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Seasonal Concentration of Fiscal Aggregates: Case Study of India

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Abstract

The phenomenon of seasonal concentration in the context of receipts and expenditures, notable in the Indian context, is an important aspect of fiscal management including borrowing costs. We have studied the pattern of monthly peaks including March bunching by utilizing the HHI index by redefining it for studying seasonal concentration patterns. The empirical counterpart of this study pertains to central finances in India with data drawn from the CGA comprising 300 monthly observations over the period 2000-01 to 2024-25. We find that in the case of net-tax revenue, the phenomenon of March bunching is quite prominent followed by the monthly peaks of June, September and December. In the case of other non-debt receipts, magnitude of concentration is even higher, and it is noticeable in the month of March but also in the earlier half of the fiscal year. Corresponding patterns of concentration are also noted in the case of revenue and capital expenditures. Except for March bunching, revenue expenditures are more evenly distributed, and their local peaks are less prominent. Capital expenditure shows higher magnitudes of concentration. In terms of inter-year comparisons, prior to Covid there was considerable improvement in concentration pattern which has deteriorated since then. It is important to minimize borrowing costs by reducing the extent of concentration within the fiscal year in receipts and expenditures, as well as minimizing the monthly gaps between the two sets of peaks.

Keywords

Fiscal Aggregates, Seasonal Concentration, March Bunching, Herfindahl-Hirschman Index, HHI, Covid Crisis, Fiscal Management

1. Introduction

The seasonal distribution of fiscal aggregates such as tax and non-tax revenues and expenditures show an extraordinarily high share in the month of March as

well as some notable intra-year peak values. This concentration of monthly shares of annual fiscal aggregates arises due to various regulatory and institutional arrangements apart from the seasonal pattern of economic activities. We measure the degree of concentration of fiscal aggregates by adapting the Hirschman-Herfindahl Index (HHI), which has been used in the context of measuring industrial concentration. We cover four major fiscal aggregates, namely Centre's net tax revenues, Centre's non-debt receipts excluding net tax revenues, Centre's revenue expenditure and Centre's capital expenditures. An index of seasonal unevenness in these fiscal aggregates was defined and studied in Srivastava and Trehan (2018). Concentration is a dimension of unevenness.

The period of study covers 2000-01 to 2024-25, that is, 300 monthly observations across 25 years. This overall period is divided into five sub-periods referred to as follows: Period 1 (2000-01 to 2004-05), Period 2 (2005-06 to 2009-10), Period 3 (2010-11 to 2014-15), Period 4 (2015-16 to 2019-20) and Period 5 (2020-21 to 2024-25). It may be noted that Periods 1, 4 and 5 were largely under the National Democratic Alliance (NDA) regime, and Periods 2 and 3 were largely under the United Progressive Alliance (UPA) regime. Two major economic shocks occurred in the overall period: 1) in 2008-09 relating to the global economic and financial crisis, and 2) in 2020-21 relating to the Covid crisis. In both these years, fiscal stimulus, introduced mainly through expanded fiscal deficit, was used to mitigate the impacts of economic shocks.

2. Using HHI Index: A Review of Literature

There is an extensive literature pertaining to the use of HHI for situations of concentration of economic activities. The HHI has been employed in multiple contexts. The U.S. Department of Justice (DOJ) and Federal Trade Commission (FTC) have adopted HHI as a primary screening tool for assessing market concentration and potential anti-competitive effects of mergers in their Merger Guidelines. The agencies consider markets with an HHI above 1800 as highly concentrated, and those above 1000 but below 1800 as moderately concentrated[1].

The HHI has emerged as a tool in assessing economic diversification, particularly in resource-dependent economies. In the study by Belbali et al. (2024), the HHI is employed to quantify the concentration of Algeria's economic activities across sectors from 2019 to 2023, revealing moderate diversification with index values ranging between 0.2 and 0.4. The literature review within the paper highlights the HHI's widespread application in similar contexts, including studies by Ghedier and Kiheli (2022), which underscore the persistent dominance of the hydrocarbon sector despite policy efforts aimed at diversification. The HHI's sensitivity to sectoral imbalances makes it a reliable indicator for evaluating structural

[1]https://www.justice.gov/atr/herfindahl-hirschman-index#:~:text=The%20agencies%20generally%20consider%20markets,Guidelines%20%C2%A7%202.1%20(2023); Merger Guidelines, US Department of Justice and the Federal Trade Commission, https://www.ftc.gov/system/files/ftc_gov/pdf/2023_merger_guidelines_final_12.18.2023.pdf.

economic shifts, as demonstrated by its use in both sectoral and export diversification analyses. Moreover, the paper discusses interpretive thresholds of HHI values, aligning them with degrees of economic concentration, and reinforces the index's utility in cross-country comparisons and longitudinal assessments of diversification strategies.

Herfindahl index has also been used for the purpose of fiscal analysis primarily to examine the concentration or diversification of fiscal variables, such as tax revenue composition, expenditure allocation, fiscal decentralization, and intergovernmental transfers (Table 1).

Table 1. Application of Herfindahl Index to fiscal analysis.

Application	Purpose of HHI
Tax revenue structure	Measure concentration/diversification of taxes
Expenditure allocation	Functional concentration (e.g., all to education)
Grant and transfer distribution	Inter-state or inter-district bias in fiscal transfers
Revenue volatility and risk	Overdependence on one revenue source (e.g., oil)
Fiscal decentralization	Autonomy vs dependence on central funds

Compaoré and Tagem (2022) utilize the index to estimate the impact of aid fragmentation on tax revenue mobilization in developing countries. The study utilizes data on 90 developing countries covering the period from 2000 to 2020 and finds that aid fragmentation has a significant negative impact on recipient countries' tax revenue ratios, particularly that of corporate income taxes and value-added tax.

In their study on fiscal stress among U.S. state and local governments, Shamsub and Akoto (2004) employ the HHI as a foundational tool to measure local revenue diversification. Recognizing that reliance on a narrow set of revenue sources can exacerbate fiscal vulnerability, the authors adapt the HHI—traditionally used to assess market concentration—to evaluate the balance among four major revenue streams: income taxes, property taxes, sales taxes, and user charges. By calculating the reciprocal of the HHI and normalizing it against the theoretical maximum diversification, they derive a diversification index that quantifies the extent to which local governments spread their revenue collection across multiple sources. This methodological innovation allows the authors to empirically demonstrate that greater revenue diversification is significantly associated with lower fiscal stress, thereby highlighting the utility of the HHI in fiscal policy analysis.

Suyderhoud (1994) introduces a quantifiable approach to measuring revenue diversification using the HHI, a widely accepted metric for assessing concentration. By adapting the HHI to state-local tax structures, he constructs a diversification index that reflects the extent to which a jurisdiction's revenue sources are balanced. A score of 1.00 indicates perfect diversification, while 0 signifies complete reliance on a single source. Suyderhoud's empirical analysis demonstrates

that higher diversification, as measured by the HHI-based index, correlates positively with several indicators of fiscal performance, including tax effort, equity, and revenue adequacy. His findings support the notion that revenue diversification, when properly measured, is a valuable policy goal for enhancing fiscal stability and efficiency.

Kotlinska, Nucinska, and Bednarz (2021) employ the HHI to analyze the concentration of educational expenditures and subvention streams among Polish local governments from 2008 to 2019. Their study reveals that while the educational subvention from the central government maintains a relatively uniform distribution—evidenced by low HHI values—the actual educational expenditures, particularly in cities with county rights, exhibit significantly higher concentration levels. This disparity suggests that local financial decisions, especially regarding property investments and subsidies to private educational institutions, disrupt the universal character of the subvention system. By applying the HHI, the authors effectively quantify the extent of fiscal decentralization and highlight the structural imbalances in education financing, offering a robust methodological framework for assessing expenditure concentration in public finance.

In the context of fiscal aggregates, Srivastava and Aggarwal (1979) had utilized the HHI for studying tax revenue centralization in India. They had defined and estimated alternative versions of the HHI. Srivastava and Trehan (2018) had defined an index of seasonal unevenness and used this index for a study of seasonal patterns of fiscal aggregates in India. In the present paper, the HHI is proposed to be used for the phenomenon of the study of seasonal concentration, particularly March bunching and other noticeable peaks.

The Herfindahl-Hirschman Index (HHI) is favorably placed for analyzing seasonality in fiscal aggregates, especially when the goal is to quantify the concentration rather than to model the seasonal cycle (Chikoto et al., 2016). The HHI highlights extreme concentration more strongly than alternatives like the Gini or Theil indices. Since it is based on squared shares, periods with disproportionately large fiscal flows—such as year-end expenditure spikes—receive greater weight, making bunching more visible. Its bounded and intuitive scale, ranging from 1/n (uniform distribution) to 1 (full concentration), also makes it easy to interpret and communicate to policymakers. Unlike other indices, HHI is less sensitive to small fluctuations or negligible monthly flows, reducing the risk of overstating minor seasonality. These features make HHI especially useful when the key concern is whether fiscal flows are concentrated in only a few months and how severe that concentration is.

A distinguishing feature of the HHI is its decomposability (Srivastava & Aggarwal, 1979). This implies that it can be used to estimate the relative contribution of the constituents of the variable under analysis. For instance, in this study, along with the examination of seasonal concentration patterns of revenues and expenditures at the aggregate level, we also examine the relative roles of their sub-components.

3. Adopting HHI for Study of Seasonal Concentration in Fiscal Aggregates

In the context of studies of concentration, the HHI (Hirschman, 1945; Herfindahl, 1950) is defined as below. For example, if the share of a particular firm in the overall size of all firms if given by r_i, then HHI is defined as:

$$H = \sum_{i=1}^{n} r_i^2 \tag{1}$$

where n is the number of firms.

The HHI Index can be adapted for a study of the pattern of monthly shares defined by r_i, where

$$r_i = \frac{R_i}{\sum_{i=1}^{12} R_i} \tag{2}$$

The index is defined as

$$C = \sum_{i=1}^{12} r_i^2 \tag{3}$$

where $i = 1$ to 12.

The maximum value for this index would arise when one-month accounts for all the shares, that is, $r_1 = 1$ and r_2 to $r_{12} = 0$ and in all other months the value of these shares is zero. In this case, the value of C is 1. The minimum value of this index would arise when there is no concentration, implying that $r_i = \frac{1}{12}$ for all i. The value of C in this case is:

$$C = \sum_{i=1}^{12} \left(\frac{1}{12}\right)^2 = \frac{1}{12} \tag{4}$$

Thus, C ranges from $\frac{1}{12}$ to 1. We can normalize the index of seasonal concentration as below. That is,

$$C^* = \frac{1}{11} \cdot \left[12 \sum_{i=1}^{12} r_i^2 - 1\right] = \frac{1}{11} \cdot [12C - 1] \tag{5}$$

The range of C^* is from zero to 1.

In order to facilitate interpretation of the values of C and C^* for certain benchmark distributional patterns, we have included illustrative values in **Table 2**. In simulation 1 it is shown that the maximum value of C and C^* are 1, whereas the minimum values are 0.083 (1/12) and 0 respectively. In the second half of the table, we compare the equally distributed pattern with a pattern of four even peaks. In the latter case, the value of C is 0.25 and the value of C^* is 0.182. In general, the magnitude of C^* tends to be quite low.

Since the values tend to be low, for any individual fiscal aggregate inter year variability can also be studied by rescaling the values of C^* as follows:

For year *t*, the value of C^* may be written as C_t^*. Then we may write C_t^{**} as a scaled up transformation of C_t^* as follows:

$$C_t^{**} = \frac{C_t^* - C_{\min}^*}{C_{\max}^* - C_{\min}^*} \tag{6}$$

Table 2. Values of C and C^* for full concentration, evenly distributed peaks and equally distributed shares.

Month	Simulation 1				Simulation 2			
	Monthly shares		Square of monthly shares		Monthly shares		Square of monthly shares	
	Full concentration	Equally distributed	Full concentration	Equally distributed	Four equal peaks	Equally distributed	Four equal peaks	Equally distributed
Apr.	1	0.083	1	0.007	0	0.083	0	0.007
May	0	0.083	0	0.007	0	0.083	0	0.007
Jun.	0	0.083	0	0.007	0.25	0.083	0.0625	0.007
Jul.	0	0.083	0	0.007	0	0.083	0	0.007
Aug.	0	0.083	0	0.007	0	0.083	0	0.007
Sep.	0	0.083	0	0.007	0.25	0.083	0.0625	0.007
Oct.	0	0.083	0	0.007	0	0.083	0	0.007
Nov.	0	0.083	0	0.007	0	0.083	0	0.007
Dec.	0	0.083	0	0.007	0.25	0.083	0.0625	0.007
Jan.	0	0.083	0	0.007	0	0.083	0	0.007
Feb.	0	0.083	0	0.007	0	0.083	0	0.007
Mar.	0	0.083	0	0.007	0.25	0.083	0.0625	0.007
C			**1**	**0.083**			**0.25**	**0.083**
C^*			1	0.000			0.182	0.000

Source (basic data): Author's estimates.

4. Seasonal Concentration in Receipts: 2000-01 to 2024-25

Utilizing the methodology described above, we have studied patterns of concentration in receipts consisting of net-tax revenue and other non-debt receipts of the central government. For the purpose of analysis, we have divided the sample period covering 2000-01 to 2024-25, into five sub-periods of five years each namely: Period 1 (2000-01 to 2004-05), Period 2 (2005-06 to 2009-10), Period 3 (2010-11 to 2014-15), Period 4 (2015-16 to 2019-20) and Period 5 (2020-21 to 2024-25). It may be noted that Periods 1, 4 and 5 were largely under the NDA regime, and Periods 2 and 3 were largely under the UPA regime.

Case of Net-Tax Revenue

Table 3 highlights that a local peak occurs in the months of June, September, December and March in the case of Centre's net tax revenues. The average share pertaining to these peak months progressively increases, resulting in the March peak to be much higher than the corresponding June peak.

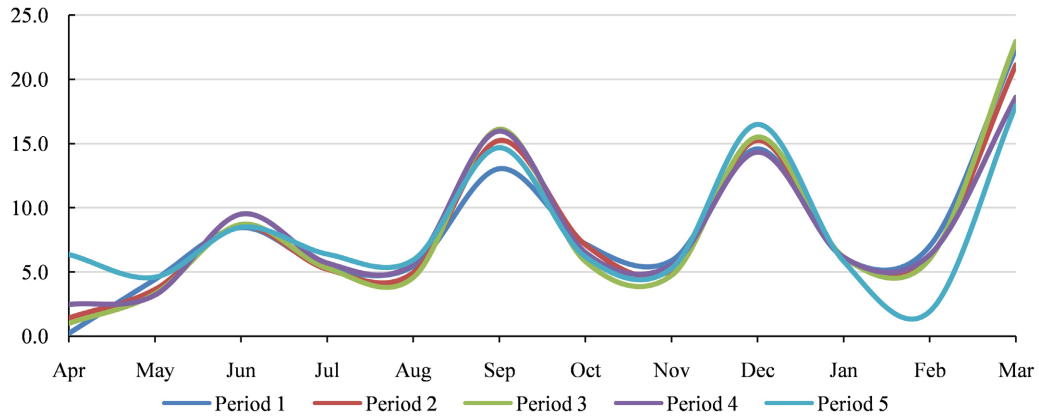
The phenomenon of March bunching is shown in Chart 1, although in some periods, September and December peaks are broadly similar. Correspondingly, troughs occur in the monthly shares of April, August, November and February. Clearly, there is significant concentration of collection of net tax revenues in the

month of March.

Table 3. Period-wise average monthly shares (%): Net tax revenue.

Period	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Period 1	0.21	4.41	8.45	5.34	5.44	13.04	7.18	5.88	14.57	6.11	7.02	22.35
Period 2	1.43	3.64	8.55	5.22	4.96	15.24	7.12	5.15	15.24	6.13	6.20	21.12
Period 3	0.98	3.29	8.68	5.28	4.55	16.11	5.80	4.71	15.49	6.14	6.01	22.94
Period 4	2.47	3.20	9.51	5.70	5.67	15.96	6.52	5.54	14.33	6.15	6.34	18.61
Period 5	6.36	4.58	8.48	6.38	5.92	14.67	6.17	5.26	16.48	5.82	1.92	17.97
All period	**2.29**	**3.82**	**8.73**	**5.58**	**5.31**	**15.00**	**6.56**	**5.31**	**15.22**	**6.07**	**5.50**	**20.60**

Source (basic data): CGA.



Source (basic data): CGA.

Chart 1. Period-wise average monthly shares: Net tax revenue.

Table 4. Period-wise average quarterly and half yearly shares (%): Net tax revenue.

Period	1Q	2Q	3Q	4Q	1H	2H
Period 1	13.07	23.81	27.64	35.48	36.88	63.12
Period 2	13.62	25.42	27.51	33.45	39.03	60.97
Period 3	12.96	25.94	26.01	35.09	38.90	61.10
Period 4	15.18	27.34	26.39	31.10	42.51	57.49
Period 5	19.42	26.97	27.91	25.70	46.39	53.61
All period	**14.85**	**25.90**	**27.09**	**32.17**	**40.74**	**59.26**

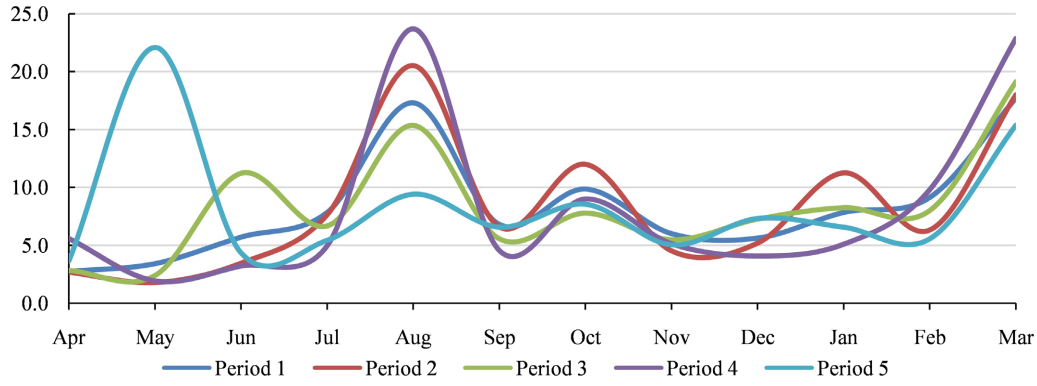
Source (basic data): CGA.

As expected, in Table 4 we show that the share of quarterly collection of net tax revenues progressively increases from first to second, second to third and third to fourth quarters. Correspondingly, the second half of the fiscal year shows, on average, a collection of 59.3%, which is nearly 19% points higher than the share of

the first half collection of net tax revenues. In this context, some features of the administrative arrangements for collection of taxes were highlighted in Srivastava and Trehan (2018), who observed that indirect taxes are collected throughout the year, while corporate tax and income tax collections usually peak according to the calendar of advance payment and finalization of accounts at the end of the fiscal year.

Case of "Other Non-Debt Receipts"

A similar exercise is taken up for other receipts, that is, non-debt receipts other than net tax revenues, comprising non-tax revenues and non-debt capital receipts. Here also there is some pattern of peaking, but it is not that prominent. Noticeable peaks occur in the months of August (except for period 5), and in the month of March. This is shown in **Table 5** and **Chart 2**. There are smaller peaks in October and January.



Source (basic data): CGA.

Chart 2. Period-wise average monthly shares: Other receipts.

Table 5. Period-wise average monthly shares (%): Other receipts (*non-tax revenues plus non-debt capital receipts*).

Period	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Period 1	2.74	3.41	5.71	7.84	17.32	6.81	9.86	6.00	5.62	7.84	9.14	17.72
Period 2	2.68	1.78	3.46	7.64	20.53	6.59	12.00	4.52	5.19	11.26	6.32	18.02
Period 3	2.83	2.39	11.23	6.68	15.36	5.57	7.79	5.49	7.27	8.26	8.01	19.12
Period 4	5.59	1.93	3.22	4.96	23.71	4.56	9.01	5.14	4.08	5.10	9.82	22.88
Period 5	3.65	22.09	4.36	5.44	9.42	6.58	8.55	5.05	7.33	6.57	5.57	15.38
All period	**3.50**	**6.32**	**5.60**	**6.51**	**17.27**	**6.02**	**9.44**	**5.24**	**5.90**	**7.81**	**7.78**	**18.62**

Source (basic data): CGA.

With the patterns of peaks or concentrations in the case of 'other receipts' vis-à-vis net tax revenues being different, these two components, when considered together, would show a lesser degree of concentration as compared to their indi-

vidual concentration coefficients. Table 6 shows that in the case of 'other receipts', second and fourth quarter show a relatively larger share of annual collections. There are some inter-period differences in this pattern. Particularly with respect to Period 5 it is noted that the maximum share is observed in the first quarter. Comparing the relative shares of half yearly collections, we notice that the all-period average in the second half at 55%, is nearly 10% points higher than the first half collections. In the case of other receipts, the peak observed in the earlier half of the fiscal year may also be due to the payment of dividends by the RBI.

Table 6. Period-wise average quarterly and half yearly shares (%): Other receipts (*non-tax revenues plus non-debt capital receipts*).

Period	1Q	2Q	3Q	4Q	1H	2H
Period 1	11.85	31.96	21.49	34.70	43.81	56.19
Period2	7.92	34.76	21.71	35.60	42.69	57.31
Period 3	16.46	27.61	20.54	35.39	44.06	55.94
Period 4	10.74	33.22	18.23	37.80	43.97	56.03
Period 5	30.11	21.44	20.93	27.52	51.55	48.45
All period	**15.42**	**29.80**	**20.58**	**34.21**	**45.21**	**54.79**

Source (basic data): CGA.

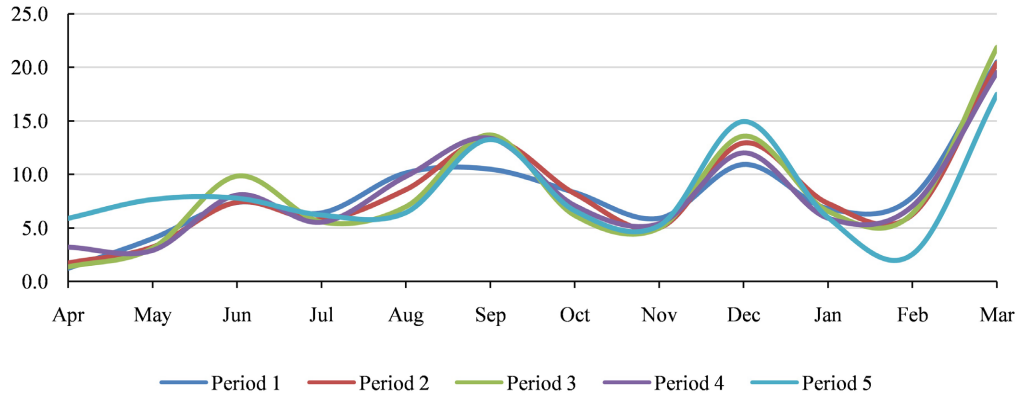
Case of Total Non-Debt Receipts

Table 7 and Chart 3 bring together the pattern of monthly shares in total receipts consisting of net tax revenues, and other receipts. In this case, with the contribution of net tax revenues being larger than that of other receipts, broadly the peaking pattern of net tax revenues is replicated with noticeable local peaks in the months of June, September, December and March. The share of March receipts is much larger than the earlier peaks. The all-period average for March is 19.95% which is marginally lower than the corresponding share of net tax revenues in this month at 20.60%.

Table 7. Period-wise average monthly shares (%): Non debt receipts (*net tax revenue plus other receipts*).

Period	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Period 1	1.23	4.01	7.38	6.41	10.14	10.49	8.31	5.90	10.93	6.81	7.88	20.50
Period 2	1.72	3.22	7.39	5.76	8.57	13.28	8.20	5.00	12.93	7.29	6.24	20.39
Period 3	1.36	3.11	9.84	5.56	6.98	13.68	6.17	4.98	13.57	6.56	6.35	21.85
Period 4	3.22	2.92	8.09	5.54	9.82	13.39	7.10	5.41	12.02	5.93	7.06	19.52
Period 5	5.90	7.66	7.78	6.21	6.43	13.26	6.61	5.22	14.94	5.97	2.55	17.47
All period	**2.69**	**4.18**	**8.10**	**5.89**	**8.39**	**12.82**	**7.28**	**5.30**	**12.88**	**6.51**	**6.02**	**19.95**

Source (basic data): CGA.



Source (basic data): CGA.

Chart 3. Period-wise average monthly shares: Non-debt receipts.

Table 8 shows that share of monthly collections is relatively higher in the second quarter and the fourth quarter. In terms of half yearly averages, the all-period average of second half is about 58%, as compared to 42% for the first half.

Table 8. Period-wise average quarterly and half yearly shares (%): Total (non-debt) receipts (*net tax revenue plus non-tax revenues plus non-debt capital receipts*).

Period	1Q	2Q	3Q	4Q	1H	2H
Period 1	12.63	27.03	25.15	35.19	39.66	60.34
Period 2	12.34	27.61	26.13	33.91	39.95	60.05
Period 3	14.31	26.22	24.72	34.76	40.52	59.48
Period 4	14.22	28.75	24.53	32.50	42.97	57.03
Period 5	21.35	25.90	26.76	25.99	47.25	52.75
All period	**14.97**	**27.10**	**25.46**	**32.47**	**42.07**	**57.93**

Source (basic data): CGA.

Estimation of Concentration Indices: Total Non-Debt Receipts and Its Components

Using the magnitudes of monthly shares, we have estimated the values of concentration indices with reference to C and C^* as defined in Equations (4) and (5). These are shown in Table 9 and Chart 4.

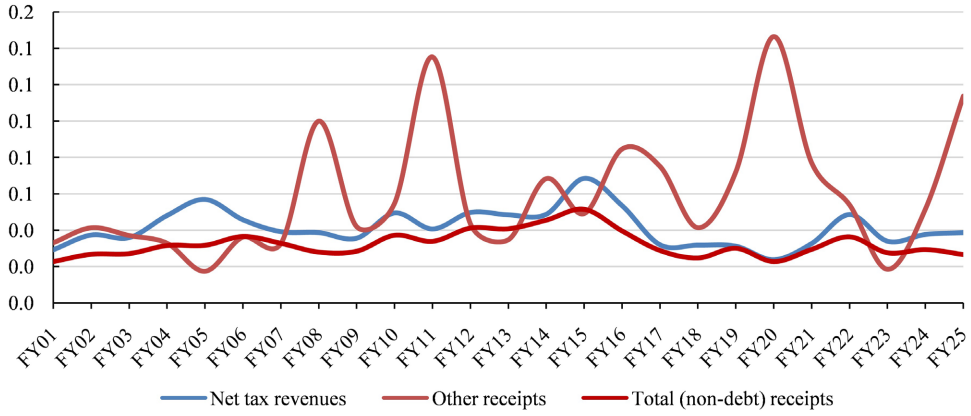
It is shown that the magnitude of concentration index is higher for other non-debt receipts as compared to that for net tax revenues. However, a decomposition of the overall receipts, as discussed in the subsequent section, would show that the weight of the concentration index of the net tax revenue is much higher that for other non-debt receipts.

Chart 5 shows inter-year values of C^*. In the bloc from 2009-10 to 2014-15, concentration index in total (non-debt) receipts was quite high. After 2014-15, it had started to come down reaching a trough in 2019-20, but remaining low in the range of 13.4% - 23% in terms of the relative index of concentration in the last three years namely 2022-23 to 2024-25.

Table 9. Value of C and C^* for components of and total receipts.

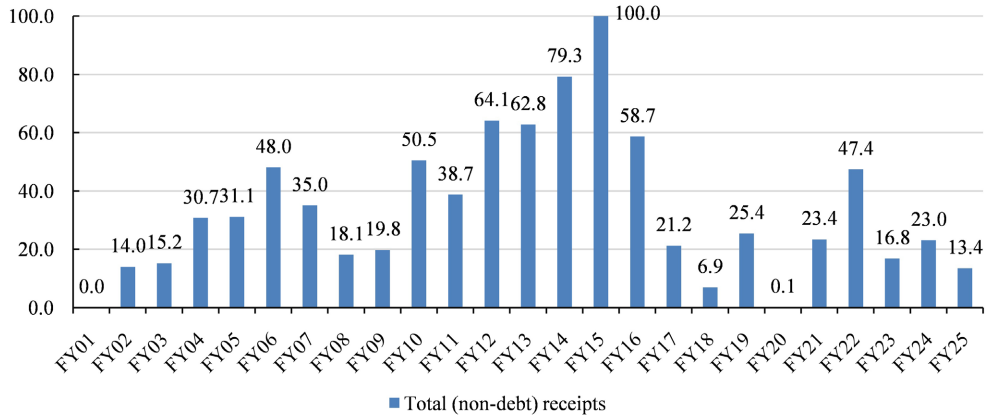
		C			C^*		
Period	Year	Net tax revenue	Non-debt receipts other than net tax revenue	Total Non-debt receipts	Net tax revenue	Non-debt receipts other than net tax revenue	Total Non-debt receipts
1	FY01	0.110	0.114	0.104	0.029	0.033	0.023
1	FY02	0.118	0.121	0.108	0.037	0.041	0.027
1	FY03	0.116	0.117	0.108	0.036	0.037	0.027
1	FY04	0.127	0.113	0.112	0.048	0.033	0.031
1	FY05	0.135	0.099	0.112	0.057	0.017	0.032
2	FY06	0.125	0.117	0.117	0.046	0.036	0.036
2	FY07	0.119	0.113	0.113	0.039	0.033	0.033
2	FY08	0.119	0.175	0.109	0.039	0.100	0.028
2	FY09	0.116	0.122	0.109	0.036	0.042	0.028
2	FY10	0.129	0.134	0.117	0.049	0.055	0.037
3	FY11	0.121	0.207	0.114	0.041	0.135	0.034
3	FY12	0.129	0.123	0.121	0.050	0.044	0.041
3	FY13	0.128	0.115	0.121	0.048	0.035	0.041
3	FY14	0.128	0.146	0.125	0.049	0.068	0.046
3	FY15	0.146	0.128	0.131	0.068	0.049	0.052
4	FY16	0.132	0.161	0.120	0.053	0.085	0.040
4	FY17	0.113	0.152	0.110	0.032	0.075	0.029
4	FY18	0.112	0.121	0.106	0.032	0.041	0.025
4	FY19	0.112	0.149	0.111	0.031	0.072	0.030
4	FY20	0.105	0.218	0.104	0.024	0.147	0.023
5	FY21	0.113	0.154	0.110	0.033	0.077	0.029
5	FY22	0.128	0.133	0.117	0.049	0.054	0.036
5	FY23	0.114	0.100	0.109	0.034	0.018	0.027
5	FY24	0.118	0.131	0.110	0.038	0.052	0.029
5	FY25	0.119	0.188	0.108	0.039	0.114	0.027
			Period averages				
1		0.121	0.113	0.109	0.041	0.032	0.028
2		0.122	0.132	0.113	0.042	0.053	0.033
3		0.130	0.144	0.122	0.051	0.066	0.043
4		0.115	0.160	0.110	0.034	0.084	0.029
5		0.118	0.141	0.111	0.038	0.063	0.030
All years		**0.121**	**0.138**	**0.113**	**0.041**	**0.060**	**0.032**

Source (basic data): CGA.



Source (basic data): CGA.

Chart 4. Trends in C* values of receipts and its components during the period 2000-01 to 2024-25.



Source (basic data): CGA.

Chart 5. Trends in C** values of total (non-debt) receipts during the period 2000-01 to 2024-25.

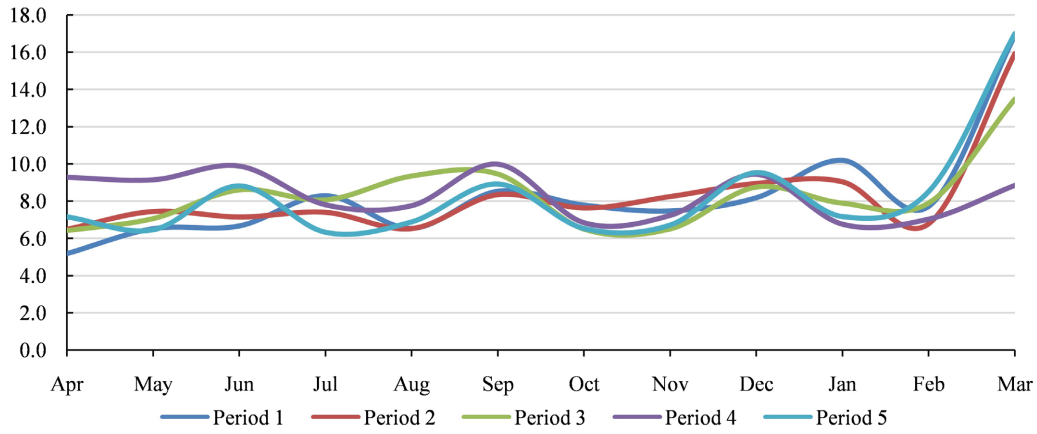
5. Seasonal Concentration in Expenditures: The Phenomenon of March Bunching

Case of Revenue Expenditures

In the case of expenditures, we look at the profile of monthly shares for revenue and capital expenditures separately as well as for total expenditures. In this case also, the phenomenon of March bunching is noted. However, the March shares of revenue expenditure (Table 10) are much lower than the corresponding shares on the revenue side including that of net tax revenues and other receipts. In fact, the inter-month distribution of shares is far more even in the case of expenditures as compared to revenues. This pattern is quite clear from Chart 6. Thus, the expectation is that the concentration indices of expenditures would be lower in magnitude as compared to corresponding magnitudes in the case of receipts.

Table 10 shows that the all-period average for March revenue expenditure is 14.4% and the June, September and December peaks are present, but in terms of their monthly shares, these peaks are much less prominent than in the case of

receipts.



Source (basic data): CGA.

Chart 6. Period-wise average monthly shares: Revenue expenditure.

Table 10. Period-wise average monthly shares (%): Revenue expenditure.

Period	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Period 1	5.18	6.52	6.67	8.29	6.54	8.53	7.79	7.48	8.18	10.19	7.72	16.91
Period 2	6.49	7.45	7.15	7.41	6.53	8.36	7.64	8.25	8.96	9.04	6.79	15.93
Period 3	6.42	7.06	8.61	8.07	9.35	9.46	6.50	6.51	8.76	7.89	7.90	13.49
Period 4	9.28	9.14	9.88	7.81	7.76	9.98	6.84	7.24	9.43	6.76	7.04	8.85
Period 5	7.15	6.46	8.82	6.33	6.88	8.92	6.53	6.71	9.53	7.17	8.52	17.00
All period	**6.90**	**7.33**	**8.23**	**7.58**	**7.41**	**9.05**	**7.06**	**7.24**	**8.97**	**8.21**	**7.59**	**14.43**

Source (basic data): CGA.

Table 11 shows that the fourth quarter share of revenue expenditure is nearly 8% points higher than the first quarter share, whereas the share of second and third quarters are broadly similar. Expenditure shares in the second half of the year are higher than the first half of the year by about 7% points.

Table 11. Period-wise average quarterly and half yearly shares (%): Revenue expenditure.

Period	1Q	2Q	3Q	4Q	1H	2H
Period 1	18.37	23.36	23.45	34.82	41.73	58.27
Period 2	21.10	22.29	24.85	31.76	43.39	56.61
Period 3	22.08	26.88	21.76	29.28	48.96	51.04
Period 4	28.30	25.54	23.51	22.65	53.84	46.16
Period 5	22.43	22.12	22.77	32.68	44.55	55.45
All period	**22.45**	**24.04**	**23.27**	**30.24**	**46.49**	**53.51**

Source (basic data): CGA.

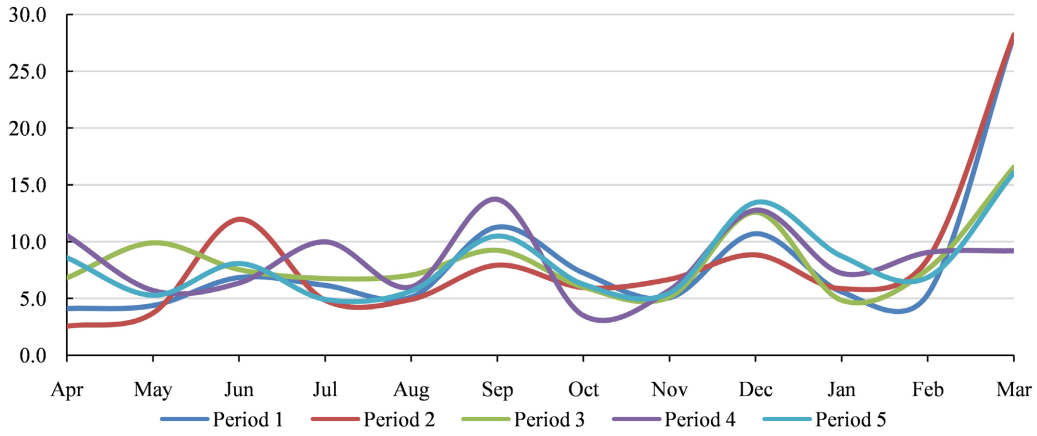
Case of Capital Expenditures

March bunching in the case of capital expenditure is noticeably higher than that of revenue expenditures. However, this March bunching has come down in Periods 4 and 5, implying that in more recent years, the monthly spread of capital expenditures has improved in the sense of becoming more evenly spread across the year, compared to Periods 1 to 3. This pattern is also depicted in Chart 7, Table 12.

Table 12. Period-wise average monthly shares (%): Capital expenditure.

Period	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Period 1	4.11	4.37	6.85	6.15	5.11	11.29	7.25	5.07	10.70	5.58	5.36	28.16
Period 2	2.56	3.71	11.97	4.84	4.92	7.94	5.96	6.69	8.84	5.86	8.48	28.22
Period 3	6.81	9.90	7.54	6.76	7.06	9.24	6.00	5.13	12.59	4.84	7.58	16.56
Period 4	10.57	5.72	6.37	10.00	6.03	13.74	3.51	5.75	12.79	7.23	9.06	9.22
Period 5	8.61	5.29	8.09	4.93	5.67	10.51	6.25	5.49	13.46	8.73	6.87	16.09
All period	**6.53**	**5.80**	**8.16**	**6.54**	**5.76**	**10.54**	**5.80**	**5.63**	**11.68**	**6.45**	**7.47**	**19.65**

Source (basic data): CGA.



Source (basic data): CGA.

Chart 7. Period-wise average monthly shares: Capital expenditure.

Table 13. Period-wise average quarterly and half yearly shares (%): Capital expenditure.

Period	1Q	2Q	3Q	4Q	1H	2H
Period 1	15.33	22.56	23.02	39.09	37.89	62.11
Period 2	18.24	17.70	21.49	42.57	35.94	64.06
Period 3	24.25	23.05	23.72	28.97	47.30	52.70
Period 4	22.67	29.77	22.05	25.51	52.44	47.56
Period 5	21.99	21.11	25.21	31.69	43.09	56.91
All period	**20.50**	**22.84**	**23.10**	**33.57**	**43.33**	**56.67**

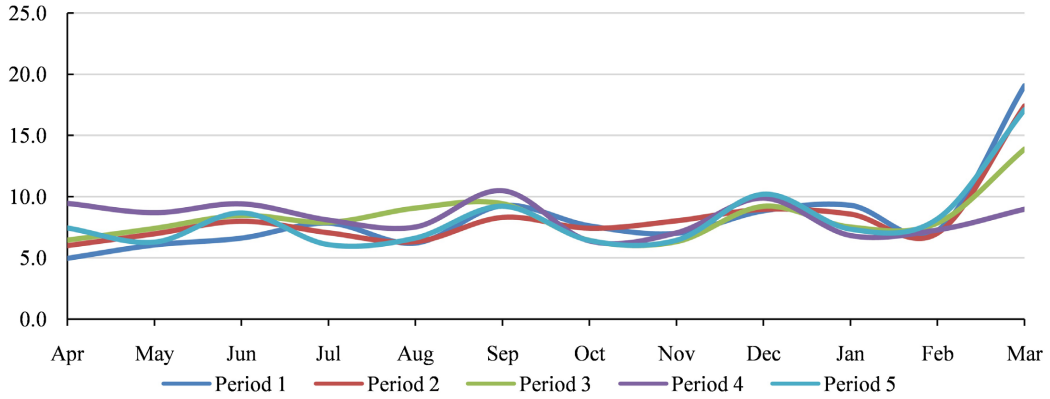
Source (basic data): CGA.

It is also noted that local peaks in the months of June, September and December are more prominent in the case of capital expenditures than in the case of revenue expenditures. As shown in Table 13, the fourth quarter share with an all-period average of 33.6% is higher than the first quarter share of 20.5% by 13.1% points. The shares of second and third quarters are nearly equal in this case but lower in terms of magnitude as compared to the corresponding shares of revenues and revenue expenditures. On the whole, in the second half, the share of capital expenditure is higher than that of the first half by nearly 13% points.

Case of Total Expenditures

Bringing together revenue and capital expenditures, we see the monthly pattern of total expenditures, which is dominated by the pattern of revenue expenditure. Here, the phenomenon of March bunching is prominent but there is an improvement in Period 4 as compared to Periods 1, 2, and 3. The monthly spread of shares of expenditures in the non-March months of the fiscal year is relatively more even as compared to the share in the month of March (Chart 8, Table 14).

Table 15 shows that in terms of all-period average, the share of fourth quarter is about 6% points higher than that of the first quarter. In fact, the relative shares of first, second and third quarter are broadly similar. In terms of half yearly shares, the second half claims the higher share but only by a little more than 5% points.



Source (basic data): CGA.

Chart 8. Period-wise average monthly shares: Total expenditure.

Table 14. Period-wise average monthly shares (%): Total expenditure.

Period	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Period 1	4.96	6.05	6.61	7.84	6.21	9.27	7.62	7.01	8.84	9.29	7.24	19.06
Period 2	5.99	6.96	7.99	7.05	6.31	8.30	7.42	8.02	8.96	8.57	7.02	17.40
Period 3	6.46	7.41	8.48	7.91	9.07	9.43	6.44	6.33	9.22	7.53	7.86	13.89
Period 4	9.45	8.69	9.41	8.09	7.52	10.48	6.38	7.04	9.87	6.82	7.27	8.98
Period 5	7.44	6.28	8.67	6.08	6.62	9.22	6.42	6.44	10.19	7.34	8.19	17.10
All period	**7.34**	**7.34**	**8.64**	**7.28**	**7.38**	**9.36**	**6.66**	**6.96**	**9.56**	**7.57**	**7.58**	**14.53**

Source (basic data): CGA

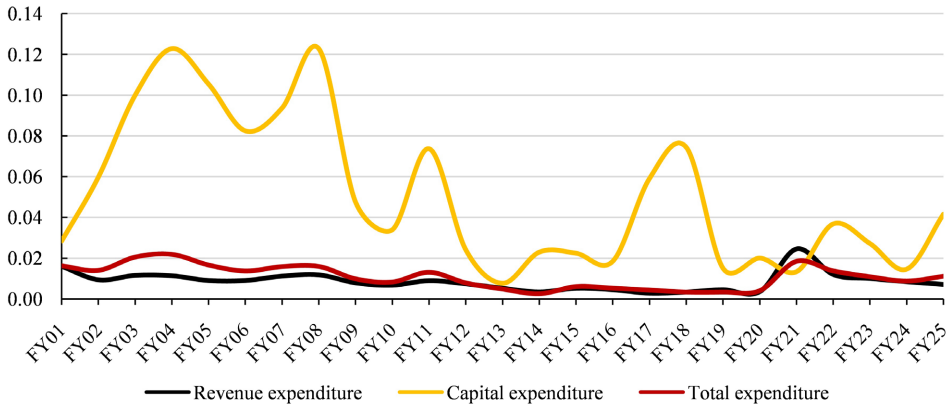
Table 15. Period-wise average quarterly and half yearly shares (%): Total expenditure.

Period	1Q	2Q	3Q	4Q	1H	2H
Period 1	17.63	23.31	23.47	35.59	40.94	59.06
Period 2	20.94	21.66	24.40	32.99	42.61	57.39
Period 3	22.34	26.41	21.98	29.27	48.75	51.25
Period 4	27.55	26.09	23.29	23.08	53.63	46.37
Period 5	22.40	21.91	23.05	32.63	44.31	55.69
All period	**23.31**	**24.02**	**23.18**	**29.49**	**47.33**	**52.67**

Source (basic data): CGA

Estimation of Concentration Indices: Total Expenditures and Its Components

Chart 9 shows that concentration is lowest for revenue expenditure in most years except in 2020-21, the year affected by Covid. The Covid period was characterized by a large fiscal stimulus accompanied by lockdowns in all countries. The primary spending entity in the economy was the central government. In this year, these factors led to a distortion in the historical expenditure patterns vis-à-vis those observed in other normal years. In the post-Covid years, there is a visible change towards restoring the earlier pattern. However, the adjustments are not complete yet.

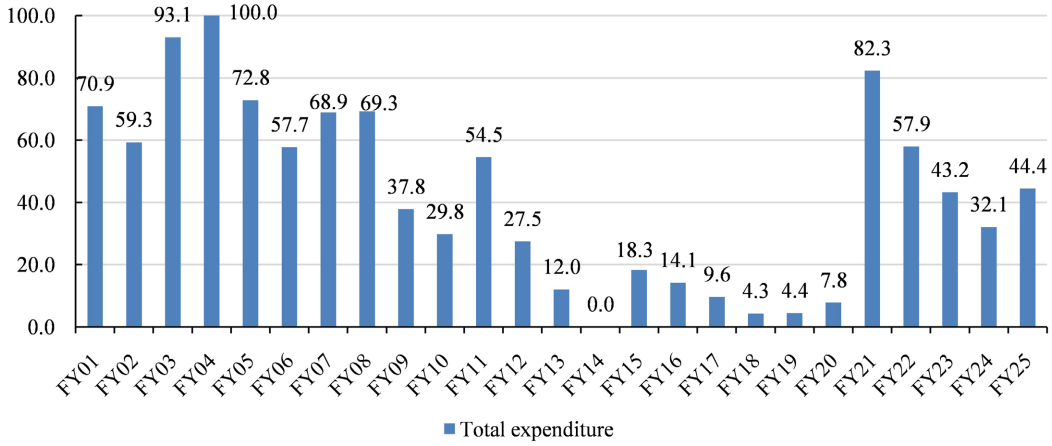


Source (basic data): CGA.

Chart 9. Trends in C^* values of expenditure during the period 2000-01 to 2024-25.

On the other hand, the level and the inter-year volatility of concentration index of capital expenditure is relatively higher. The pattern in total expenditure is dominated by the pattern in revenue expenditure because of its higher weight.

For a comparison of the inter-year pattern of the concentration index we have defined and calculated the index of C^* for total expenditures as shown in Chart 10. It is shown that concentration has noticeably improved over the periods 1 to 4. In fact, concentration is quite low in Period 4, indicating much better period of fiscal management in the sense of more even distribution of monthly expenditures. However, in Period 5 there is once again an increase in the concentration index.



Source (basic data): CGA.

Chart 10. Trends in C^{**} values of total expenditure during the period 2000-01 to 2024-25.

6. Decomposing Index of Concentration: Receipts and Expenditures

The index of concentration C or C^{*} can be decomposed in terms of the relative contribution of the sub-components of total receipts and total expenditures. We can apply the suggested scheme of decomposition for both revenue and expenditure aggregates.

C can be decomposed in order to highlight the relative contribution of the concentration in indices pertaining to its contribution as follows:

$$C = \sum\left(\frac{R_i}{RR}\right)^2 = \frac{1}{RR^2}\sum R_i^2 \tag{7}$$

Substituting R_i with $\left(R_{1i} + R_{2i}\right)$

$$C = \frac{1}{RR^2}\sum\left(R_{1i} + R_{2i}\right)^2 = \frac{1}{RR^2}\sum\left(R_{1i}^2 + R_{2i}^2 + 2\cdot R_{1i}\cdot R_{2i}\right) \tag{8}$$

$$C = \frac{1}{RR^2}\sum\left[\frac{RR_1^2}{RR_1^2}R_{1i}^2 + \frac{RR_2^2}{RR_2^2}R_{2i}^2 + 2\cdot R_{1i}\cdot R_{2i}\right] \tag{9}$$

This can be solved to

$$C = W_1C_1 + W_2C_2 + \frac{2}{RR^2}\cdot\sum\left(R_{1i}\cdot R_{2i}\right) \tag{10}$$

where $W_1 = \dfrac{\sum R_1^2}{\left(\sum R\right)^2}$ and $W_2 = \dfrac{\sum R_2^2}{\left(\sum R\right)^2}$

Table 16 shows the relative contribution in the overall concentration index pertaining to total receipts of the two main components on the receipts side namely net tax revenues and other (non-debt) receipts. It is shown that the contribution of C_1 pertaining to net tax revenues to the overall concentration index has been larger and has also been rising over time, although there is some inter-year volatility. In contrast, the contribution of the concentration index of other (non-debt)

receipts has been lower. The joint interaction term also explains the variation in the overall concentration index. This has also fallen over time. In Period 1 it averaged 43.2%, falling to 22.2% in Period 5.

Table 16. Contribution of W_1C_1, W_2C_2 and Joint term to C.

		Total non-debt receipts				Total expenditure			
Period	**Year**	W_1C_1	W_2C_2	**Joint term**	**Total**	W_1C_1	W_2C_2	**Joint term**	**Total**
1	FY01	46.2	12.6	41.2	100.0	72.7	2.4	24.9	100.0
1	FY02	39.7	17.7	42.6	100.0	66.2	4.0	29.8	100.0
1	FY03	37.4	18.2	44.3	100.0	61.5	5.7	32.8	100.0
1	FY04	32.8	21.6	45.6	100.0	53.5	10.2	36.3	100.0
1	FY05	43.9	13.9	42.2	100.0	55.4	9.5	35.1	100.0
2	FY06	60.5	6.2	33.3	100.0	72.1	2.8	25.0	100.0
2	FY07	66.8	4.1	29.1	100.0	74.4	2.4	23.2	100.0
2	FY08	61.4	10.0	28.6	100.0	66.9	5.5	27.6	100.0
2	FY09	69.7	4.0	26.3	100.0	79.1	1.4	19.5	100.0
2	FY10	62.9	6.7	30.4	100.0	78.3	1.5	20.2	100.0
3	FY11	50.5	17.2	32.3	100.0	72.5	2.7	24.8	100.0
3	FY12	67.9	4.1	27.9	100.0	76.8	1.7	21.5	100.0
3	FY13	68.8	3.6	27.6	100.0	78.0	1.4	20.5	100.0
3	FY14	61.0	6.1	32.9	100.0	78.1	1.8	20.1	100.0
3	FY15	68.7	4.6	26.7	100.0	77.1	1.6	21.3	100.0
4	FY16	62.3	8.4	29.3	100.0	73.2	2.3	24.6	100.0
4	FY17	59.9	7.7	32.3	100.0	71.9	3.3	24.8	100.0
4	FY18	68.1	4.5	27.3	100.0	77.0	2.6	20.4	100.0
4	FY19	63.2	5.9	30.9	100.0	76.1	2.0	21.9	100.0
4	FY20	60.6	10.6	28.8	100.0	76.1	1.8	22.1	100.0
5	FY21	72.9	3.5	23.6	100.0	81.6	1.4	17.0	100.0
5	FY22	73.2	3.8	23.0	100.0	70.0	3.0	27.0	100.0
5	FY23	76.9	2.0	21.1	100.0	67.4	3.6	29.1	100.0
5	FY24	74.5	3.2	22.3	100.0	61.6	4.8	33.5	100.0
5	FY25	72.7	6.2	21.1	100.0	57.6	6.6	35.8	100.0
				Period averages					
1		40.0	16.8	43.2	100.0	61.9	6.3	31.8	100.0
2		64.3	6.2	29.5	100.0	74.1	2.7	23.1	100.0
3		63.4	7.1	29.5	100.0	76.5	1.9	21.6	100.0
4		62.8	7.4	29.7	100.0	74.9	2.4	22.7	100.0
5		74.0	3.7	22.2	100.0	67.6	3.9	28.5	100.0
All years		60.9	8.3	30.8	100.0	71.0	3.4	25.6	100.0

Source (basic data): CGA.

In the case of expenditures, the overall concentration index is dominated by the concentration index of revenue expenditures. The relative contribution of the concentration index of revenue expenditure has also increased over time. It reached a peak in Period 3 and has since fallen marginally.

This study has focused on examining seasonal concentration in central government finances. It would be useful to undertake a similar analysis at the state level individually and for all states considered together in order to highlight the seasonal pressures on government borrowing by the combined government of central and state governments.

7. Conclusion

In the context of fiscal management, an even spread of fiscal aggregates across the year may be considered desirable. Fiscal intervention represents injections into and withdrawals from the aggregate demand in the system. Any imbalances between receipts and expenditures will have to be financed by borrowing, which carries its own costs. If the patterns of concentration in receipts and expenditures are different, the need to rely on borrowing to fill the gap between expenditures and receipts would be higher. In fact, the borrowing costs could be reduced by bringing seasonal expenditure patterns more in alignment with the seasonal revenue patterns. Administratively, seasonality of expenditure is under relatively greater control of the government than the revenue patterns, which depend on administrative provisions as well as market responses. There are no significant economic reasons why receipts and expenditures should be characterized by a high degree of concentration or unevenness. Some of the noted phenomenon of March bunching and other local peaks in the context of India, particularly with respect to central finances, are due relatively to the formulation of the fiscal year ending in March and certain administrative and institutional arrangements.

In this paper, we have defined and estimated an index of seasonal concentration using the HHI. We have suggested a normalization for this index as well as a scheme of decomposition. Our main findings are indicated below:

1) March bunching and seasonal concentration is higher in the case of receipts as compared to expenditures.

2) In the case of net tax revenues, March concentration is the highest. But there are noticeable local peaks in the months of June, September and December.

3) In the case of other non-debt receipts, the magnitudes of concentration indices are even higher than that of net-tax revenues. However, the impact of this higher magnitude of concentration is less in the overall index of concentration of total receipts because of the lower weight of other non-debt receipts.

4) Looking at inter-period profile of concentration indices, the highest concentration for the series of overall total (non-debt) receipts is observed in Period 3. For individual series, in the case of net tax revenues, it is in Period 3. However, for other receipts, the highest concentration is in Period 4. Thus, fiscal management appears to be successfully geared towards management of concentration in

the years 2010-11 to 2014-15.

5) On a trend basis, with respect to the overall series of non-debt receipts, the concentration index appears to have fallen after reaching a peak around 2014-15. With respect to individual years, peak concentration is observed in 2014-15, which fell in the subsequent years to reach a trough in 2019-20, after which concentration increased again.

Overall, it is observed that there was improvement in fiscal management in terms of reducing the magnitude of seasonal concentration before the onset of Covid. But these magnitudes became larger in subsequent years. There is a need to now reduce the magnitude of concentration in fiscal aggregates so that the need for additional intra-year borrowing may be minimized.

Disclaimer

Views or perspectives in this article are solely those of the authors and do not necessarily reflect the views, policies, or positions of any organization, employer, or affiliated group.

Notes

$$C = \sum\left(\frac{R_i}{RR}\right)^2 = \frac{1}{RR^2}\sum R_i^2$$

Substituting R_i with $\left(R_{1i} + R_{2i}\right)$

$$C = \frac{1}{RR^2}\sum\left(R_{1i} + R_{2i}\right)^2 = \frac{1}{RR^2}\sum\left(R_{1i}^2 + R_{2i}^2 + 2\cdot R_{1i}\cdot R_{2i}\right)$$

$$C = \frac{1}{RR^2}\sum\left[\frac{RR_1^2}{RR_1^2}R_{1i}^2 + \frac{RR_2^2}{RR_2^2}R_{2i}^2 + 2\cdot R_{1i}\cdot R_{2i}\right]$$

$$C = \frac{1}{RR^2}\cdot\sum\frac{RR_1^2}{RR_1^2}R_{1i}^2 + \frac{1}{RR^2}\cdot\sum\frac{RR_2^2}{RR_2^2}R_{2i}^2 + \frac{2}{RR^2}\cdot\sum\left(R_{1i}\cdot R_{2i}\right)$$

$$C = \frac{RR_1^2}{RR^2}\cdot\sum\frac{R_{1i}^2}{RR_1^2} + \frac{RR_2^2}{RR^2}\cdot\sum\frac{R_{2i}^2}{RR_2^2} + \frac{2}{RR^2}\cdot\sum\left(R_{1i}\cdot R_{2i}\right)$$

$$C = W_1C_1 + W_2C_2 + \frac{2}{RR^2}\cdot\sum\left(R_{1i}\cdot R_{2i}\right)$$

where $W_1 = \frac{\sum R_1^2}{\left(\sum R\right)^2}$ and $W_2 = \frac{\sum R_2^2}{\left(\sum R\right)^2}$.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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