH	47924588	286	635	125	498	63692	14902	2037	32781	73366	277	82197	260	88310	13114	27648	**50992819**
MN	2824	664018	6336	12241	14093	6164	334	36	774	753	732	1595	613	1260	926	2651	**739769**
MG	1842	770	643823	2378	1792	2569	275	23	507	1226	356	567	1309	1125	880	7000	**714091**
MZ	480	1041	2127	330584	386	678	52	1	311	363	53	207	18411	281	286	544	**360949**
NL	1401	1589	1752	541	435046	1921	486	14	569	789	225	558	751	868	729	3170	**480780**
DL	86131	652	2	188	10	676519	8006	802	45310	83134	481	12139	250	566210	52002	15815	**2232827**
OD	114411	87	525	65	1236	41162	14488013	1753	11717	12991	602	22863	303	35269	4224	142179	**15759134**
PY	1568	0	8	3	15	537	149	366400	310	114	2	252312	16	206	69	251	**655234**
PB	73951	102	986	106	470	247966	6832	169	10968355	213308	319	6082	108	142235	45667	18154	**12709232**
RJ	570233	706	1901	104	2480	315238	12203	1267	202166	19240666	675	88474	495	284056	18410	57668	**22997382**
SK	551	288	145	43	145	995	143	22	330	327	167125	231	18	476	612	11537	**188584**
TN	226029	203	343	107	412	45862	6256	270900	5540	9042	156	29351926	407	9458	1748	7932	**31337083**
TR	1577	766	2868	5606	2923	1490	465	33	385	717	92	374	989623	698	501	20497	**1075485**
Unclassifiable	40154	115	168	36	119	40030	5075	96	1675	62157	291	1057	191	33725	1566	8676	**379009**
UP	2754706	853	3098	477	4076	2854297	33063	907	649557	585982	2280	27985	1518	52000937	890663	238819	**64320529**
UK	42968	81	1191	142	751	294704	931	51	55392	23233	359	1040	141	393540	2983115	3599	**3976685**
WB	309766	638	5492	646	3746	182356	164699	1202	46958	67695	33158	28829	5349	234042	26298	29052806	**31458328**
TOTAL [In-migrants in States in Col.]	**57376776**	**686935**	**759554**	**387370**	**549618**	**7224514**	**15421793**	**712401**	**13735616**	**22071482**	**247049**	**31274107**	**1299623**	**56452083**	**4317454**	**33448472**	**455787621**

Source: Census, 2011; DS-0000-D02-MDDS India Table; PC11_D02: Total Migrants; all reasons; all Durations of Stay; RTO Codes for State Names

Similarly, the totals in the columns are the total in-migrants into the respective States in the columns. As per Census 2011, the total number of migrants [*all reasons; all lengths of stay; all ages*] stood at **45,57,87,621.**

Some important takeaways from Table 3 are as under:

- Just five states – Uttar Pradesh, Maharashtra, Andhra Pradesh, Bihar and West Bengal together account for about **48% of** the total **outbound migrants**. This includes within-State migrants as well.
- Similarly, just five states – Maharashtra, Uttar Pradesh, Andhra Pradesh, West Bengal and Tamil Nadu together account for about **48%** of all **incoming migrants**. This includes within-State migrants as well.
- With the exception of Assam we see **little outward migration** from most states of the **Northeast**. Even when there is outward migration it is typically to neighbouring states.
- Most **migrants tend** to move **close to origin states**. We need to keep in mind that these are total migrants, which would include migration on account of marriage.
- With the exception of Delhi, there is **little out-migration** from most of the **Union Territories**.
- Similarly, we see little out-migration from the **hill states**
- As per Census 2011, there were a total of **54,91,194 migrants** who indicated their last place of residence as being **outside of India**. Out of these, more than a third were resident in West Bengal. Other states with significant international immigrants were Bihar, Uttar Pradesh, Maharashtra and Punjab.

Tracking Indians on the Move

While Censuses are typically conducted once in ten years, migration is a continuous phenomenon. There are a number of reasons why we would like to track migration, on a more regular basis.

As per Census 2011, the percentage of migrants [for economic reasons] in the total workforce stood at a little over 45 Million [9.34% of the total workforce; up from 8.15% from Census, 2001. However, there have

been alternative estimates which have placed the number and proportion of migrants in the workforce at a significantly higher level.

For example, in a paper titled, "*Migration and Human Development in India*" (Deshingkar & Akter, 2009)[34], used field evidence from employing sectors to synthesize that there were over 100 million migrants. The authors averred that the Census tends to understate the levels of migration since it does not take into account circular migration and therefore intra-year/seasonal movements are not adequately captured.

Further, presently Census Data on the reasons for migration is captured as one of the following:

- Work/Employment
- Business
- Education
- Marriage
- Moved after Birth
- Moved with household

It may be noted that while the reason for the migration may have been on account of *Marriage* or *Moved with household*, however at the destination it is possible that some of these individuals would be now in the workforce. This would be especially true for women who are often enumerated as having moved on account of marriage.

Economic Survey[35] 2016-17 had also discussed this issue had gone on to estimate that the workforce is likely to exceed 500 Million by 2016 with about 100 Million [20%] constituting migrants. We would get a clearer picture in the next decennial Census.

Further, an updated sense of the numbers and location of migrants helps in targeting social sector welfare programmes; in planning urban infrastructure as well as understanding the impact of migration in the places of origin. In order to address the issue of more updated numbers, we

[34] Priya Deshingkar & Shaheen Akter, 2009. "Migration and Human Development in India," Human Development Research Papers (2009 to present) HDRP-2009-13, Human Development Report Office (HDRO), United Nations Development Programme (UNDP), revised Apr 2009.

[35] https://www.indiabudget.gov.in/budget2017-2018/es2016-17/echapter.pdf

look towards some novel datasets viz. Railway Reservations Data; Data on Telecom Mobility, Geospatial data and data on banking transactions from the RBI.

Each of these datasets have their own advantages and shortcomings and admittedly they would not be as comprehensive as the decennial Census, however our attempt here is to discern trends in the inter-decennial period and to build on the data captured in the Census.

You can hear the whistle blow, a hundred miles:

Using high frequency railway reservation data to track migration!

With an estimated passenger volume close to a 1,000 Billion Passenger-Kilometres[36,37] over the last decade, the Indian Railways remains a popular mode of transport for passengers travelling across cities/states, especially those travelling longer distances. The total number of passengers carried by the Railways in 2023-24 stood at 6,843 Million[38]. This includes **3,852 Million Suburban passengers** and **2,991 Million non-Suburban passengers**. Indian Railways defines **suburban services** as those being **up to 150 Kms.** from the origin[39]. In order to maintain uniformity, we continue use this distance as our base for further analysis.

We use publicly available data sourced from the Rail Budget and from the Annual Reports[40] of the Indian Railways to get a sense of how the passenger volumes have moved since the last Census in 2011. The trend in passenger volumes [*in Passenger-Kms.*] since 2011, shown separately for non-suburban passenger volume [*Red Line; primary axis*] and suburban passenger volume [*Blue Line; secondary axis*] is as under [Figure 2].

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36 Railway Statistics Synopsis 2020 (Statistics for 2019)" (PDF). International Union of Railways

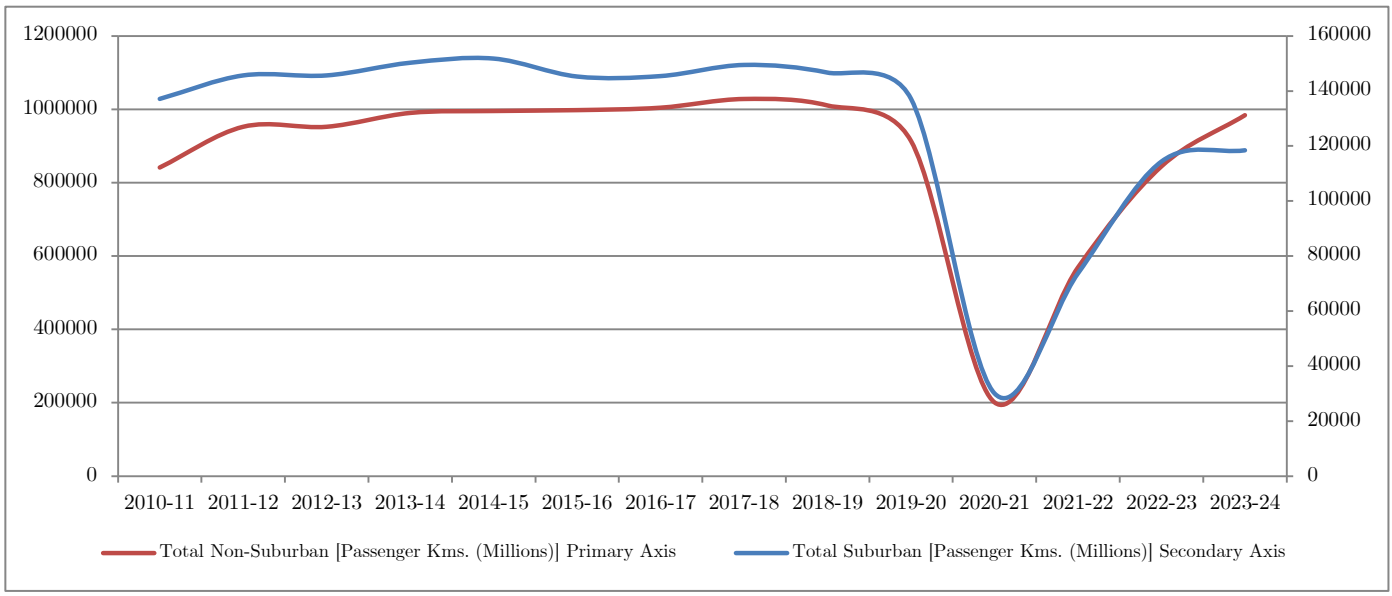
37 *Number of journeys x mean kilometric distance*; https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/yearbook10-11/Passenger_business.pdf

38 Railway Budget at a Glance; https://indianrailways.gov.in/railwayboard/uploads/directorate/finance_budget/Budget_2024-25/Statement%20of%20Railway%20Receipts%20and%20Expenditure%20Budget%202024-25.pdf

39 Lok Sabha PAC 69th Report (2016-17); Suburban Train Services In Indian Railways; https://eparlib.nic.in/bitstream/123456789/65704/1/16_Public_Accounts_69.pdf

40 Indian Railways Statistical Statements; https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,554

Fig. 2: Indian Railways Passenger Nos. and Volume (in Passenger Kms. Millions); All Classes; All Gauges



We can see that barring the years 2019-20 and 2020-21 [Covid years] the trend in passenger volume, especially for **non-suburban travel has shown a consistent upward trend** and has since bounced back to pre-Covid levels.

Given the reach and spread of its network, Indian Railways is a preferred mode for transport especially for longer trips[41]. In particular, we propose to make use of data for unreserved tickets booked on the Indian Railway (IR) network as a marker of trends in the movement of migrants.

Unreserved Second Class (*Mail & Express/Ordinary*) tickets are the cheapest class of tickets[42] on the IR network. Unreserved tickers are required for boarding a train but typically don't guarantee a seat. We use these tickets as a proxy for blue collar migrants, primarily on account of their price.

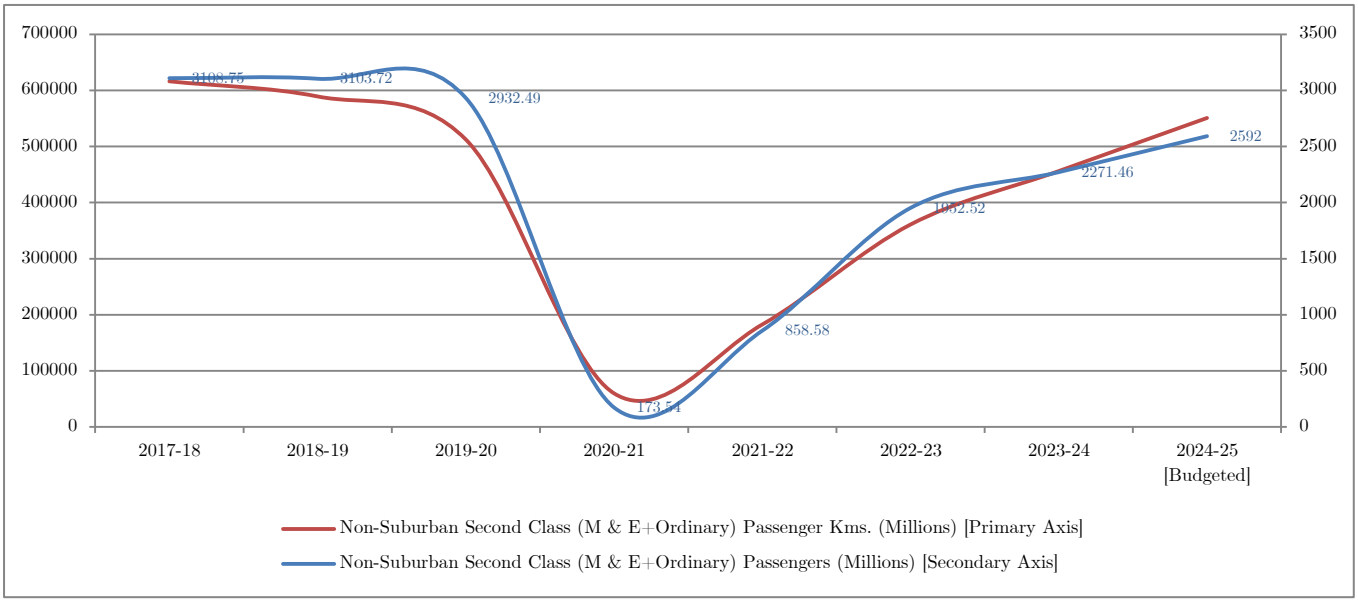
We look at the total passenger volumes and numbers for Non-suburban, Second Class (*Mail & Express and Ordinary Trains*) for the period

[41] Analysing mode choice for inter-regional travel in India (Janaa & Varghesea, 2016)

[42] Indian Railways Commercial Circular, 31.12.2019; https://indianrailways.gov.in/railwayboard/uploads/directorate/traffic_comm/CC-2019/CC_65_2019.pdf

2017-18 to 2024-25 [Budgeted][43]. The results are plotted as under [Figure 3].

Fig. 3: Passenger Numbers and Volumes; II Class (*Mail & Express and Ordinary*) [Non-suburban]



From above, we note that the number of non-suburban, second class passengers has reduced from 3,108 million in 2017-18 to 2,592 million in 2024-25 [Budgeted]. In the same period, the second class passenger volume has also reduced from 6,16,202 Million Passenger Kms. to 5,50,814 Million Passenger Kms.

It is instructive to note that while second class **passenger numbers** have **reduced by 16.62%** in the period 2017-18 to 2024-25 [Budgeted]; however the **passenger volumes** [passenger kms.] has reduced only by **10.6%**.

Since passenger volumes are a computed as *number of journeys* x *mean kilometric distance*, the divergence between the two is likely to be an indicator of relatively longer journeys being undertaken by fewer passengers.

In the absence of a high frequency, granular dataset to track migration, we propose to track the movement of people on Indian Railways

[43] Indian Railways Statistical Publications; Ministry of Railways (RB); https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,554

In particular we use data from the Indian Railways (IR) *Unreserved Ticketing System* (UTS), which is used to book unreserved tickets.

For the purposes of this paper we have used UTS II Class ticket bookings. These, as we saw above, are the cheapest tickets on the IR network and are noted as being most preferred by blue collar migrants[44]. Given the geographic spread and density of the IR network, this forms a robust mechanism to track trends in domestic migration.

Prior to beginning our examination, we run a regression between the 2012 non-Suburban, UTS II Class passengers destined to each State and compare that with the State-wise number of total migrants enumerated in Census, 2011[45]. The regression results are in Table 4.

Table 4: Regression results comparing State-wise UTS II Class Non-Suburban Passengers and numbers of Migrants as per Census 2011

Regression Statistics	
Multiple R	0.930293275
R Square	0.865445578
Adjusted R Square	0.86046208
Standard Error	6090151.032
Observations	29

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.44112E+15	6.44112E+15	173.6623009	2.82775E-13
Residual	27	1.00143E+15	3.70899E+13		
Total	28	7.44255E+15			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1074038.7	1581964.829	0.678927041	0.502962775	-2171885.013	4319962.413	-2171885.013	4319962.413
X Variable 1	0.607612158	0.046107723	13.17809929	2.82775E-13	0.513006924	0.702217392	0.513006924	0.702217392

From the above, it is seen that state-wise railway passenger data is a robust predictor of the actual migrants. However, *in limine*, we would like to highlight certain limitations.

[44] https://www.indiabudget.gov.in/budget2017-2018/es2016-17/echapter.pdf

[45] Census, 2011; D-02 Tables: Migrants classified by place of last residence, sex and duration of residence in place of enumeration; https://censusindia.gov.in/

Firstly, all railways data is recorded from Station to Station, therefore the actual origin and destinations may not always be captured accurately. This is more so if there are multiple stations in or around a major urban centre or if a station serves a large catchment area.

For example, some passengers travelling to *Thane* may eventually be headed to *Mumbai*. On the obverse, it may also be so that passengers taking a train from *Prayagraj* may actually be residing outside the district.

Secondly, since the data captures passenger numbers (i.e. journeys), Circular Migration/Short term migration or travel around festival/marriage seasons would **inflate the figures**. Therefore the data would need to be used with some caution. Thirdly, the data **does not capture details** such as age, gender, reasons for migrating etc.

Thirdly, there is a possibility that new lines/services/trains may have been since have been added or discontinued which might have a bearing on the figures.

In general, while the data is **useful for discerning trends**, routes, changes in directions, hotspots for origin/destination etc. however it has limited utility for use as absolute figures.

Data on number of tickets booked on the unreserved ticketing system from the Indian Railways Centre for Railway Information Systems (CRIS)[46] was used to conduct this analysis.

This data captures the month and year of travel, the place (district) of origin of the journey and the place (district) of destination as well as the number of passengers travelling on the route.

We query the dataset looking for answers to the following questions:

[46] CRIS secure file transfer communication dated 13.02.2024 and 03.05.2024 refers

- What have been the overall trends in migration, as indicated by unreserved train travel moved since the 2011 Census
- Which are the top origin districts for in-/out-migration
- Origins for Cities (Districts) with the maximum migrant in-flows
- Destinations for Places (Districts) with the maximum migrant out-flows
- Top District and State Routes
- Seasonal trends in flow of railway traffic

We also attempt to delve into the trends in sub-urbanization of Indian Cities. In particular, we explore where the number of people travelling in the suburban zone for major cities in India. We use the same definition of *suburban* as the Indian Railways i.e. places within 150 kms. of the origin[47]. This is done in order to maintain continuity and comparability.

In order to account for sub-urban movement, each City (District) is geocoded and distanced between city/district pairs are computed using the *Haversine Formula*[48]:

$$hav\ \theta = hav(\Delta\varphi) + cos(\varphi_1) \,.\, cos\ (\varphi_2) \,.\, hav\ (\Delta\lambda)$$

where

- φ_1, φ_2 are the latitude of point 1 and latitude of point 2;
- λ_1, λ_2 are the longitude of point 1 and longitude of point 2;
- $\Delta\varphi = \varphi_2 - \varphi_1$, $\Delta\lambda = \lambda_2 - \lambda_1$

The distance calculated here is the *orthodromic* or spherical distance and in some cases might differ from the actual road distances. However, for uniformity of application we use the above to compute distances and use the 150 km mark for segregating suburban and non-suburban travel. For the purposes of this paper, we define *'passenger'*, as a *UTS II Class, non-Suburban passenger*, unless otherwise qualified.

We begin by taking a look at **State-wise** migration. Table 5 depicts States which were the top destinations in 2023 along with the percentage of total passengers destined to those States. The figures include intra-State non-suburban travellers as well.

[47] PAC 69th Report on Suburban Railways; https://eparlib.nic.in/bitstream/123456789/65704/1/16_Public_Accounts_69.pdf; Pg. 7

[48] https://community.esri.com/t5/coordinate-reference-systems-blog/distance-on-a-sphere-the-haversine-formula/ba-p/902128

For comparison, the state-wise percentage of total passengers as well as the number of Statewise in-migrants enumerated as per Census, 2011 is also included.

Table 5: Top Destinations for Passengers; 2023/2012; UTS II Class Non-Suburban Passengers and Statewise in-migrants as per Census, 2011 [including intra-State Migrants]

STATES TO	**% of Total Passengers** 2023	**% of Total Passengers** 2012	**Statewise In-migrants** [Census 2011][49]	**% of Total In-Migrants** [Census 2011]
UTTAR PRADESH	12.68	13.16	**56452083**	12.39
MAHARASHTRA	10.74	12.34	**57376776**	12.59
WEST BENGAL	7.33	5.00	**33448472**	7.34
RAJASTHAN	7.19	6.17	**22071482**	4.84
MADHYA PRADESH	6.75	6.89	**24735119**	5.43
BIHAR	6.54	6.47	**27244869**	5.98
KARNATAKA	6.36	5.84	**26463170**	5.81
TAMIL NADU	6.08	5.89	**31274107**	6.86
ANDHRA PRADESH	5.73	6.64	**38360644**	8.42
DELHI	5.16	5.38	**7224514**	1.59
GUJARAT	5.10	6.00	**26898286**	5.90
TELANGANA	3.60	3.79		0.00
HARYANA	2.93	2.90	**10585460**	2.32
KERALA	2.89	2.55	**17863419**	3.92
ODISHA	2.57	2.33	**15421793**	3.38
PUNJAB	2.27	2.53	**13735616**	3.01
JHARKHAND	2.19	2.26	**9659702**	2.12
CHHATTISGARH	1.15	1.44	**8888075**	1.95
ASSAM	0.94	0.75	**10644234**	2.34
UTTARAKHAND	0.73	0.78	**4317454**	0.95
JAMMU AND KASHMIR	0.42	0.41	**2809629**	0.62
CHANDIGARH	0.28	0.19	**678188**	0.15
GOA	0.18	0.14	**1140690**	0.25
NAGALAND	0.07	0.08	**549618**	0.12
HIMACHAL PRADESH	0.04	0.05	**2647067**	0.58
TRIPURA	0.04	0.03	**1299623**	0.29
PUDUCHERRY	0.03	0.02	**712401**	0.16
ARUNACHAL PRADESH	0.00	0.00	**630831**	0.14
MEGHALAYA	0.00	0.00	**759554**	0.17
		TOTAL In-migrants [Census, 2011]	**455787621**	

Source: IR UTS Data; Census 2011; DS-0000-D03-MDDS; Migrants within the State/UT by place of last residence, duration of residence and reason of migration – 2011

From the above we can see the following:

- The **composition of the top five** States attracting migrants **has changed**. **West Bengal and Rajasthan** are the new entrants and while Andhra Pradesh and Bihar are now ranked a notch lower.

[49] Census 2011; DS-0000-D03-MDDS; Migrants within the State/UT by place of last residence, duration of residence and reason of migration – 2011

- Even amongst the top five the percentage of **passengers headed to the respective States has reduced**. This could be on account of an overall reduction in the migration rate or could also indicate a greater spatial spread of outward movement of passengers.
- West Bengal, Rajasthan and Karnataka are the **States showing the maximum amount of growth** in percentage **share of the arriving passengers**. Similarly, Maharashtra and Andhra Pradesh are States where the percentage share of total migrants has reduced.
- As regards, the quality of IR UTS II Class Passenger data, it may be noted that as a percentage of the total numbers, the **railway data closely corresponds** to the data captured as part of the Census 2011 exercise in most cases. The passenger arrivals and Census enumerated migrants in Delhi do show a deviation. This may be on account of Delhi being used as a transit station.

We may note that the above figures include *all* non-suburban arriving passengers/migrants, irrespective of the state of their origin. Therefore the figures above include those who might be arriving or migrating from within the respective State as well.

We move on to attempt a comprehensive perspective on the percentage of passengers arriving as well as departing from each State. Table 6 captures the percentage of arrivals in each State [columns] from other states [rows] in the year 2023. For example, we can see that Gujarat, Uttar Pradesh, Bihar, Karnataka and Telangana are the major origin states for arrivals in **Maharashtra**. Similarly, for **Delhi**, the major origin states are Uttar Pradesh, Bihar, Rajasthan, Haryana and Madhya Pradesh.

In the same vein, Table 7 captures the state wise percentage of destinations [States in columns] for outbound UTS II Class non-suburban travellers from each origin [States in rows]. We can see that the major destinations for UTS II Class travellers heading out from **Uttar Pradesh** are Delhi, Bihar, Maharashtra, Madhya Pradesh and Haryana. Major Destinations for UTS II Class non-suburban travellers heading out from **Bihar** are Delhi, West Bengal, Uttar Pradesh, Maharashtra and Jharkhand.

Table 6: Percentage of UTS II Class passengers from States [Rows] arriving in States [Columns], 2023 [Non-Suburban]

Origin States in Rows; Destination States in Columns

	AP	AR	AS	BH	CH	CG	DL	GA	GJ	HR	HP	JK	JH	KN	KL	MP	MH	NL	OD	PY	PB	RJ	TN	TG	TR	UP	UK	WB
AP	46.60	0.00	0.37	0.36	0.03	2.39	0.21	1.70	0.18	0.01	0.00	0.04	1.45	11.94	0.87	0.30	0.72	0.09	13.80	18.39	0.02	0.08	7.51	36.19	0.01	0.27	0.00	1.22
AR	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AS	0.06	96.34	57.61	1.21	0.04	0.02	0.22	0.00	0.02	0.01	0.00	0.14	0.19	0.20	0.47	0.01	0.03	74.24	0.05	0.00	0.01	0.02	0.21	0.05	61.66	0.15	0.00	1.79
BH	0.57	2.58	8.75	16.12	3.94	2.68	18.20	4.84	4.39	7.24	0.04	7.04	27.85	1.24	0.41	1.29	7.33	16.67	2.24	0.02	15.76	1.66	1.54	2.82	14.09	7.12	4.70	12.49
CH	0.00	0.00	0.03	0.22	0.00	0.00	0.67	0.26	0.04	1.14	0.00	1.70	0.06	0.01	0.01	0.02	0.02	0.05	0.00	0.00	1.04	0.10	0.00	0.01	0.00	1.36	1.81	0.02
CG	0.52	0.00	0.03	0.42	0.00	21.60	0.47	0.28	0.42	0.16	0.00	1.94	1.75	0.09	0.08	2.94	2.11	0.00	5.70	0.00	0.35	0.16	0.19	0.67	0.00	0.58	0.15	0.44
DL	0.17	0.00	1.16	11.21	11.26	1.95	0.00	3.42	1.37	9.33	29.70	14.39	2.19	0.45	0.42	4.56	0.76	0.26	0.46	0.49	12.83	6.94	0.30	0.70	0.62	11.65	15.31	0.76
GA	0.04	0.00	0.00	0.11	0.13	0.04	0.14	0.00	0.11	0.01	0.00	0.00	0.11	0.79	0.55	0.12	0.63	0.00	0.20	0.00	0.00	0.05	0.02	0.03	0.00	0.09	0.01	0.09
GJ	0.16	0.03	0.12	2.65	0.59	1.90	1.63	2.88	37.45	0.60	0.32	0.65	1.20	0.28	0.13	5.22	12.29	0.00	1.48	0.00	0.62	6.19	0.13	0.40	0.00	3.55	0.91	0.42
HR	0.01	0.00	0.08	2.80	15.63	0.39	10.07	0.18	0.38	26.02	56.57	12.08	0.36	0.01	0.03	1.14	0.14	0.03	0.02	0.00	16.92	7.14	0.00	0.01	0.19	4.30	4.02	0.08
HP	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.05	0.06	0.00
JK	0.00	0.00	0.05	0.43	1.99	0.85	1.62	0.00	0.07	1.85	0.00	0.00	0.20	0.00	0.00	0.24	0.04	0.00	0.02	0.00	4.75	0.22	0.01	0.01	0.00	0.83	2.19	0.06
JH	0.58	0.00	0.47	10.36	0.38	3.29	1.13	1.73	0.67	0.32	0.01	0.83	14.66	0.42	0.36	0.40	0.58	0.10	9.14	0.39	0.40	0.24	0.72	0.59	7.11	1.45	0.50	7.20
KN	10.40	0.00	1.67	1.13	0.15	0.50	0.61	24.53	0.36	0.03	0.00	0.01	1.23	57.51	7.92	0.44	5.42	0.21	1.70	10.25	0.01	0.23	8.51	5.50	0.00	0.63	0.01	0.93
KL	0.54	0.00	1.57	0.19	0.06	0.13	0.24	7.35	0.07	0.02	0.00	0.02	0.57	3.22	69.26	0.11	0.17	0.35	0.79	11.98	0.01	0.05	7.16	0.20	0.00	0.13	0.07	0.79
MP	0.31	0.03	0.07	1.54	0.51	17.28	7.03	4.15	7.43	2.51	0.18	4.67	1.27	0.39	0.21	55.41	3.71	0.04	0.50	0.06	1.28	9.09	0.32	1.05	0.10	5.95	1.26	0.14
MH	1.37	0.00	0.38	11.93	0.68	20.47	1.79	35.16	25.46	0.50	0.02	0.94	2.37	9.04	0.69	5.72	50.91	0.06	1.48	0.75	0.71	2.26	0.65	11.35	0.00	6.00	0.57	1.18
NL	0.00	0.00	5.01	0.14	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.01	0.00	0.05
OD	5.80	0.00	0.17	0.86	0.02	12.20	0.26	1.85	0.94	0.02	0.00	0.11	10.22	0.64	0.66	0.19	0.34	0.08	44.10	5.46	0.04	0.05	1.24	1.53	0.04	0.24	0.07	4.66
PY	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.25	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.02
PB	0.01	0.00	0.05	5.41	11.44	0.84	6.31	0.05	0.29	12.51	0.34	24.69	0.38	0.00	0.01	0.48	0.15	0.04	0.04	0.00	11.85	1.62	0.01	0.01	0.02	4.40	11.19	0.07
RJ	0.13	0.00	0.17	1.88	2.65	1.01	10.20	1.66	9.02	16.54	2.29	3.90	0.67	0.29	0.15	9.30	1.59	0.12	0.15	0.00	5.26	54.72	0.11	0.44	0.00	4.44	9.71	0.32
TN	7.51	0.00	1.47	1.05	0.09	0.82	0.39	0.51	0.13	0.01	0.00	0.06	2.23	8.30	15.28	0.37	0.40	0.26	3.04	46.76	0.02	0.08	67.91	1.16	0.02	0.46	0.00	1.53
TG	22.94	0.00	0.36	1.20	0.10	2.08	0.54	1.01	0.32	0.02	0.00	0.05	0.88	3.28	0.28	0.68	3.94	0.02	2.00	0.08	0.02	0.18	0.75	33.42	0.38	0.74	0.00	0.86
TR	0.00	0.00	2.33	0.08	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
UP	0.63	0.26	1.95	14.11	44.23	6.83	33.81	5.83	10.03	19.36	10.10	21.84	7.00	1.16	0.48	10.77	7.94	1.29	1.13	1.19	24.47	7.67	0.92	2.62	1.01	41.54	43.95	2.47
UK	0.00	0.00	0.01	0.55	5.77	0.18	2.90	0.06	0.23	0.94	0.43	4.05	0.19	0.00	0.02	0.15	0.07	0.00	0.03	0.00	3.38	0.99	0.00	0.00	0.00	2.69	3.13	0.06
WB	1.46	0.75	15.63	14.04	0.31	2.56	1.18	2.55	0.61	0.16	0.00	0.86	22.85	0.67	1.44	0.13	0.67	5.59	11.89	4.18	0.24	0.26	1.34	1.23	14.38	1.38	0.36	62.28
GRAND TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Description: What % of arrivals in a State in Column is from States in Rows
Source: UTS Data for II Class from CRIS; RTO Codes for State Names; Columns formatted individually

Table 7: Percentage of UTS II Class passengers departing State [Row] and destined to State [Column], 2023 [Non-Suburban]

Origin States in Rows; Destination States in Columns

	AP	AR	AS	BH	CH	CG	DL	GA	GJ	HR	HP	JK	JH	KN	KL	MP	MH	NL	OD	PY	PB	RJ	TN	TG	TR	UP	UK	WB	Grand Total
AP	45.16	0.00	0.06	0.39	0.00	0.47	0.18	0.05	0.16	0.01	0.00	0.00	0.54	12.86	0.43	0.34	1.31	0.00	5.99	0.09	0.01	0.10	7.73	22.02	0.00	0.59	0.00	1.52	100.00
AR	0.00	0.00	95.63	3.22	0.01	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.19	0.00	0.87	100.00
AS	0.38	0.43	58.88	8.59	0.01	0.03	1.23	0.00	0.13	0.05	0.00	0.06	0.46	1.39	1.48	0.06	0.41	5.58	0.15	0.00	0.04	0.14	1.36	0.21	2.57	2.11	0.00	14.26	100.00
BH	0.48	0.00	1.21	15.50	0.16	0.45	13.83	0.13	3.29	3.12	0.00	0.44	8.96	1.16	0.17	1.28	11.58	0.17	0.85	0.00	5.26	1.75	1.38	1.49	0.08	13.28	0.51	13.46	100.00
CH	0.02	0.00	0.08	4.59	0.00	0.01	10.92	0.15	0.65	10.56	0.00	2.26	0.39	0.14	0.06	0.48	0.78	0.01	0.02	0.00	7.49	2.18	0.09	0.08	0.00	54.39	4.18	0.47	100.00
CG	2.62	0.00	0.02	2.40	0.00	21.72	2.10	0.05	1.88	0.40	0.00	0.72	3.34	0.49	0.19	17.30	19.82	0.00	12.77	0.00	0.68	1.01	1.01	2.11	0.00	6.43	0.10	2.84	100.00
DL	0.24	0.00	0.26	17.45	0.75	0.53	0.00	0.15	1.67	6.52	0.28	1.45	1.14	0.68	0.29	7.33	1.95	0.00	0.28	0.00	6.94	11.87	0.43	0.60	0.01	35.18	2.67	1.33	100.00
GA	1.15	0.00	0.01	3.78	0.18	0.25	3.76	0.00	2.81	0.14	0.00	0.00	1.18	25.49	8.02	4.24	34.56	0.00	2.59	0.00	0.05	1.65	0.48	0.52	0.00	5.67	0.05	3.42	100.00
GJ	0.19	0.00	0.02	3.50	0.03	0.44	1.70	0.11	38.56	0.35	0.00	0.06	0.53	0.36	0.07	7.10	26.64	0.00	0.77	0.00	0.28	8.98	0.16	0.29	0.00	9.09	0.13	0.62	100.00
HR	0.01	0.00	0.03	5.74	1.37	0.14	16.32	0.01	0.61	23.92	0.71	1.60	0.25	0.03	0.03	2.40	0.48	0.00	0.02	0.00	12.05	16.07	0.01	0.01	0.00	17.09	0.92	0.19	100.00
HP	0.00	0.00	0.00	0.57	0.00	0.00	40.38	0.00	0.40	41.52	0.00	0.00	0.01	0.00	0.00	0.74	0.06	0.00	0.00	0.00	0.42	1.97	0.00	0.00	0.00	12.90	1.02	0.01	100.00
JK	0.04	0.00	0.10	6.10	1.20	2.11	18.17	0.00	0.76	11.79	0.00	0.00	0.96	0.04	0.01	3.55	1.03	0.00	0.10	0.00	23.37	3.35	0.11	0.04	0.00	22.68	3.47	1.02	100.00
JH	1.40	0.00	0.19	28.78	0.04	1.61	2.48	0.13	1.45	0.40	0.00	0.15	13.63	1.15	0.45	1.15	2.64	0.00	9.97	0.00	0.39	0.73	1.85	0.90	0.12	7.80	0.15	22.43	100.00
KN	9.54	0.00	0.25	1.18	0.01	0.09	0.51	0.71	0.30	0.01	0.00	0.00	0.43	58.63	3.68	0.47	9.33	0.00	0.70	0.05	0.00	0.27	8.30	3.17	0.00	1.27	0.00	1.09	100.00
KL	1.07	0.00	0.51	0.42	0.01	0.05	0.43	0.46	0.13	0.02	0.00	0.00	0.43	7.11	69.55	0.25	0.63	0.01	0.71	0.12	0.01	0.14	15.12	0.25	0.00	0.55	0.02	2.01	100.00
MP	0.26	0.00	0.01	1.46	0.02	2.89	5.28	0.11	5.50	1.07	0.00	0.29	0.40	0.36	0.09	54.30	5.80	0.00	0.19	0.00	0.42	9.48	0.28	0.55	0.00	10.96	0.13	0.15	100.00
MH	0.74	0.00	0.03	7.36	0.02	2.23	0.87	0.60	12.27	0.14	0.00	0.04	0.49	5.43	0.19	3.65	51.63	0.00	0.36	0.00	0.15	1.53	0.38	3.86	0.00	7.18	0.04	0.82	100.00
NL	0.14	0.00	75.87	14.76	0.01	0.00	0.43	0.00	0.00	0.03	0.00	0.00	0.08	0.34	0.62	0.04	0.12	0.00	0.07	0.00	0.02	0.04	0.36	0.01	0.23	1.32	0.00	5.51	100.00
OD	12.93	0.00	0.06	2.19	0.00	5.46	0.53	0.13	1.87	0.02	0.00	0.02	8.70	1.59	0.75	0.51	1.42	0.00	44.01	0.06	0.03	0.14	2.93	2.14	0.00	1.20	0.02	13.28	100.00
PY	20.46	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	7.29	13.79	0.10	0.51	0.00	2.37	0.00	0.00	0.00	52.33	0.05	0.00	0.66	0.00	2.25	100.00
PB	0.02	0.00	0.02	15.38	1.39	0.42	14.19	0.00	0.65	15.95	0.01	4.54	0.37	0.01	0.01	1.41	0.72	0.00	0.04	0.00	11.70	5.06	0.02	0.01	0.00	24.28	3.56	0.23	100.00
RJ	0.10	0.00	0.02	1.71	0.10	0.16	7.31	0.04	6.38	6.72	0.01	0.23	0.20	0.25	0.06	8.69	2.37	0.00	0.05	0.00	1.65	54.50	0.09	0.22	0.00	7.81	0.98	0.32	100.00
TN	7.08	0.00	0.23	1.13	0.00	0.16	0.33	0.02	0.11	0.00	0.00	0.00	0.80	8.69	7.28	0.42	0.71	0.00	1.28	0.21	0.01	0.09	67.96	0.69	0.00	0.96	0.00	1.85	100.00
TG	36.08	0.00	0.09	2.16	0.01	0.66	0.76	0.05	0.45	0.02	0.00	0.01	0.53	5.73	0.22	1.26	11.63	0.00	1.41	0.00	0.01	0.36	1.25	33.01	0.00	2.59	0.00	1.72	100.00
TR	0.00	0.00	59.80	13.86	0.00	0.00	1.30	0.00	0.00	0.17	0.00	0.00	6.90	0.00	0.00	0.13	0.01	0.94	0.00	0.00	0.02	0.01	0.03	0.00	0.00	1.25	0.00	15.58	100.00
UP	0.28	0.00	0.14	7.10	0.95	0.61	13.45	0.08	3.94	4.37	0.03	0.71	1.18	0.57	0.11	5.59	6.57	0.01	0.22	0.00	4.28	4.24	0.43	0.73	0.00	40.55	2.47	1.40	100.00
UK	0.00	0.00	0.01	4.47	2.02	0.25	18.75	0.01	1.44	3.46	0.02	2.14	0.53	0.02	0.06	1.27	0.89	0.00	0.10	0.00	9.59	8.88	0.00	0.01	0.00	42.68	2.86	0.52	100.00
WB	1.17	0.00	2.06	12.82	0.01	0.41	0.85	0.06	0.44	0.07	0.00	0.05	6.98	0.59	0.58	0.12	1.01	0.05	4.26	0.02	0.08	0.26	1.14	0.62	0.08	2.44	0.04	63.78	100.00

Description: What % of departures from a State in Rows goes to States in Columns
Source: UTS Data for II Class from CRIS
RTO Codes for State Names; Rows formatted individually

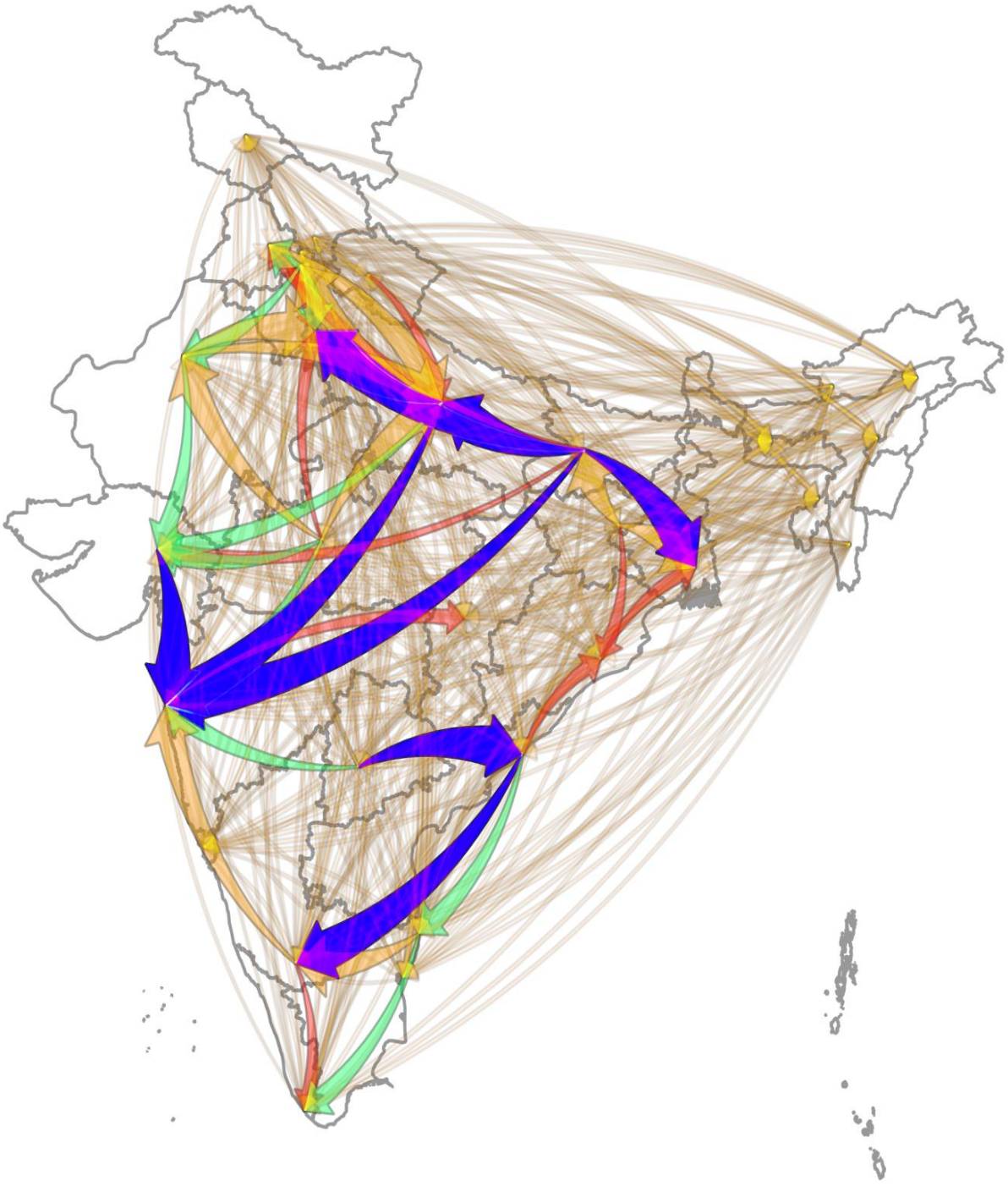
We now take a look at the ten most popular **State-to-State Routes**. This is based on passenger movements in 2023. Here intra-State and suburban movement is excluded.

Table 8: Top Ten State-to-State Routes [2023]

STATE FROM	STATE TO
UTTAR PRADESH	DELHI
GUJARAT	MAHARASHTRA
TELANGANA	ANDHRA PRADESH
BIHAR	DELHI
BIHAR	WEST BENGAL
BIHAR	UTTAR PRADESH
UTTAR PRADESH	MAHARASHTRA
BIHAR	MAHARASHTRA
ANDHRA PRADESH	KARNATAKA
JHARKHAND	BIHAR

For better visualization we map State-to-State routes [Figure 4]. As above, intra-State and suburban movement is excluded.

Fig. 4: State-to-State Predicted Migration Routes [2023]



Basemap: India States Shapefile [ADM1]; Data: UTS II Class IR Passengers, 2023
Intra-State and suburban movement is excluded

Another visualization of the above is a chord diagram [Figure 5]. The size of the arcs indicates the proportional size of the movements in the respective States [RTO Codes are used to denote States]. Both inter-State as well as intra-State movements are depicted.

Fig. 5: Predicted Inter-State and Intra-State Movement [2023]



Data: UTS II Class IR Passengers [Non-Suburban], 2023
Data includes both inter-State and intra-State movement

We now take a look at the month-on-month changes in the total number of non-suburban as well as suburban passenger movement from January, 2012 to December, 2023. The figures are indexed with January 2012 set at 100. Figure 6 tracks the monthly trends in movement of non-suburban UTS II Class passengers.

Fig. 6: Trends in movement of non-suburban UTS II Class passengers; Jan, 2012 indexed at 100

[Jan, 2012 to Dec, 2023]

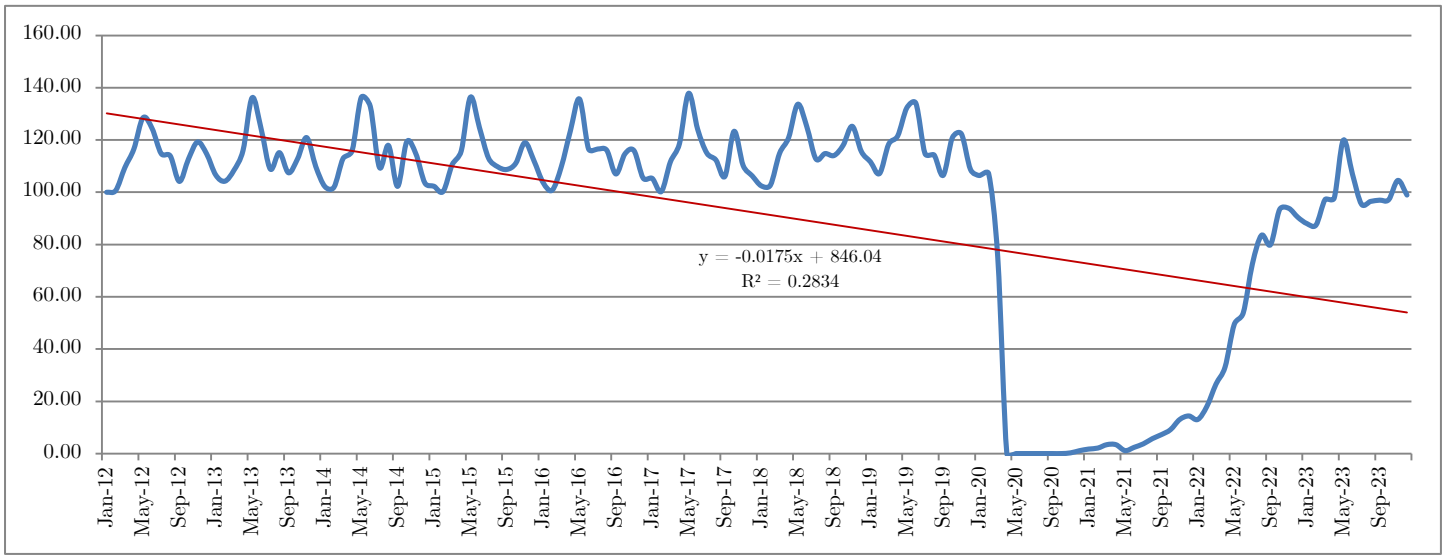


Figure 7 indicates a distinct **seasonality** of movements, with **May-June** being the **high months** and **November-December** witnessing **secondary highs**. These are perhaps months where most migrant labour travel back to their places of origin. A secondary high in winter time is perhaps indicative of travel around the festival/marriage season. **January**, on the other hand, appears to be the month of **lowest travel**.

However, the seasonal rhythms appear to have been affected by the Covid-19 pandemic. We can clearly see April-May 2020 as a month which saw passenger movements plummeting to nil as the Covid-19 related lockdown brought regular rail movement to a standstill. While the numbers have steadily come up once the Covid-19 related restrictions were lifted however, the level of movement is yet to reach pre-pandemic levels.

Even prior to the pandemic related lockdowns, there were signs of the passenger movement showing little growth, however after the pandemic, even the high months i.e. Apr-May are at a **distinctly lower level** as compared to the corresponding period before the pandemic - passenger levels for May 2023 being only **6.67% lower** than the corresponding number for May 2012.

A **reduction in the overall levels of migration** is indicated on the basis of passenger movement data. The overall non-suburban UTS II Class **passenger numbers** in 2023 are about **11.78% lower** than the corresponding numbers in 2012. In this period, the India's population has **grown by 14.98%** from 121,08,54,977 in 2011[50] to an estimated 139,23,29,000 in 2023[51].

Moreover, as per Census 2011[52], the number of migrants [*all persons, all reasons, all durations*] were enumerated as 45,57,87,621. Therefore, the migration rate, based on Census 2011, stood at **37.64%**. Analysing corresponding trends in railway passenger movement, we hypothesize that the **migration rate** has since **reduced to 28.878%** of the population [as of 2023].

Consequently, we estimate the **number of migrants** in the country, as of **2023**, to be **40,20,90,396**. We eagerly look forward to next round of the Census to verify our estimates!

There is considerable academic literature indicating that when an economy grows and the benefits of this growth are broadly distributed, rural/semi-urban, typically areas of out-migration, also tend to grow. This leads to a broader spread of economic opportunities and is seen as reducing the incentive to migrate to urban centres[53].

Further, it is seen that improved infrastructure (roads, education, healthcare, public transport), social security nets and localized economic growth that creates jobs closer to rural areas, together allow people to remain in their hometowns or to migrate shorter distances[54].

This is seen in India in the period since the last Census i.e. from 2011 to 2023. For example, *completed road length* under the *Pradhan Mantri Gram*

[50] Population Projections For India and States 2011 – 2036; National Commission on Population, Ministry of Health & Family Welfare, Pg. 24

[51] Lok Sabha Unstarred Q. No. 890; Answered on 25th July, 2023; *https://sansad.in/getFile/loksabhaquestions/annex/1712/AU890.pdf?source=pqals*

[52] Census 2011, D-2 Table: Migrants Classified by Place of Last Residence, Sex and Duration of Residence In the Place of Enumeration

[53] The Economics of Internal Migration: Advances and Policy Questions (Jia, Molloy, Smith, et al; 2022); https://www.federalreserve.gov/econres/feds/files/2022003pap.pdf

[54] https://documents.worldbank.org/curated/en/617151468332982240/pdf/WPS5558.pdf

Sadak Yojana (PMGSY)[55], increased from 3,25,576.26 kms. in 2011-12 to 12,47,459.42 kms in FY 2022-23 (an increase of 283%!)[56]. Similarly, 2,64,87,910 houses have been completed under the *Pradhan Mantri Awaas Yojana-Gramin* (PMAY-G)[57] in the period 2014 to 2024[58]. Under the *Deen Dayal Upadhyaya Gram Jyoti Yojana* (DDUGJY), launched in December 2014, as on 31.03.2019, all households in India have been reported as electrified[59].

Similarly, as of August 12th, 2024, the Jal Jeevan Mission (JJM) [launched on August 15th, 2019] has successfully provided tap water connections to 11.82 crore additional rural households, bringing the total coverage to more than 15.07 crore households, which accounts for 77.98% of all rural households in India. For context, at the time of its inception, only 3.23 crore (17%) of rural households had tap water connections[60]. Similarly, as of April 2024, 95.15% villages have access to internet with 3G/4G mobile connectivity[61]. Cumulatively, this has led to 24.82 crore Indians escaping Multidimensional Poverty in last 9 years[62].

In addition to being high frequency, an important feature of Railway reservation data is its granularity. Using the data we delve deeper to get a sense of the originating and destination districts.

However, we hasten to add that while these are the end points, however the passengers may not be a resident of that particular district and the catchment area of the district/station of origin may extend far beyond the district the Station is located in.

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55 Launched on 25th December, 2000 the Pradhan Mantri Gram Sadak Yojana is a scheme aimed at providing all-weather access to eligible unconnected habitations; https://omms.nic.in/ReferenceDocs/PMGSY_Guidelines.pdf

56 Pradhan Mantri Gram Sadak Yojana (PMGSY) Dashboard; *https://omms.nic.in/dbweb/Home/TimeSeries*

57 Launched on 20th November 2016, Pradhan Mantri Awas Yojana – Rural (PMAY – Rural) aims to provide housing for the poorest segments of society with the beneficaries being selected by a three stage process. https://pib.gov.in/PressReleasePage.aspx?PRID=2074713#:~:text=Under%20the%20Pradhan%20Mantri%20Awas,of%20millions%20of%20rural%20families

58 https://rhreporting.nic.in/netiay/PhysicalProgressReport/YearWsHsCompSchemePhaseWise_InterimRpt.aspx

59 https://pib.gov.in/PressReleasePage.aspx?PRID=1883918

60 https://pib.gov.in/PressNoteDetails.aspx?NoteId=152025&ModuleId=3&reg=3&lang=1

61 https://pib.gov.in/PressReleasePage.aspx?PRID=2040566

62 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1996271

Similarly, there is a fair possibility that the district/station where the journey terminates might not necessarily be the final destination for the migrants. Further, just as in the case of States, we use district-wise railway passenger data as an indicator of trends rather than of actual numbers.

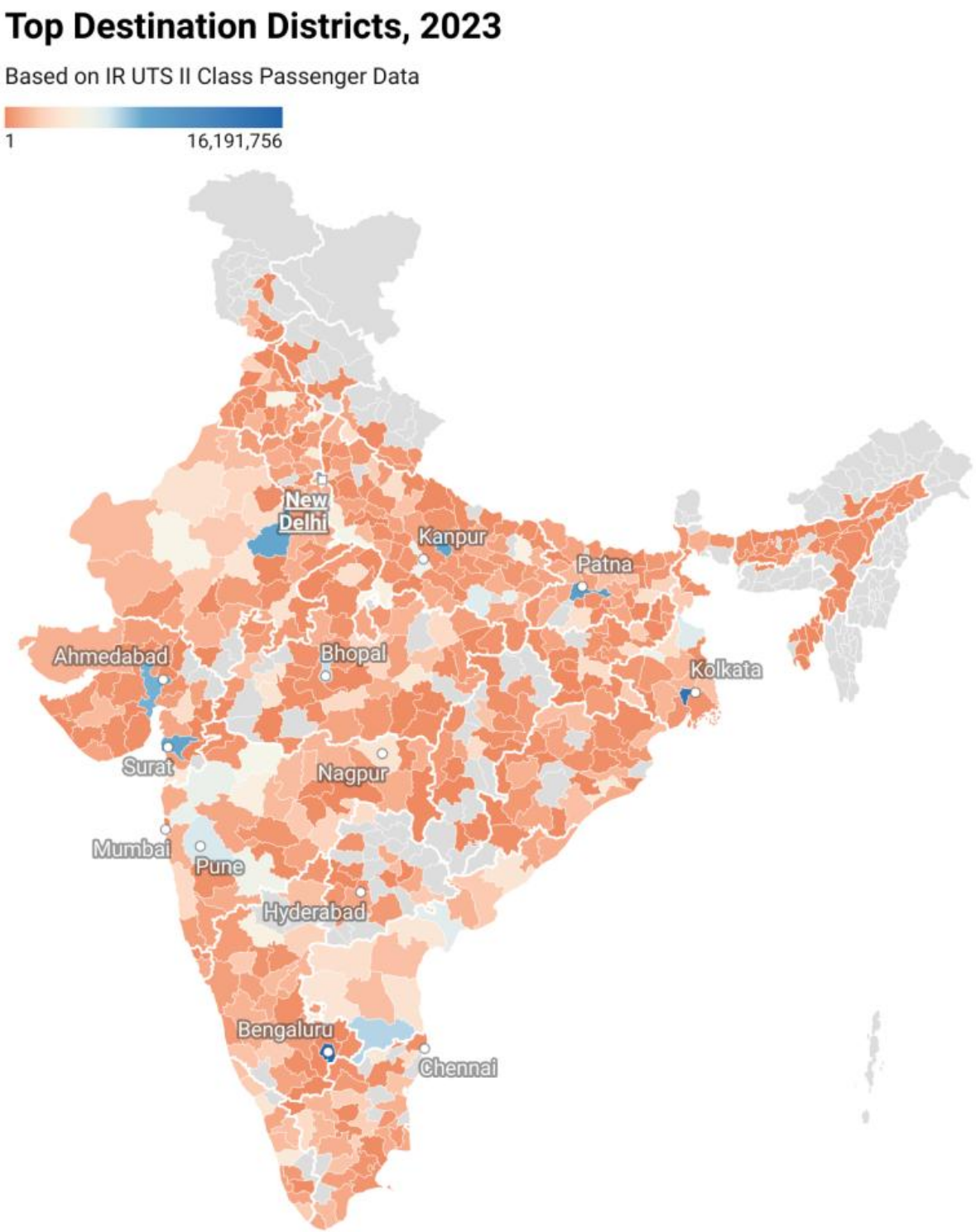
The following are the districts which were the top destinations for non-suburban [150+ km.] travel in 2012 as well as in 2023 (Table 9). While the order of the districts might have changed however the composition of the top ten stays constant.

Table 9: Top ten destination districts for non-suburban UTS II Class Passengers [2012, 2023]; All Origins

2012	2023
MUMBAI	MUMBAI
CENTRAL DELHI	BENGALURU URBAN
HOWRAH	HOWRAH
BENGALURU URBAN	CENTRAL DELHI
NORTH DELHI	HYDERABAD
HYDERABAD	CHENNAI
CHENNAI	PATNA
SURAT	NORTH DELHI
LUCKNOW	LUCKNOW
PATNA	SURAT

We map the top destination districts [2023] for predicted in-migration [Figure 7]. We see that the top destination districts are the major urban agglomerations viz. Delhi, Mumbai, Chennai, Bangalore, Kolkata etc. Given the relative geographic size of Mumbai City and the districts of Delhi, the two cities are not as prominent in the map [Figure 7].

Fig. 7: Top destination Districts [Non-Suburban, 2023]



Similarly, the following are the districts which were the top originating districts for non-suburban [150+ km.] travel in 2012 as well as in 2023

(Table 10). Here we see some new source districts feature in 2023 that weren't there in 2012.

Table 10: Top ten source districts for non-suburban UTS II Class Passengers [2012, 2023]; All Destinations

2012	2023
VALSAD	VALSAD
PATNA	CHITTOOR
PASCHIM BARDHAMAN	PASCHIM BARDHAMAN
CHITTOOR	AGRA
AGRA	GUNTUR
GUNTUR	VILLUPURAM
SPSR NELLORE	SAHARSA
MUMBAI	MORADABAD
PRAYAGRAJ	PRAYAGRAJ
BHAGALPUR	MURSHIDABAD

While Valsad remains the top source district, however being 193 kms from Mumbai there is likelihood that this travel is actually daily suburban travel. However, for sake of completeness we include Valsad in the above list.

We map the top origin districts [2023] for predicted out migration [Figure 8]. We see that the top origin districts are coalesced around major urban agglomerations viz. Delhi, Mumbai, Chennai, Bangalore, Kolkata etc.

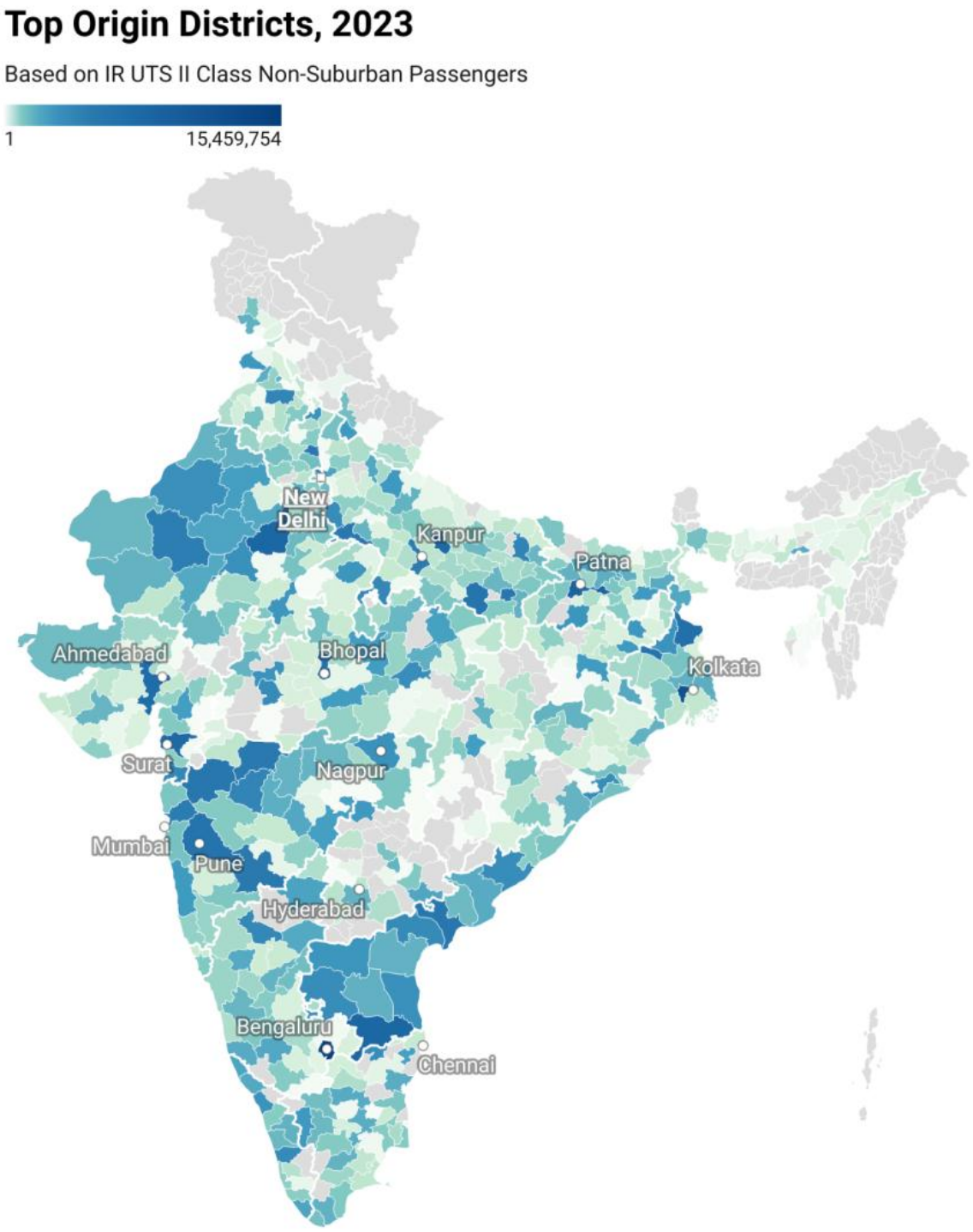
Not only is this in line with gravity models of migration[63] but perhaps also is a tentative confirmation of priors i.e **short distance migration** accounts for the largest share of migrants[64] and that **distance has a negative effect** on labour flows[65].

[63] Spatial Interaction Patterns, (Tobler; 1975), https://pure.iiasa.ac.at/id/eprint/241/1/RR-75-019.pdf

[64] Migration in India: trends and characteristics; (Singh & Biradar, 2022);

[65] Economic Survey, 2016-17; Chapter 12; Pg 276

Fig. 8: Top origin Districts [Non-Suburban, 2023]



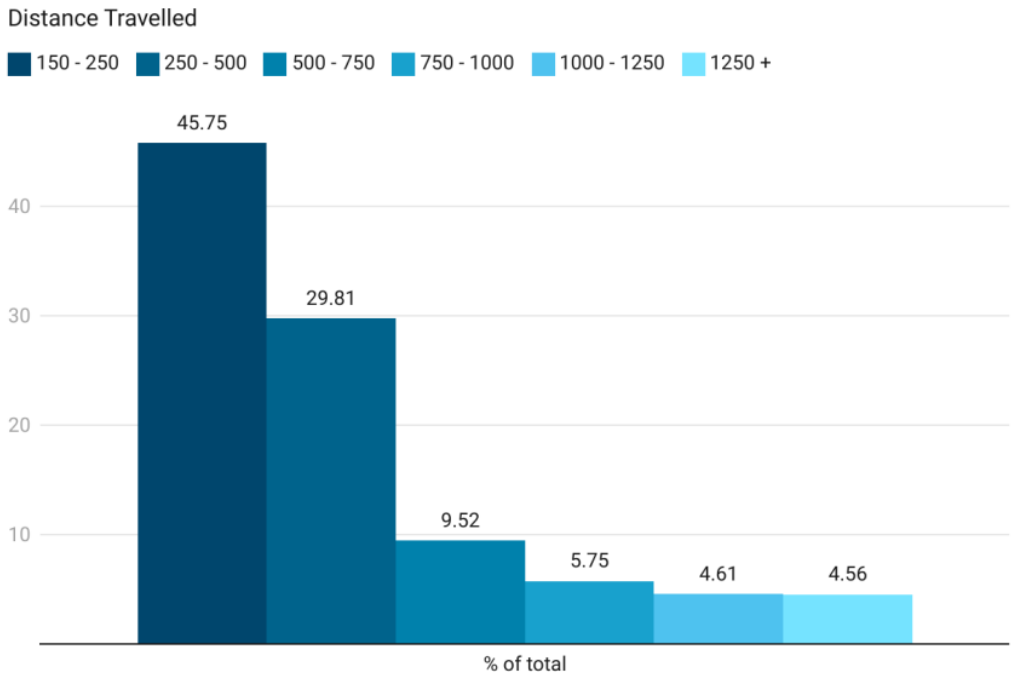
Similarly, the top ten routes for passenger movement, at the district level, is at Table 11.

Table 11: Top ten routes for non-suburban UTS II Class Passengers [District Level, 2023]

FROM	TO
MURSHIDABAD	KOLKATA
PASCHIM BARDHAMAN	HOWRAH
VALSAD	MUMBAI
CHITTOOR	BENGALURU URBAN
SURAT	MUMBAI
BIRBHUM	HOWRAH
VELLORE	BENGALURU URBAN
HASSAN	BENGALURU URBAN
NASHIK	MUMBAI

Further, it is interesting to note that that a majority [>75%] of our predicted migration flows are within 500 kms of the origin (Figure 9). This is in line with gravitation effects and Ravenstein's *Theory of Human Migration* (1834 – 1913)[66].

Figure 9: Percentage Distribution of passenger numbers by distance travelled (km)
[Non-Suburban, 2023]

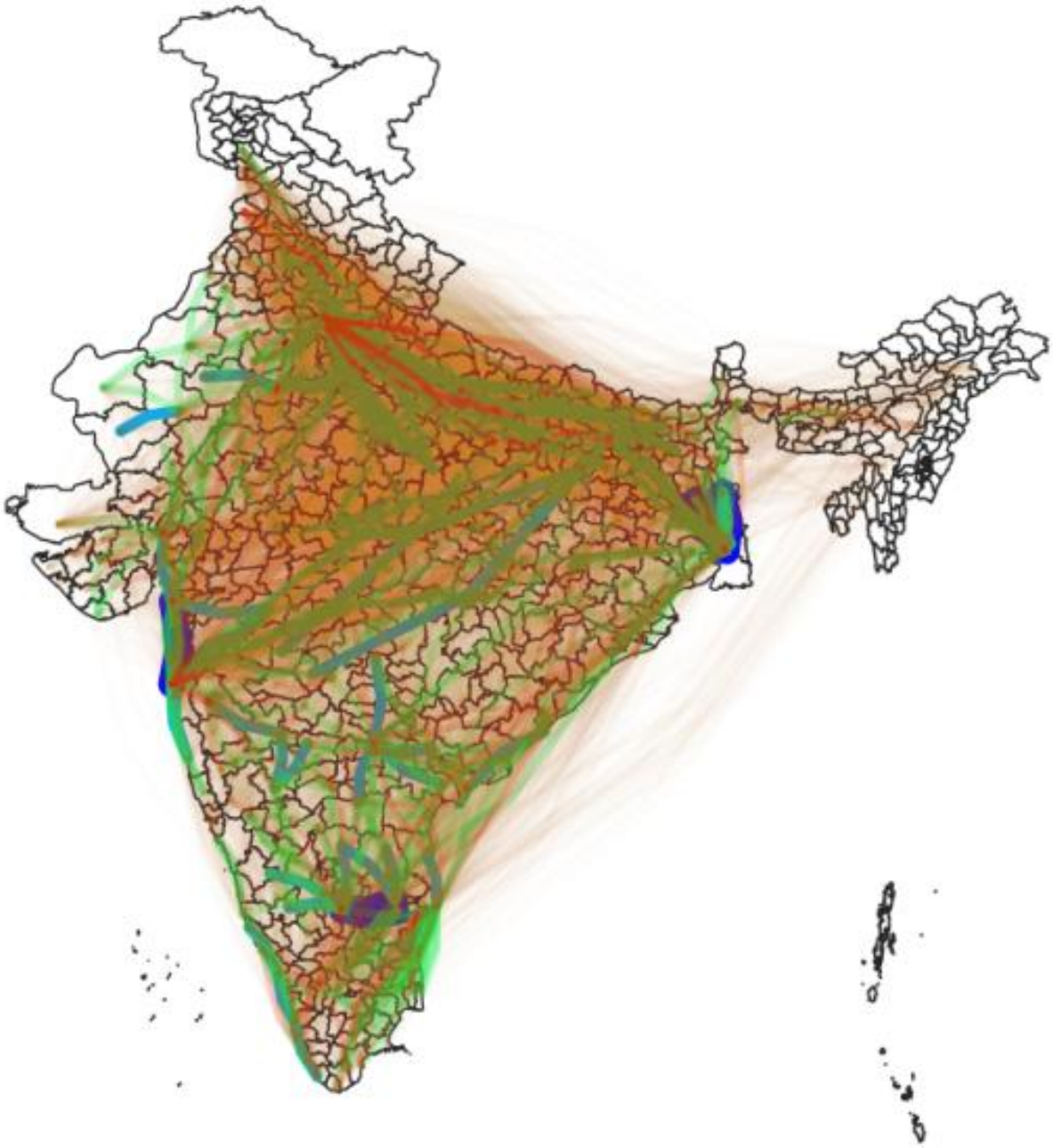


Before we move on the next section, we quickly visualize the district-to-district movement on a map (Figure 10). Given the sheer number of connections, the map is admittedly somewhat busy! The blue lines denote

[66] Ernest George Ravenstein: The Laws of Migration, 1885; John Corbett; http://csiss.org/classics/content/90

the highest amount of non-suburban travel and are clustered around Mumbai, Chennai, Bangalore and Kolkata. As earlier, flows to Delhi are split amongst the districts of Delhi and therefore don't show up as Blue lines.

Fig. 10: District -to-District Predicted Migration Routes [2023]



Basemap: India Districts Shapefile [ADM2]; Data: UTS II Class IR Passengers, 2023
Intra-District and suburban movement is excluded

We extend the above model to examine the districts of origin for predicted migration to Delhi (Table 12A). The districts are ranked by their respective percentage contribution to the total non-suburban arrivals in Delhi.

Table 12A: Top source districts for non-suburban UTS II Class Passengers [2012, 2023]; Destination Delhi [All Districts]

2012		2023	
Origin District	**% of Total**	**Origin District**	**% of Total**
AGRA	5.18	AGRA	4.54
PATNA	3.07	PATNA	2.90
MORADABAD	2.45	KANPUR NAGAR	2.01
KANPUR NAGAR	2.27	JHANSI	1.97
JHANSI	2.24	BAREILLY	1.80
BAREILLY	2.18	JAIPUR	1.75
DARBHANGA	2.02	HARIDWAR	1.69
GORAKHPUR	1.98	MORADABAD	1.69
JAIPUR	1.70	DAUSA	1.66
MUZAFFARPUR	1.57	LUDHIANA	1.58

From the above, we can see that districts like Dausa and Ludhiana now feature in the top ten origin districts for predicted migration into Delhi. However, in the period 2012 to 2013, the relative weightage of the top ten districts to the total has reduced. This is perhaps an indicator of a greater spatial spread of the origins of migration.

Using the same model, we take a look at the figures for Mumbai (Table 12B). In the case of Mumbai, we note that while the relative weights of the origins districts have changed however there is just one new entrant. Here too, the relative weightage of the top ten districts to the total has reduced.

Table 12B: Top source districts for non-suburban UTS II Class Passengers [2012, 2023]; Destination Mumbai

2012		2023	
Origin District	**% of Total**	**Origin District**	**% of Total**
VALSAD	15.93	VALSAD	13.49
NASHIK	11.98	SURAT	10.02
SURAT	11.35	NASHIK	8.75
GORAKHPUR	3.39	RATNAGIRI	4.92
VARANASI	3.14	VARANASI	2.77
NAVSARI	2.73	GORAKHPUR	2.45
AHMADABAD	2.56	AHMADABAD	2.45
LUCKNOW	2.07	PRAYAGRAJ	2.01
SOLAPUR	1.73	NAVSARI	1.76
VADODARA	1.73	SINDHUDURG	1.73

We also take quick look at some of the routes showing the biggest increases and decreases in the period between 2012 and 2023. The district-to-district routes showing the greatest increases are summarized in Table 13. Similarly, district-to-district routes showing the greatest decreases are summarized in Table 14.

Table 13: Top 10 District-to-District Routes showing the greatest increase in predicted migration between 2012 and 2023

ROUTES
MURSHIDABAD-KOLKATA
RATNAGIRI-THANE
RATNAGIRI-MUMBAI
KOLKATA-MURSHIDABAD
BENGALURU URBAN-HASSAN
HASSAN-BENGALURU URBAN
RATNAGIRI-RAIGAD
AGRA-CENTRAL DELHI
PANIPAT-SOUTH DELHI
SAHARSA-PATNA

Table 14: Top 10 District-to-District Routes showing the greatest decrease in predicted migration between 2012 and 2023

ROUTES
SPSR NELLORE-CHITTOOR
CHITTOOR-BENGALURU URBAN
BENGALURU URBAN-VELLORE
NASHIK-JALGAON
MUMBAI-NASHIK
MUMBAI-SURAT
PASCHIM BARDHAMAN-HOWRAH
PUNE-SOLAPUR
NASHIK-MUMBAI
VALSAD-MUMBAI

"I just called to say..."

Using *Roaming* to track trends in Migration

Not only are Indians mobile but increasingly more of them are on the mobile! India is home to the second largest telecommunication network [measured by number of phone connections] in the world[67]; the second highest number of internet users[68]; overall wireless Tele-density[69] in India for the month of April, 2024 stood at 83.31% with wireless Tele-density for Urban areas at 127.12% and that for Rural areas at 59.12%.

As on 30th of April, 2024, India's total Wireless Subscribers stood at 1166.96 Million with Rural subscribers accounting for 533.42 Million [45.71%] and Urban Subscribers making up 633.53 Million [54.29%] of all Wireless Subscribers[70].

The Telecom Regulatory Authority of India (TRAI), India's telecom sector regulator publishes monthly statistical reports regarding the telecom sector in the country. Included in this monthly report are the figures for subscribers in the *Visitor Location Register* (VLR).

[67] World Bank Data; https://data.worldbank.org/indicator/IT.CEL.SETS.P2

[68] ITU Data Hib; https://datahub.itu.int/data/?e=701&c=&i=11632

[69] Based on MoHF&W population projections from '*Report of the Technical Group on Population Projections for India and States 2011 – 2036*'

[70] Telecom Regulatory Authority of India; Press Release, 19th June, 2024; https://trai.gov.in/sites/default/files/PR_No.31of2024_1.pdf

Under the Global System for Mobile Communication (GSM) standards, the *Visitor Location Register* (VLR) is a database of Mobile Stations (Mobile Devices) that have roamed in the jurisdiction of the Mobile Switching Centre (MSC) it serves.

Each Mobile Device (Base Transceiver Station) is served by exactly one VLR and a subscriber can be present in only one VLR at a time[71]. This system is used by Cellular Service Providers to keep track of home and visiting (roaming) subscribers so as to be able to provide them appropriate services.

Therefore, tracking the VLR subscribers could be a useful proxy for the number of subscribers roaming/visiting the home location. It is useful, that the telecom circles in India typically correlate with state boundaries, with the cities of Delhi, Mumbai and Kolkata[72] being distinct telecom circles.

This helps us track the trends in the number of cellular devices/mobile phones '*visiting*' the respective cities. A similar approach was been used to understand interstate migration during the COVID-19 Pandemic (*Nizam, Sivakumar and Irudaya Rajan, 2022*)[73].

While using telecom data is a useful measure for understanding trends in movement of people, however, there are a number of caveats. Firstly, we cannot build a dyad i.e. there is no information in public domain of the home location of a roaming mobile subscriber. As a result it is difficult to correlate origins/destinations.

Secondly, a number of migrants – even blue collar migrants – may not have obtained their mobile connections at their place of origin and may only have obtained the mobile connection after having reached their destination. Therefore, they won't be reflected in the roaming numbers. Further, there may be other factors such as festivals, marriages etc. which might cause spikes and troughs.

[71] https://en.wikipedia.org/wiki/Network_switching_subsystem#Visitor_location_register_(VLR)

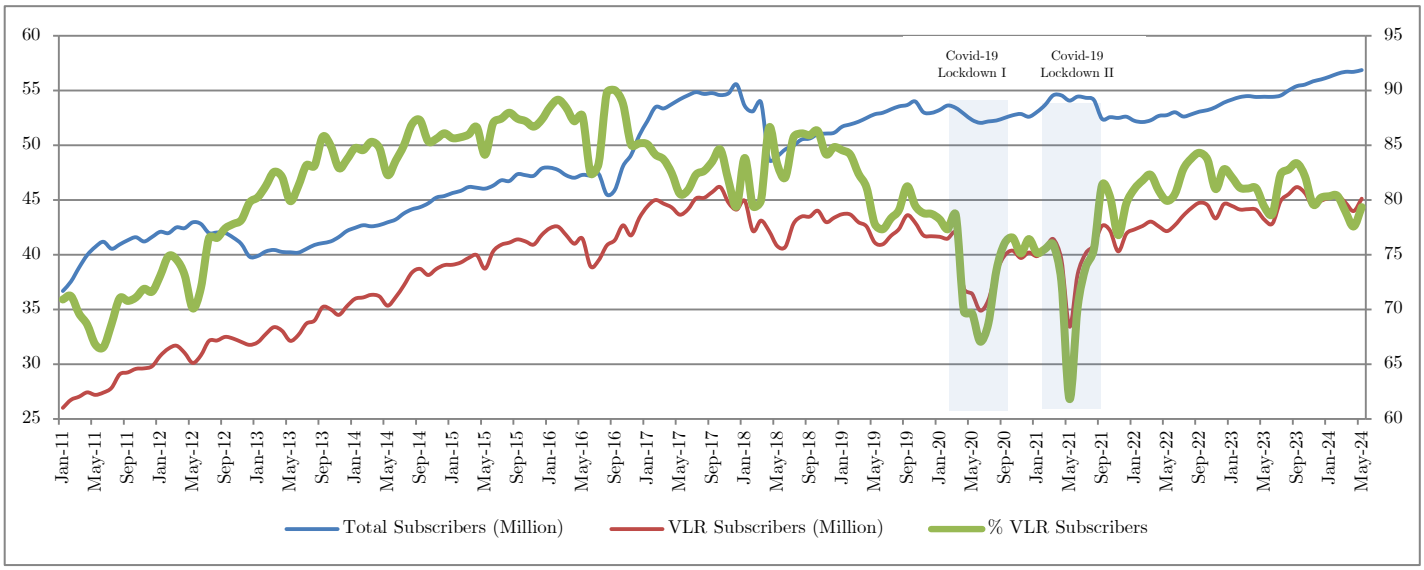
[72] https://dot.gov.in/sites/default/files/list%20of%20unifiedaccess%20licensees_0.pdf?download=1

[73] Nizam, A., Sivakumar, P., & Rajan, S. I. (2022). Interstate Migration in India During the COVID-19 Pandemic; https://doi.org/10.1177/09731741221122000

However, despite these caveats, TRAI telecom data is a high frequency, publicly available dataset which can help in discerning trends in the number of mobile subscribers and can act a useful proxy for the movement of migrants. Keeping that in mind, we take a look at the trends in VLR subscribers, expressed as a percentage of total subscribers.

We begin by taking a look at the three telecom service areas contiguous with cities viz. Delhi, Mumbai & Kolkata. Starting with **Delhi**, we track the **trends in total number of wireless subscribers**, total number of VLR Subscribers (in-*roamers*) (both on left axis) and **VLR Subscribers as a percentage of total subscribers** (right axis) for a period from January 2011 to May 2024 using historical TRAI Monthly Subscription Data[74] (Figure 11).

Fig. 11: Monthly trends of Total Wireless Subscribers; Total VLR Subscribers (both Left Axis); % of VLR Subscribers (Right Axis) for Delhi; January 2011 to May 2024



The two shaded areas correspond to the two Covid-19 lockdown periods viz. April-June, 2020 and April-July, 2021[75] which saw large numbers of migrant workers moving back to their places of origin[76]. Given that in this period there was little movement/travel other than migrant workers moving back, it is reasonable to assume that this movement is reflective of movement of migrants.

[74] TRAI Monthly Reports; https://trai.gov.in/release-publication/reports/telecom-subscriptions-reports?field_start_date_value%5Bvalue%5D=&page=16

[75] https://pib.gov.in/PressReleasePage.aspx?PRID=1624763

[76] Understanding Migration Behaviour in India from PLFS Data: Post-lockdown and Future Perspective (Mitra, Shrivastav; 2023)

It is evident that as compared to the first lockdown (April - June 2020), the second lockdown (April - June 2021) saw a more pronounced drop in the percentage of VLR Subscribers (*in-roamers*). Looking at the absolute numbers, comparing the number of VLR Subscribers in May 2019 [the month-year prior to the peak levels of the Pandemic in Delhi] to the number at the peak of the lockdown i.e. **May, 2021** we note reduction of **7.69 Million**. Similarly, the reduction in the number of *in-roamers* in **May 2020** as against VLR Subscribers in May 2019 stood at **4.68 Million**.

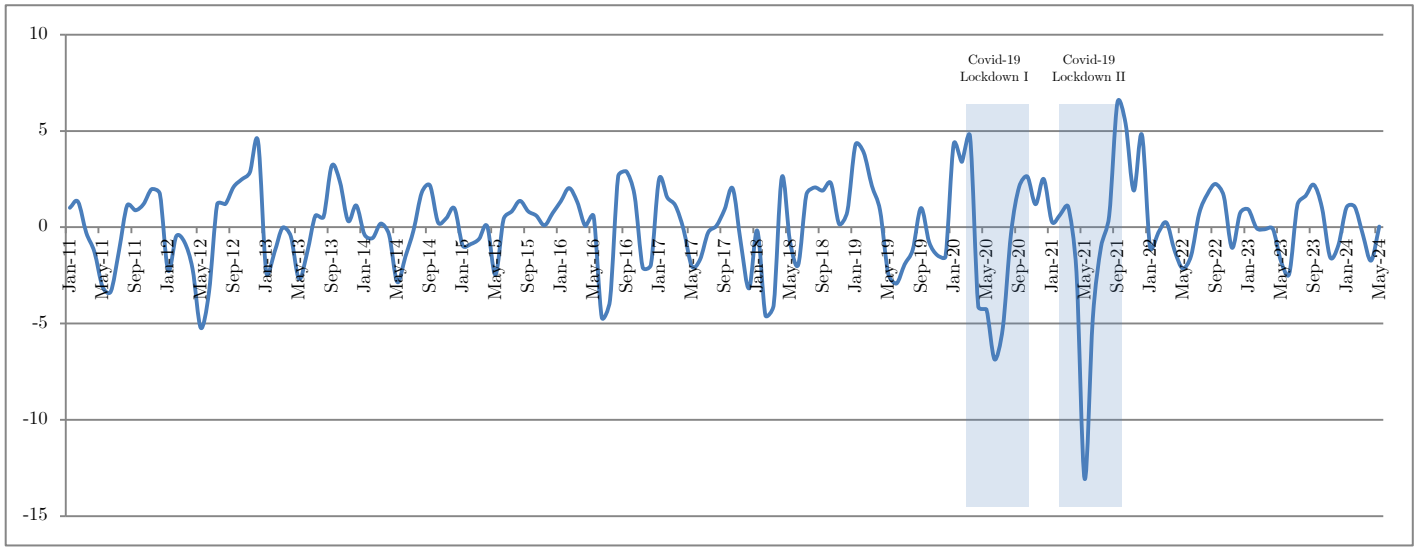
While this is a useful indicator of the absolute number of migrants in Delhi, however we need to consider this figure with some caveats – not every migrant would be have a roaming connection, some would have obtained their connections in the destination so they won't show up as VLR subscribers (*in-roamers*), moreover not every migrant might have an individual phone connection.

It is instructive to note that while the percentage of VLR Subscribers (in-*roamers*) quickly bounced back post the pandemic however the growth in the total numbers appears to have slowed.

We now go on to use Telecom Data for analysing **seasonal trends in the movement of people**. We do this by tracking the trends in the deviations in the VLR Subscribers as a percentage of the Total Subscribers from the average percentage of VLR Subscribers in that year.

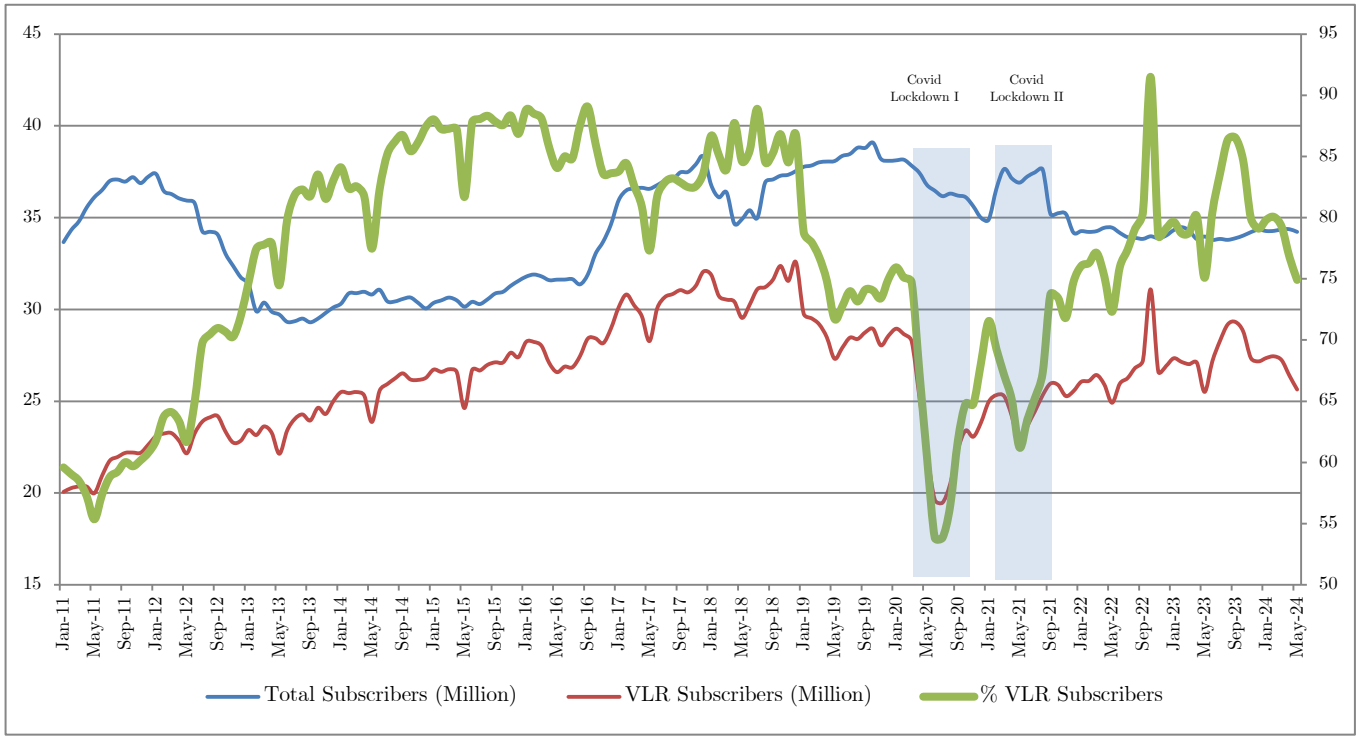
We do this to account for internal seasonality and smoothen for growth/de-growth between years. Looking at seasonal trends since January 2011 (Figure 12), we can see that **December-January** and **August-September** are the months with the **highest inflows** whereas **May-June** and **October-November** are the months with the **highest outflows** in Delhi.

Fig. 12: Monthly Deviation from the Avg. Annual % of VLR Subscribers - Delhi, [2011 - 2024]



Undertaking a similar exercise for the city of **Mumbai**, we see that the first lockdown (April - June 2020) witnessed a bigger drop in the percentage of VLR Subscribers (*in-roamers*) as compared to the second lockdown (April - June 2021) (Figure 13).

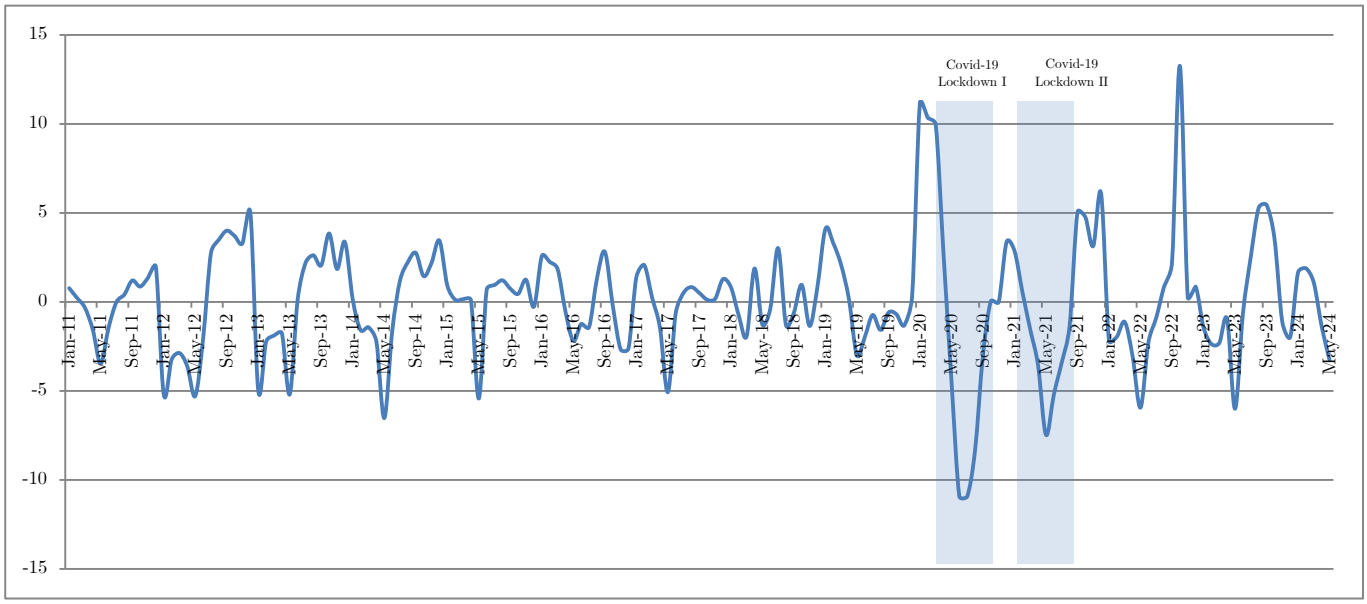
Fig. 13: Monthly trends of Total Wireless Subscribers; Total VLR Subscribers (both Left Axis); % of VLR Subscribers (Right Axis) for Mumbai; January 2011 to May 2024



Looking at the absolute numbers, we again compare the number of VLR Subscribers in July 2019 [the month-year prior to the peak levels of the Pandemic in Mumbai] to the number at the peak of the lockdown in Mumbai i.e. **July, 2020** we note a reduction of **8.99 Million**. Similarly, the reduction in the number of *in-roamers* in the second lockdown in **July 2021** as against VLR Subscribers in July 2019 was **4.02 Million**.

As discussed above, the usual caveats for using these numbers as indicators of numbers of migrants apply. We now proceed to look at the trends in deviations in the VLR Subscribers as a percentage of the Total Subscribers from the average percentage of VLR Subscribers in that year (Figure 14).

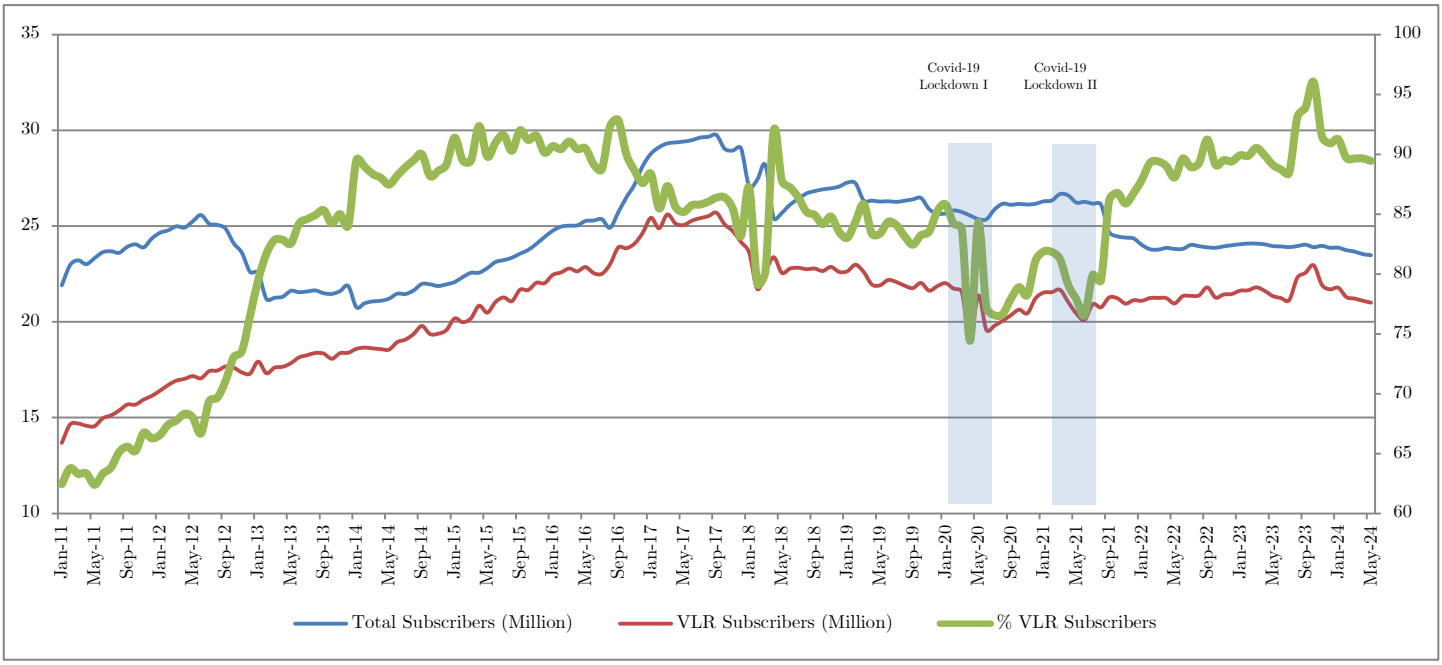
Fig. 14: Monthly Deviation from the Avg. Annual % of VLR Subscribers - Mumbai, [2011 - 2024]



From the seasonal trend, we can see that **December-January** and **September-October** are the months with the **highest inflows** whereas **May-June** and **January-February** are the months with the **highest outflows** in Mumbai (Figure 8).

Moving on to the city of **Kolkata**, while we can see a drop in the percentage of VLR Subscribers in the months April - June 2020 (first lockdown) and (April - June 2021 (second lockdown), the reduction is far lesser than in Mumbai or Delhi (Figure 15).

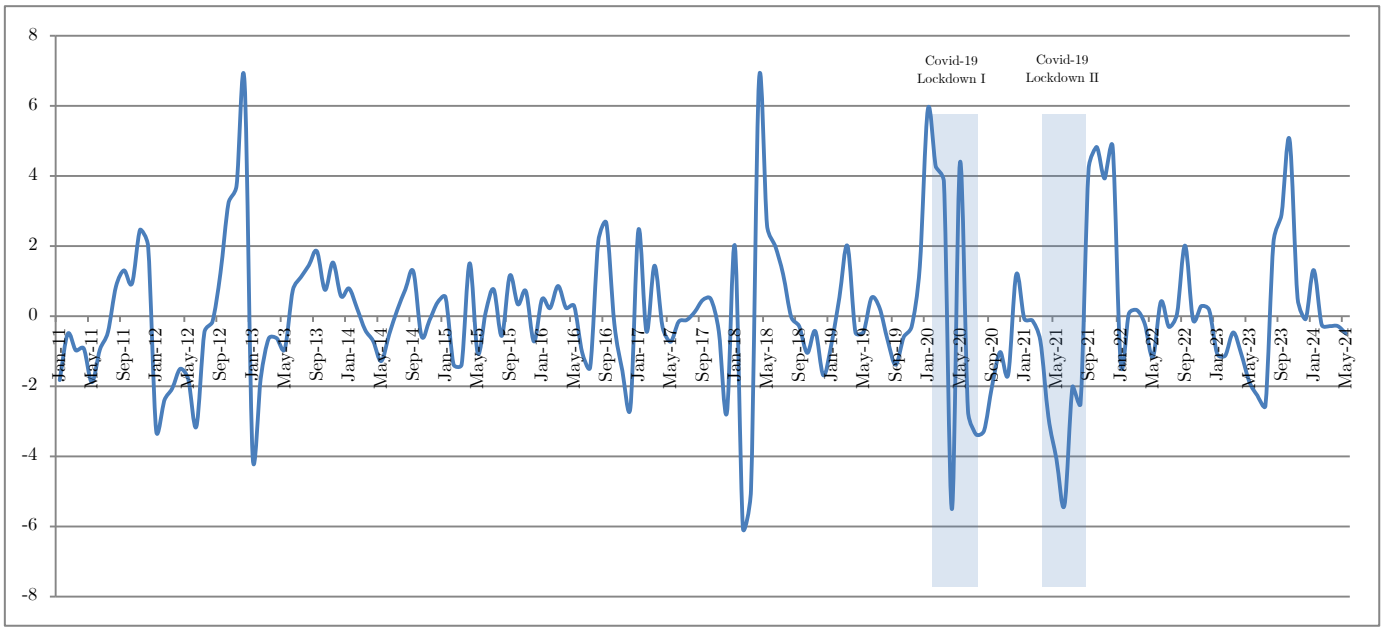
Fig. 15: Monthly trends of Total Wireless Subscribers; Total VLR Subscribers (both Left Axis); % of VLR Subscribers (Right Axis) for Kolkata; January 2011 to May 2024



In terms of absolute numbers (with the usual caveats), comparing the number of VLR Subscribers (*in-roamers*) in June 2019 [the month-year prior to the peak levels of the Pandemic in Kolkata] to the number at the peak of the lockdown in Kolkata i.e. **June, 2020** there is a reduction of about **2.6 Million**. Similarly, the reduction in the number of VLR Subscribers (*in-roamers*) in the second lockdown in **June 2021** as against VLR Subscribers in July 2019 was about **2.08 Million**.

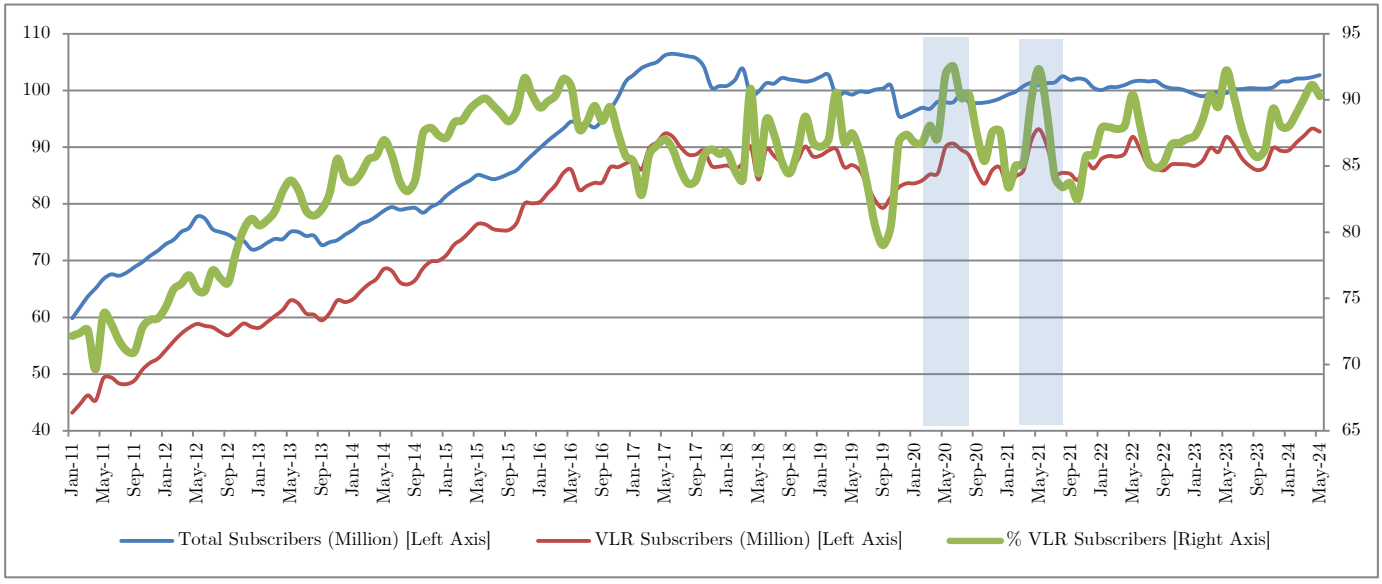
Looking at the seasonal trends in the numbers of VLR Subscribers we see that the months of **September-November** as the months with higher VLR Subscribers (*in-roamers*) i.e **higher inflows**. On the other hand, the months of **June-July** were the months of **higher outflows**.

Fig. 16: Monthly Deviation from the Avg. Annual % of VLR Subscribers [Kolkata, 2011 - 2024]



We now look take a quick look at the other side i.e. the trends in in-flows and out-flows at the origin. Since there is no data in public domain that could be used to build origin-destination pairs, we take a look at the movement trends in two regions (corresponding to telecom circles) which have been noted for higher outflow of migrants[77] viz/ Uttar Pradesh (East) and Bihar. We begin by look at data from Uttar Pradesh (East) (Figure 17).

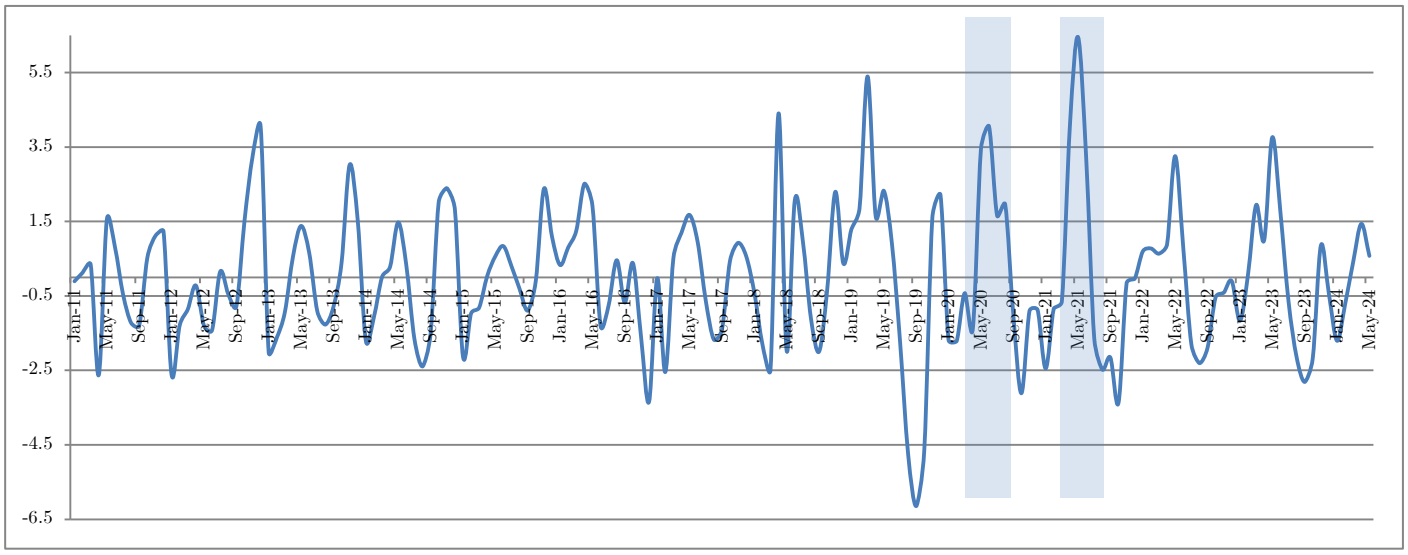
Fig. 17: Monthly trends of Total Wireless Subscribers; Total VLR Subscribers (both Left Axis); % of VLR Subscribers (Right Axis) for UP (East); January 2011 to May 2024



[77] https://www.indiabudget.gov.in/budget2017-2018/es2016-17/echapter.pdf

From the above we see that in the period of the two lockdowns, the percentage of in-roamers has shown a substantial increase, indicating a higher than usual return of migrants. Looking at seasonality of movements, we see that (Figure 18).

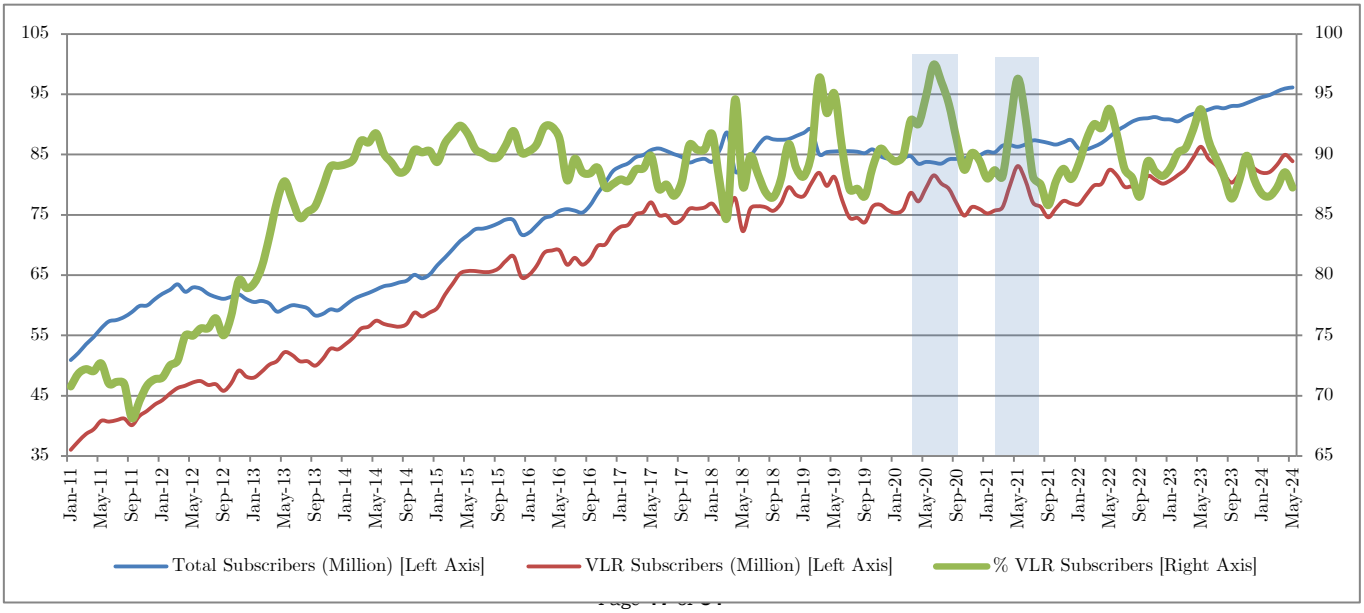
Fig. 18: Monthly Deviation from the Avg. Annual % of VLR Subscribers [UP East, 2011 - 2024]



From the above, we see that the months of **highest inflows** are **April-May** and **December-January** and the **highest outflows** are seen in the months of **August-September**.

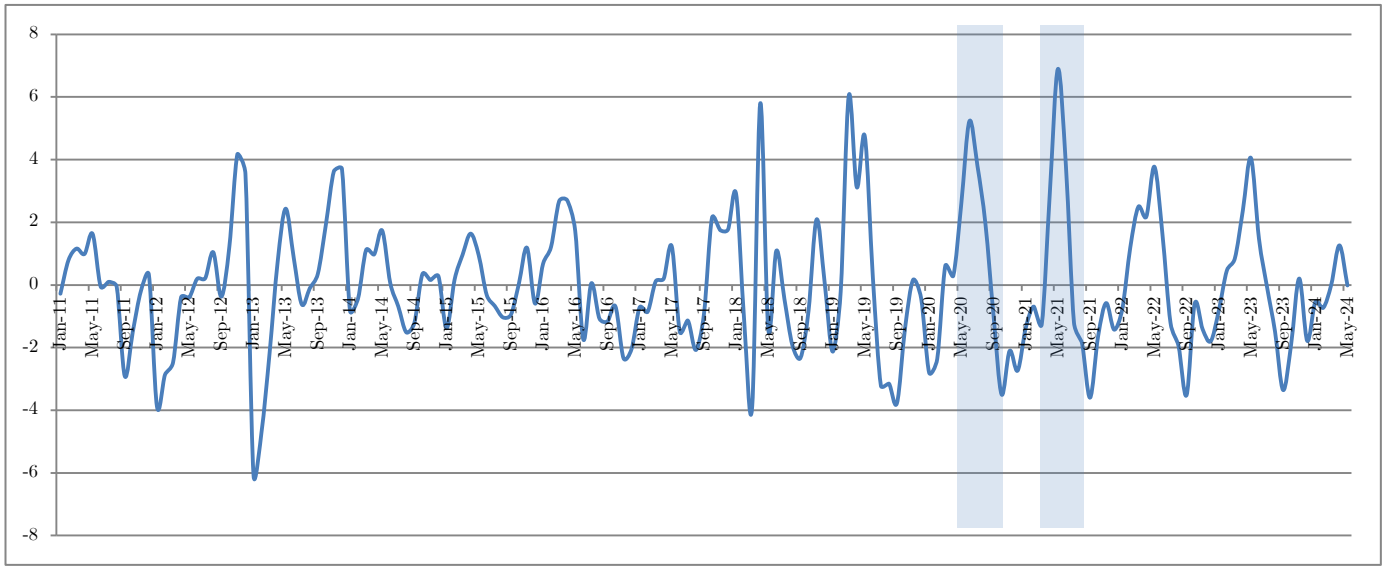
Similar trends in in-roamers for the state of Bihar are at Figure 19.

Fig. 19: Monthly trends of Total Wireless Subscribers; Total VLR Subscribers (both Left Axis); % of VLR Subscribers (Right Axis) for Bihar; January 2011 to May 2024



Here also we can see a higher than usual in-flow of VLR Subscribers (*in-roamers*) the period corresponding to the Covid-19 Lockdowns (shaded regions in Fig. 20). Looking at the seasonal movement of VLR Subscribers for Bihar (Figure 20), we can see that the months of highest inflow are April-May and the months with higher that average annual percentage of VLR Subscribers are September.

Fig. 210: Monthly Deviation from the Avg. Annual % of VLR Subscribers [Bihar, 2011 - 2024]



The above analysis is an attempt to discern trends in the movement of people using publicly available telecom data. While, given a number of constraints, this data has limited applicability for aggregate numbers and for building origin-destination dyads, however low months in the destinations seem correspond to high months in the sources. Typically, the summer months of **April-June** and the winter (festival?) months of **September-November** are seen as **months of the maximum movement**.

Wheels on the bus go round and round...

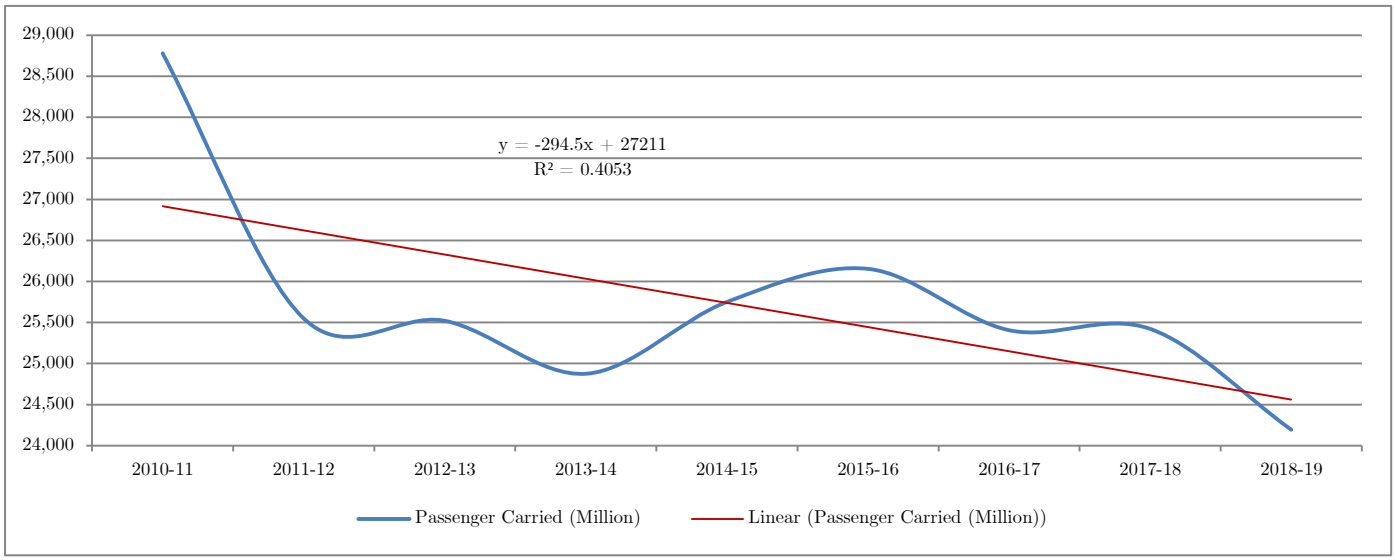
Before we move on to examining the effects of migration on the respective places of origin, we take a quick look at trends in travel by the buses – the other popular mode of inter-city public transport.

Here we make use of data from the *Review of the Performance of State Road Transport Undertakings* (SRTUs) published by the Transport Research Wing of the Ministry of Road Transport & Highways (MoRTH)[78]. Tracking the number of passengers carried from 2010-11 to 2018-19 [the last year for which data is available on the MoRTH website], shows a downward trend. It may be kept in view that the figure is of passengers carried or journeys performed.

Therefore, looking at the trends in passenger numbers travelling in buses does not bear any significant shift from Railway to buses. However, there may be variations from State to State.

Fig. 21: Passengers Carried by State Road Transportation Corporations

[Millions, 2010-11 to 2018-19]



"Show me the money!"

Evaluating the impact of migrant remittances

Having taken a look at the directions, volumes and seasonal variations of internal migrations, we now turn our gaze in the other direction i.e. the impact that migration has at the place of origin primarily on account of flow of remittances.

Migration of labour has been viewed as a critical component of economic growth and development as it enables the equalization of capital

[78] Transport Research Wing of the Ministry of Road Transport & Highways; https://morth.nic.in/Performance-%20of-State-Road

and labour across an economy by incentivizing movement of labour from areas of surplus labour and the movement of capital from areas of surplus capital[79].

Recent trends have indicated that while there has been a significant level of migration from rural to urban areas however; for most rural migrants, there continues to be significant attachment to the rural place of origin[80]. Moreover, labour remittances have been noted to be significant contribution to rural household income at the respective places of origin for migrants[81]. Previous studies have shown that remittances received from out-migrants have a significant impact of the socio-economic development in the areas of origin[82].

Most prior studies have depended on data from the Census or Surveys for this analysis. Use of such static and non-frequent data sources impairs the analysis of the economic impact of migrants in the place of origin. Further, district level economic/income data, at regular intervals and with uniformity across districts is not always publicly available.

In order to address this issue it is proposed to use banking data published by the Reserve Bank of India (RBI). In particular, we use the District wise Deposits of Scheduled Commercial Banks (SCBs) [*Statement No. 4B*] from the RBI Quarterly Statistics on Deposits and Credit of Scheduled Commercial Banks[83].

This data is granular to the level of districts and is available at a quarterly interval[84]. The data contains Savings/Capital and Term Deposit account balances in the reporting period.

[79] Internal borders and migration in India (Kone, Liu, Mattoo, Ozden; 2018)

[80] "*Internal Migration in India: Are the Underprivileged Migrating More?*" Asia-Pacific Population Journal, (R.B. Bhagat); 2010

[81] "*Circular Internal Migration and Development in India"; (*P. Deshingkar), 2008

[82] Effects of labour out-migration on socio-economic set-up at the place of origin: Evidence from rural India; Das, Saha, Chouhan (2020)

[83] https://rbi.org.in/Scripts/QuarterlyPublications.aspx?head=Quarterly%20Statistics%20on%20Deposits%20and%20Credit%20of%20Scheduled%20Commercial%20Banks

[84] RBI Database on Indian Economy

The Debroy-Misra Index of Endogenous Prosperity (DMIEP)

A metric to measure prosperity based on endogenous economic activity

Tracking the economic impact of domestic migration at the place of origin can be a challenge, especially in the absence of domestic remittance data. Some studies have made use of primary survey data[85], sample surveys such as the MoSPI, Household Consumption Expenditure Survey[86] or All India Debt & Investment Survey[87] for data on ownership of assets etc. However, the challenge has been how to control for endogenous economic activity i.e. economic growth on account of activities undertaken within the area under observation.

By itself, savings account balances are a good indicator of income and prosperity , however, increases/decreases in saving account balances could also be on account of endogenous economic activity arising within the district as well as from transfers [remittances] from other districts.

In order to account for this and to isolate the impact of transfers [remittances] from other districts, instead of looking at saving account balances as such, we analyse the ratio of saving account balances to current account balances. This is because a current account is typically operated by businesses which offers features that a saving bank account does not.

This gives us a sense of remittances/savings from outside the district. This is qualified with the caveat that there is a likelihood of income growth from non-formal sectors such as agriculture or trades.

We see that **districts/cities with greater economic activity** such as Mumbai [0.56], Delhi [2.24], Bangalore [2.21], Chennai [2.08] have a relatively lower ratio [average ratio from 2017-18 to 2022-23]. The **median value** for the **all-India ratio was 3.72**.

[85] Effects of labour out-migration on socio-economic set-up at the place of origin: Evidence from rural India (Das, Saha, Chouhan; 2020); https://www.sciencedirect.com/science/article/abs/pii/S0190740920311671

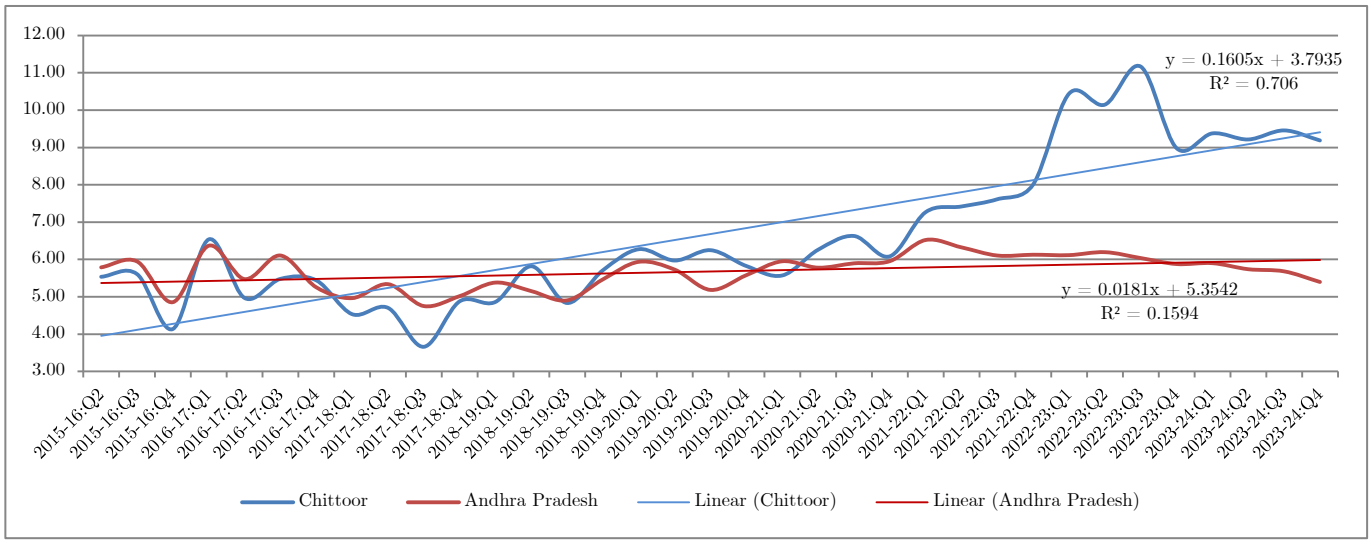
[86] https://www.mospi.gov.in/sites/default/files/publication_reports/Report_591_HCES_2022-23New.pdf

[87] https://www.mospi.gov.in/sites/default/files/publication_reports/Report_no588-AIDIS-77R-SeptFinal_0.pdf

We begin by taking a look at the trends in select districts for out-migration as identified in Economic Survey 2016-17[88]. We compare our results against the corresponding ratio of savings to current account deposits for the respective States for context.

We begin by taking a look Chittoor in Andhra Pradesh, a district noted for high outward migration (Figure 22). We can see that the saving bank deposits have shown a significant uptick post the 2020-21 Q4, broadly corresponding to the Covid-19 lockdown period.

Fig. 22: Trends in Ratio of Quarterly Savings Account Balances and Current Account Balances in for the District of Chittoor and State of Andhra Pradesh [2015-16 to 2023-24]



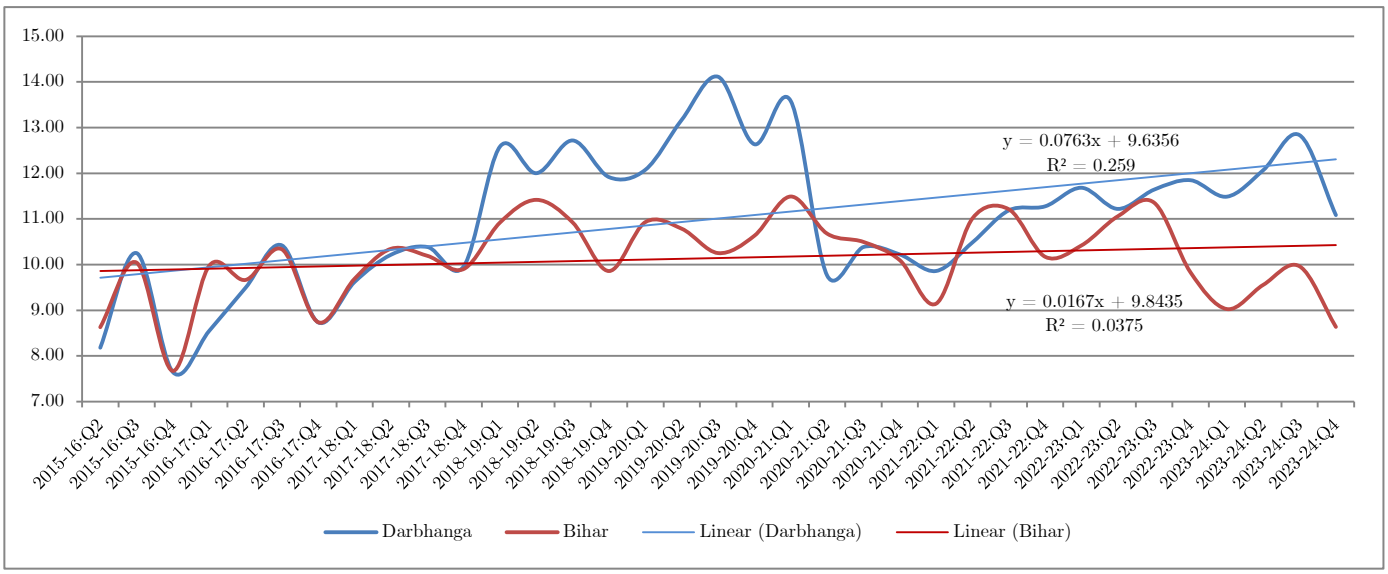
This is an indicator of the transfer deposits [remittances] increasing in the district at a far higher rate than the rest of the State, especially in the post-Covid period.

Similarly, we look at the trends in Darbhanga and compare it to average trends for the State of Bihar (Figure 23). It may be noted that Bihar's average ratio of Savings Deposits to Current Account Deposits for the period 2015-16 to 2023-24 is 10.14 which is significantly higher than the all India figures of 3.6 across the same period.

[88] https://www.indiabudget.gov.in/budget2017-2018/es2016-17/echapter.pdf

Even when compared against these already high figures, we can see the ratio for Darbhanga has remained higher than the State average.

Fig. 23: Trends in Ratio of Quarterly Savings Account Balances and Current Account Balances in for the District of Darbhanga and State of Bihar [2015-16 to 2023-24]



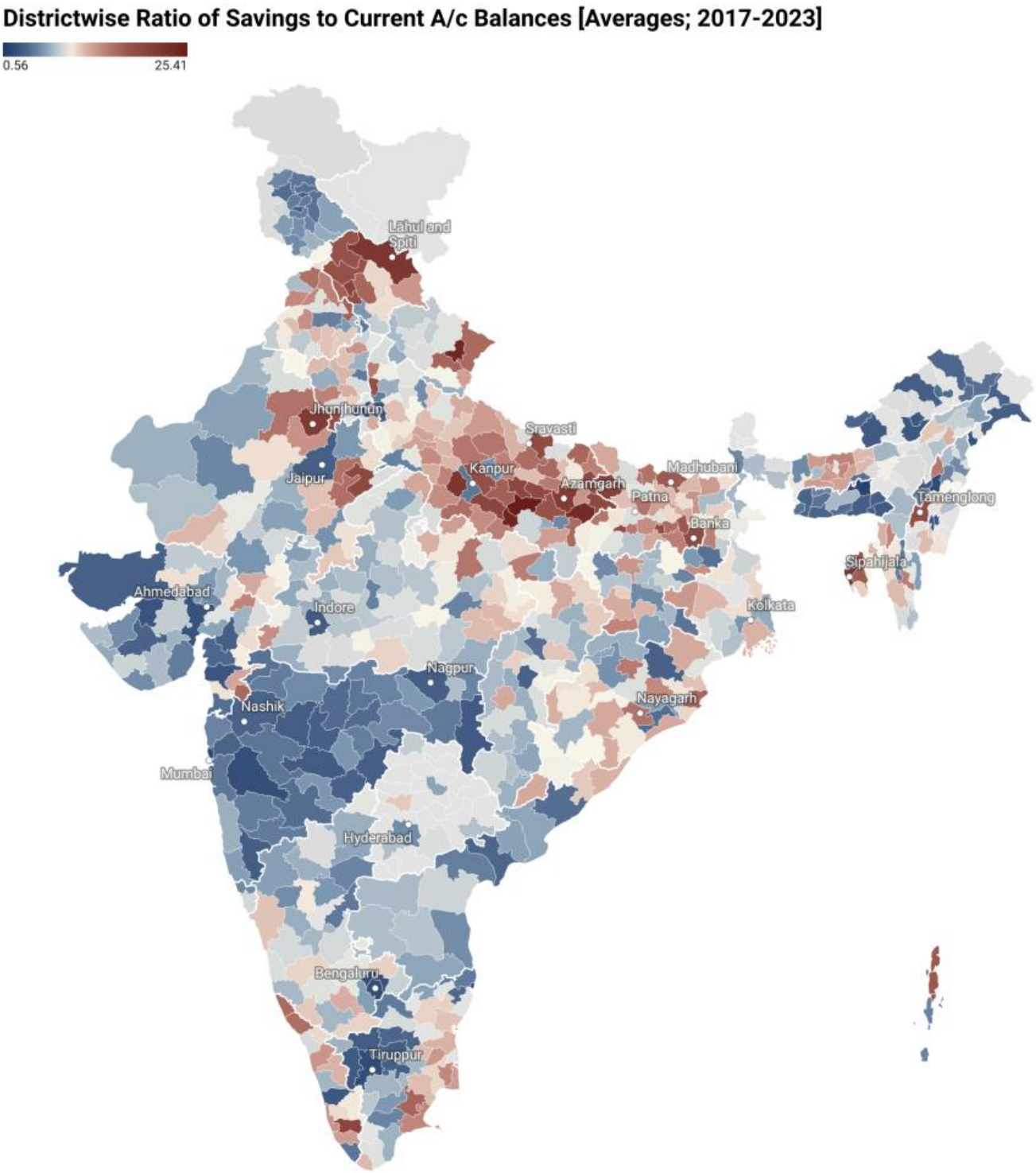
In order to scope a more macro level view, we look at the average ratio of Savings Account Deposits to Current Account Deposits from 2017-18 to 2022-23, for all districts in the country.

The districts/cities with low savings-to-current account ratios are typically cities with high levels of economic activity which often can act as a magnet for migration[89]. On the other hand, cities with relatively higher savings to current account balances are seen as having limited economic activity.

A district level map of the average ratio of Savings Account Deposits to Current Account Deposits from 2017-18 to 2022-23 is Figure 24. We might add here that not all districts with a high DMIEP ratio would be witnessing out-migration; however districts with high out-migrations are likely to see a growth in saving account deposits.

[89] Consultation Paper on City GDP Estimation Framework (2019); NIUA, MoHUA

Fig. 24: Districtwise ratio of Savings to Current Account Deposits [avg.; 2017-18 to 2022-23]



Conclusion

While we study its economics and geography, migration is essentially a journey of hope, of dreams and aspirations and of the unyielding human pursuit of a better tomorrow.

Understanding the patterns and the ebbs and flow of migration helps us gain a better understanding of how many are moving, from where-to where are they moving, when is it that they move and what are the impacts of this move.

This paper is an attempt to address the issue of timeliness of availability of data for analysing trends in domestic migration especially that of blue collar migration. While the decennial Census provides comprehensive and granular migration data, however on account of its periodicity, there remains a significant lag by the time the data can be analysed. Similarly, household surveys capturing data on domestic migration, are restricted by the size of their dataset and have limits in building source-destination dyads, seasonal trends, event study on trends in migration etc.

In this paper, use high frequency, granular data from multiple sources to address the above issues. Our primary data sources are data from the Indian Railways Unreserved Ticketing System (IR-UTS) and data from the Telecom Regulatory Authority of India (TRAI) on Visitor Location Register (VLR) roaming subscribers.

Further, in order to track the impact of out-migration on the originating districts, we use publicly available, district level, quarterly banking data published by the Reserve Bank of India (RBI) to construct an index to isolate and track effects of remittances originating from outside of the district. This is intended as a quick proxy for examining the economic impact of out migration in the source districts.

While the focus of this paper was to understand the trends and patterns in movement of people in India, especially blue-collar migrants, in a companion paper, we propose to use sub-urban travel data to understand the trends in movement to cities and to understand the directions and intensity of growth of urban agglomerations.

In addition to migration we also explore related topics such, as the impact on urbanization - especially the growth of cities, commuter zones and popular movement dyads. Further, given that most migration is borne out of a desire for better opportunities and is seen as having an impact in improving incomes, we also make an attempt to discern the extent of impact that out-migration has in the places of origin. The highlights from our study are as under:

- Overall domestic migration in India is slowing. We estimate the overall **number of migrants** in the country, as of **2023**, to be **40,20,90,396**. This is about 11.78% lower as compared to the number of migrants enumerated as per Census 2011 [45,57,87,621]. Consequently, the migration rate which stood at **37.64%** as per Census, 2011 is estimated to have since **reduced to 28.88%** of the population.

- We hypothesize that this is on account of **availability of improved services** such as education, health, infrastructure and **connectivity** as well as **improved economic opportunities** in or near in major sources of migration and is an indicator of overall economic growth.

- Looking at the spatial dimensions of travel, the top origin districts are coalesced around major urban agglomerations viz. Delhi, Mumbai, Chennai, Bangalore, Kolkata etc. Not only is this in line with **gravity models of migration** but perhaps also is a tentative confirmation of priors i.e **short distance migration** accounts for the largest share of migrants and that **distance has a negative effect** on labour flows.

- The composition of the top five recipient States attracting migrants [all migrants including intra-State migrants] has changed. West Bengal and Rajasthan are the new entrants and while Andhra Pradesh and Bihar are now ranked a notch lower.

- Even amongst the top five recipient States the percentage of predicted migrants headed to the respective States has reduced. This could be on account of an overall reduction in the migration rate or could also indicate a greater spatial spread in the outward movement of passengers.

- West Bengal, Rajasthan and Karnataka are the States showing the maximum amount of growth in percentage share of the arriving passengers. Similarly, **Maharashtra and Andhra Pradesh** are States where the percentage **share of total migrants has reduced**.

- Mumbai, Bengaluru Urban, Howrah, Central Delhi, Hyderabad are the districts attracting **most migrant arrivals**, while Valsad, Chittoor, Paschim Bardhaman, Agra, Guntur, Villupuram and Saharsa are the **top origin districts**

- We use the data to identify **popular State-to-State** and **district-to-district dyads**. At the State level, *Uttar Pradesh - Delhi*; *Gujarat - Maharashtra*; *Telangana - Andhra Pradesh* and *Bihar - Delhi* emerge as the primary dyads of movement.

- At the district level, *Murshidabad - Kolkata*; *Paschim Bardhaman-Howrah*; *Valsad - Mumbai*; *Chittoor - Bengaluru Urban* and *Surat - Mumbai* are the most popular routes for migration between districts. This has implications for urban planning as well as for planning of transportation networks.

- We make use of TRAI roaming data to identify the seasonality of movement of migration. We find that **April-June** is the high months for movement with **November-December** witnessing secondary highs. These are perhaps months where most migrant labour travel back to their places of origin. A secondary high in winter time is perhaps indicative of travel around the festival/marriage season. January, on the other hand, appears to be the month of lowest travel.

- Even prior to the pandemic related lockdowns, there were signs of the passenger movement showing little growth, however after the pandemic, even the high months i.e. Apr-May are at a **distinctly lower level** as compared to the corresponding period before the pandemic - passenger levels for May 2023 being **6.67% lower** than the corresponding number for May 2012.

- Further, it is interesting to note that that a **majority** [>75%] of our predicted migration flows are **within 500 kms of the origin** (Figure 10). This is in line with gravitation effects and theories such as Ravenstein's Theory of Human Migration (1834 – 1913).

Having made the above observations regarding domestic migration in India, we do acknowledge the challenges in being able to completely capture the spatio-temporal trends of a phenomenon as complex as migration.

While our methods can give a general idea about the trends, however we eagerly await the decennial Census to check the accuracy of our findings.

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The views expressed are the author's own.

Key Words: Transportation Economics, Migration, Urban Economics
JEL Classification Codes: J61; O15; R23; R30

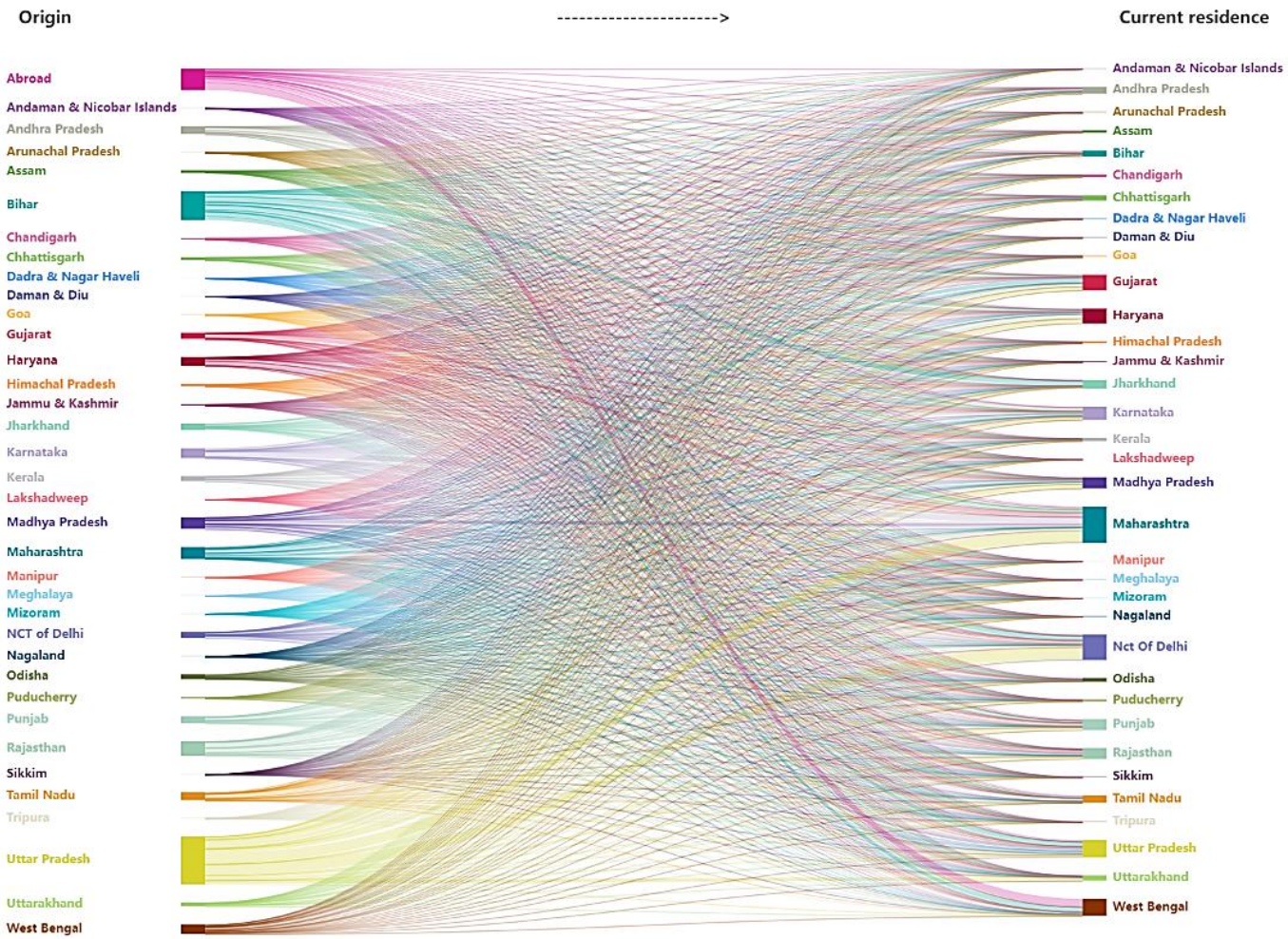
Appendix A

Trends and patterns of the migration as per Census 2011

We begin by capturing the State-to-State movement of migrants (Figure A1). In the figure, the states on the left hand side are the origin states while those on the right are the recipient/destination states. The relative thickness of the lines indicates the volume of movement.

Fig. A1: Migrant population by State/UT of origin and State of Current Residence

Source: Census, 2011



Above figures are for Total Persons; All durations of stay

While, the above figure is far too dense to be able to make any meaningful analysis, however there are a few important takeways – the left (origin) side clearly indicates that the primary sources/**origin States** for inter-State migration are Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh

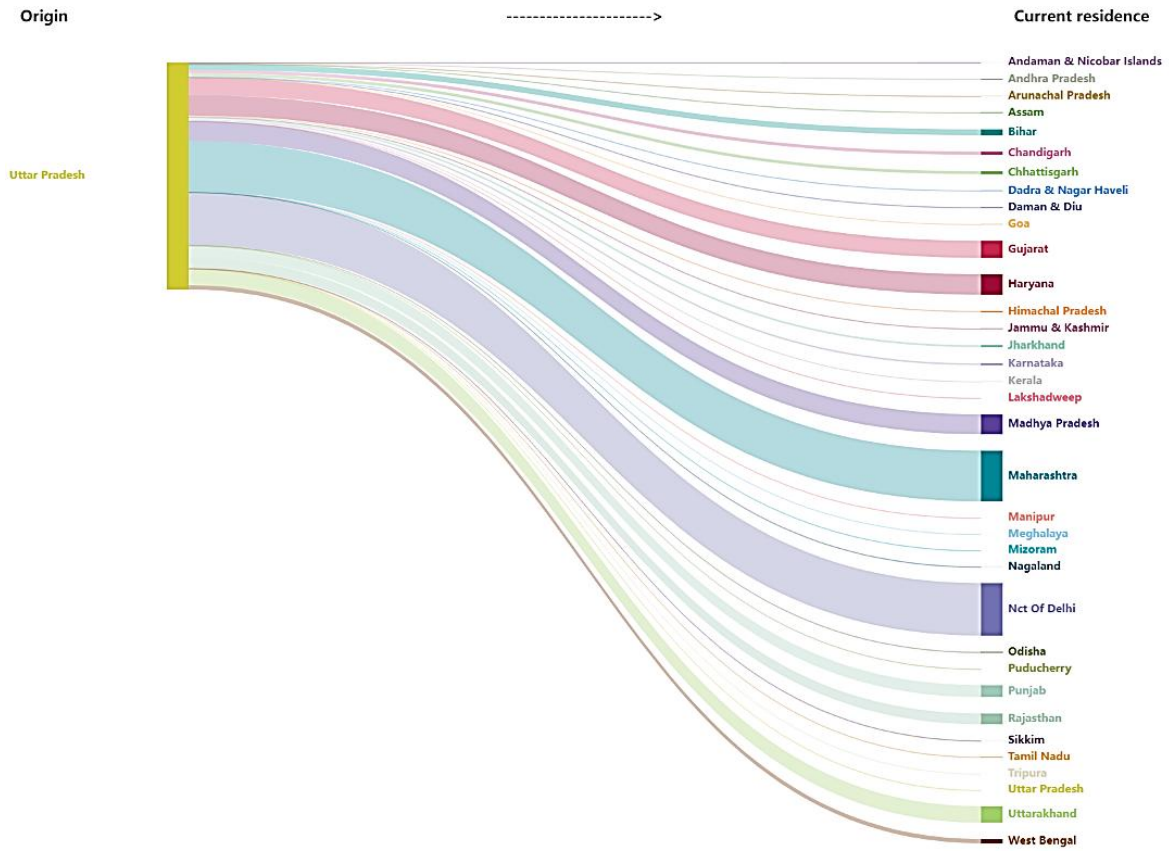
(MP), Maharashtra and Abroad. Similarly, the major **destination States** for inter-State migration are Maharashtra, Delhi, Gujarat, West Bengal and Haryana.

The Census Tables have granular details of the exact numbers of migrants, along with parameters such as gender, duration of residence at the destination, educational attainment etc. Since the focus of the instant paper is more on the recent trends in migration, we refrain from going into too great a detail on the 2011 Census migration patterns.

However, for context, we take a quick look at the direction and volume of migration from the primary origin States. It needs to be kept in mind that these are total migrations i.e. due to all causes. The out migrations from select origin States and from Abroad are Figure A2 – E2.

Fig. A2: Migrant population by State of origin – Uttar Pradesh and State of Current Residence

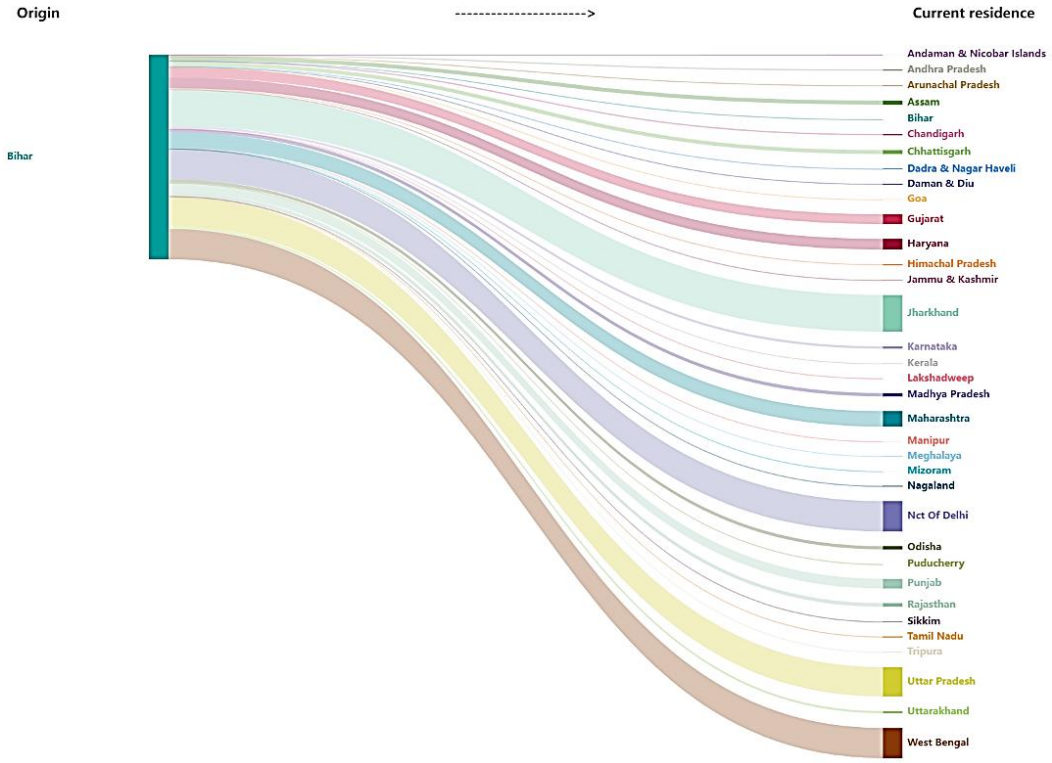
Source: Census, 2011



Above figures are for Total Persons; All durations of stay

Fig. B2: Migrant population by State of origin – Bihar and State of Current Residence

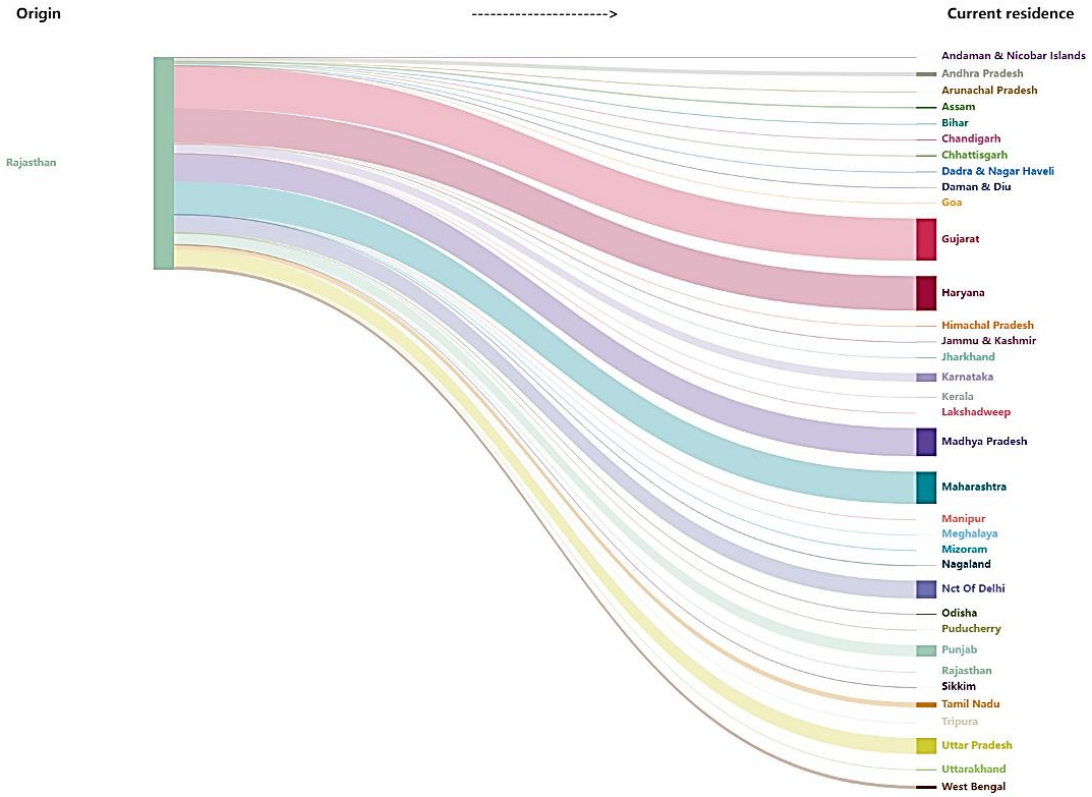
Source: Census, 2011



Above figures are for Total Persons; All durations of stay

Fig. C2: Migrant population by State of origin – Rajasthan and State of Current Residence

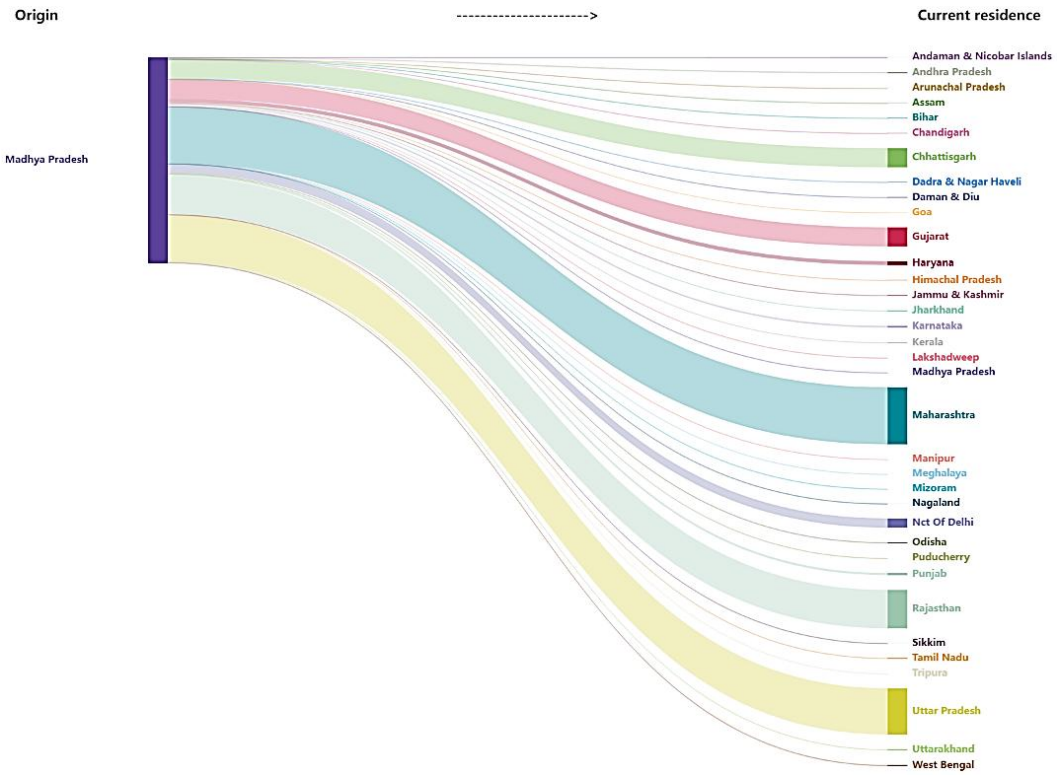
Source: Census, 2011



Above figures are for Total Persons; All durations of stay

Fig. D2: Migrant population by origin – Madhya Pradesh and State of Current Residence

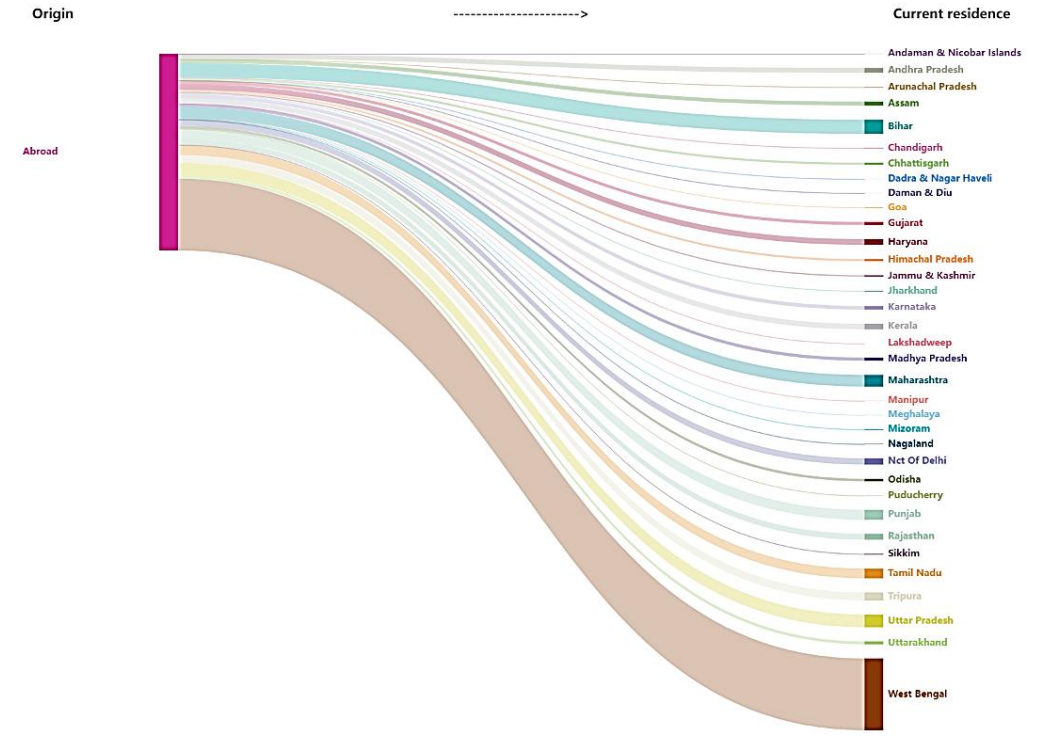
Source: Census, 2011



Above figures are for Total Persons; All durations of stay

Fig. E2: Migrant population by origin – Abroad and State of Current Residence

Source: Census, 2011



Above figures are for Total Persons; All durations of stay

Based on the above, the popular Source-Destination pairs along with number of persons moving between them [as per Census, 2011] is summarized below [Table 1].

Table 1: Top 30 Source and Destination State Pairs with total number of Migrants, Census 2011

Origin State	Destination State	Total Migrants
Uttar Pradesh	State - NCT OF DELHI (07)	28,54,297
Uttar Pradesh	State - MAHARASHTRA (27)	27,54,706
Karnataka	State - MAHARASHTRA (27)	13,99,591
Bihar	State - JHARKHAND (20)	13,36,048
Uttar Pradesh	State - HARYANA (06)	11,13,535
Bihar	State - NCT OF DELHI (07)	11,06,629
Bihar	State - WEST BENGAL (19)	11,03,757
Uttar Pradesh	State - MADHYA PRADESH (23)	10,90,881
Bihar	State - UTTAR PRADESH (09)	10,72,739
Gujarat	State - MAHARASHTRA (27)	9,83,653
Maharashtra	State - GUJARAT (24)	9,71,975
Uttar Pradesh	State - GUJARAT (24)	9,29,411
Andhra Pradesh	State - KARNATAKA (29)	8,90,697
Uttar Pradesh	State - UTTARAKHAND (05)	8,90,663
Madhya Pradesh	State - MAHARASHTRA (27)	8,24,624
Rajasthan	State - GUJARAT (24)	7,47,445
Tamil Nadu	State - KARNATAKA (29)	7,36,821
Madhya Pradesh	State - UTTAR PRADESH (09)	6,68,537
Haryana	State - NCT OF DELHI (07)	6,66,331
Uttar Pradesh	State - PUNJAB (03)	6,49,557
Rajasthan	State - HARYANA (06)	6,11,160
Maharashtra	State - KARNATAKA (29)	5,86,864
Uttar Pradesh	State - RAJASTHAN (08)	5,85,982
Rajasthan	State - MAHARASHTRA (27)	5,70,233
Bihar	State - MAHARASHTRA (27)	5,68,667
NCT of Delhi	State - UTTAR PRADESH (09)	5,66,210
Madhya Pradesh	State - RAJASTHAN (08)	5,54,058
Haryana	State - PUNJAB (03)	5,45,584
Punjab	State - HARYANA (06)	5,38,328
Haryana	State - RAJASTHAN (08)	5,33,963

Source: Census, 2011 [Table DS-0000-D03-MDDS]
Figures are Total Migrants; All Reasons; All Durations; States names are as per Census Codes

While, the above captures all migrants – irrespective of the reason for migrating, we also look at the numbers for migrants moving for economic reasons i.e. for reasons stated as *Work/Employment* or *Business*. The top 30 routes for movement for economic reasons is Table 2.

Table 2: Top 30 Source and Destination Pairs for Migrants moving for Economic Reasons

Origin State	Destination State	Migrants for Economic Reasons [Work/Employment or Business]
Uttar Pradesh	State - MAHARASHTRA (27)	11,36,753
Uttar Pradesh	State - NCT OF DELHI (07)	9,19,207
Bihar	State - NCT OF DELHI (07)	4,10,601
Uttar Pradesh	State - GUJARAT (24)	3,74,311
Bihar	State - WEST BENGAL (19)	3,15,180
Uttar Pradesh	State - HARYANA (06)	3,07,409
Bihar	State - JHARKHAND (20)	3,06,335
Karnataka	State - MAHARASHTRA (27)	2,89,474
Bihar	State - MAHARASHTRA (27)	2,68,628
Uttar Pradesh	State - PUNJAB (03)	2,35,894
Tamil Nadu	State - KARNATAKA (29)	2,21,881
Andhra Pradesh	State - KARNATAKA (29)	2,13,578
Uttar Pradesh	State - UTTARAKHAND (05)	2,09,047
Rajasthan	State - GUJARAT (24)	2,04,967
Maharashtra	State - GUJARAT (24)	2,01,991
Madhya Pradesh	State - MAHARASHTRA (27)	1,95,855
Gujarat	State - MAHARASHTRA (27)	1,93,065
Uttar Pradesh	State - MADHYA PRADESH (23)	1,81,027
Rajasthan	State - MAHARASHTRA (27)	1,80,959
Bihar	State - UTTAR PRADESH (09)	1,68,222
Haryana	State - NCT OF DELHI (07)	1,41,792
Uttar Pradesh	State - RAJASTHAN (08)	1,10,512
NCT of Delhi	State - UTTAR PRADESH (09)	87,778
Rajasthan	State - HARYANA (06)	66,919
NCT of Delhi	State - HARYANA (06)	66,599
Punjab	State - HARYANA (06)	65,423
Jharkhand	State - WEST BENGAL (19)	63,504
Maharashtra	State - MADHYA PRADESH (23)	61,348
Madhya Pradesh	State - RAJASTHAN (08)	61,303
Maharashtra	State - KARNATAKA (29)	60,207

Source: Census, 2011 [Table DS-0000-D03-MDDS]
Figures are Total Migrants; Economic Reasons; All Durations; States names are as per Census Codes

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