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Analyzing the Dynamics and Implications of Industrial Concentration in India: Trends, Challenges, and Policy Perspectives

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ABSTRACT: The concentration of economic power often draws criticism due to its social and political consequences, yet it may also provide the scale needed to compete internationally. Researchers typically use measures such as the Herfindahl-Hirschman Index (HHI) or Lerner's Index to gauge concentration, but such studies usually focus on specific industries. Extending these measures to encompass the entire range of industries, at various levels of aggregation, would allow for comprehensive comparisons between countries. For instance, this could enable us to determine if India exhibits higher levels of concentration compared to the USA. Our paper addresses these issues by utilizing Prowess data to estimate concentration ratios across different industrial levels, from NIC Sections to NIC Sub-classes. We find that while concentration ratios can be estimated for a wide range of industries, data coverage discrepancies may affect the reliability of these estimates, particularly at lower levels of aggregation. Moreover, country-level concentration ratios tend to overestimate actual concentration unless properly weighted.

KEYWORDS: Concentration, Indices, Aggregation, Industry Classification

I. INTRODUCTION

Recent societal concerns often center on income inequality, with notable figures such as Zuckerberg, Bezos, and Adani highlighting extreme wealth disparities. This concern extends to market concentration, where giants like Google, Facebook, and Amazon dominate their sectors, raising alarms about potential monopolistic practices and consumer exploitation. Historically, economic concentration has drawn scrutiny, with competition laws like the Sherman Act in the USA designed to curb monopolistic power. European and Asian countries have also attempted to tackle concentration through nationalization and other regulatory measures.

India's experience with economic concentration and inequality is complex. The Indian Constitution of 1950 emphasized reducing economic inequality and concentration, leading to policies such as industrial licensing and the Monopoly and Restrictive Trade Practices Act (MRTPA). Despite these efforts, anecdotal evidence suggests that individuals found ways around these regulations. The 1990s liberalization era marked a significant shift, with the abolition of industrial licensing, reduced tax rates, and the replacement of the MRTPA with the Competition Act, which focused more on case-by-case assessments rather than blanket prohibitions. The impact of these changes on market concentration is not entirely clear. Liberalization was expected to result in consolidation as businesses shed non-core activities, potentially increasing concentration, while also fostering the entry of new competitors. To understand the net effect on competition and concentration, our research investigates these dynamics using detailed data.

II. THE DEBATE ON CONCENTRATION

The debate over market concentration is multifaceted. While high concentration often signals potential harm, such as reduced competition and higher consumer prices, it may also offer benefits. For instance, concentration can provide the scale necessary for international competition. Critics of concentration argue that it leads to increased market power, resulting in higher prices and reduced consumer welfare. According to economic theory, a monopolist typically charges higher prices than in more competitive markets. Empirical research, particularly the Structure-Conduct-Performance (SCP) paradigm, supports this view by showing a correlation between market concentration and higher prices and profitability. However, the SCP paradigm has limitations, such as difficulties in establishing causation whether market structure drives conduct or vice versa.

Alternative theories suggest that market concentration might not always indicate market power. For instance, predatory pricing strategies or contestable market theories could explain lower prices even in concentrated industries. Additionally, efficiency and managerial effectiveness might contribute to profitability without necessarily implying monopolistic behavior. The Lerner Index, which measures the difference between price and marginal cost, provides another perspective on market power. A higher Lerner Index indicates greater market power, though estimating marginal costs from accounting data presents challenges. New methods have been developed to estimate marginal costs indirectly, but these methods also rely on certain assumptions.

III. MEASURING CONCENTRATION

Several methods are commonly used to measure market concentration:

- **K-firm Concentration Ratio (CRK):** This index measures the combined market share of the top K firms within an industry. It is calculated by summing the market shares of the largest K firms. Higher values indicate greater concentration.

$$CRK = \sum_{i=1}^K s_i$$

- **Herfindahl-Hirschman Index (HHI):** The HHI is the sum of the squares of the market shares of all firms in a market. With values ranging from 0 to 10,000, higher HHI values signify higher concentration.

$$HHI = \sum_{i=1}^n s_i^2$$

- **Lerner Index:** This index measures market power by calculating the price-cost margin. The formula is:

$$L = \frac{P - MC}{P}$$

Here, P represents the price and MC represents the marginal cost. A higher Lerner Index suggests greater market power.

In addition to these indices, entry and exit rates can offer insights into market dynamics. Barriers to entry, such as regulatory or technological factors, can maintain high market power, while low entry and exit rates may signal entrenched market power.

3.1 Aggregating Concentration Measures

To compare concentration across countries, one must aggregate concentration measures from various industries. This task involves several challenges:

- **Aggregation Level:** Concentration can be measured at different levels of industrial aggregation, from broad sectors to specific sub-classes. The choice of aggregation level affects the overall concentration measure.
- **Geographic Aggregation:** Concentration can be assessed geographically. For instance, comparing concentration across different regions within a country or between countries requires careful consideration of geographic markets.
- **Weighting:** Different industries may have different levels of coverage and significance. Weighting industries appropriately is crucial for accurate aggregation. For instance, using industry-wide sales or revenues as a basis for market share can vary in appropriateness depending on the context.
- **Methodological Issues:** Constructing a comprehensive concentration index for a country involves methodological considerations, including how to aggregate industry-level data and which variables to use for calculating market shares.

IV. DATA DISCUSSION

In addition to addressing conceptual challenges, the selection of data sources is critical for conducting robust quantitative analyses. For research focused on Indian firms, two prominent data sources are Prowess and the Annual Survey of Industries (ASI). Prowess is maintained by the Center for Monitoring the Indian Economy (CMIE), a private organization, while ASI is managed by the Ministry of Statistics & Program Implementation (MoSPI). Both sources are widely used by practitioners and researchers to study various aspects of the Indian economy, including market dynamics, firm performance, and industrial concentration.



4.1 Preparing the Data

Our analysis begins with a comprehensive examination of the market share of firms included in the Prowess database. We focus on the period from Financial Year (FY) 2011-12 to FY 2021-22, using the vintage "Sep 2022" dataset. This version was the most recent available at the time of data extraction, which occurred on October 31, 2022. The initial dataset comprised 313,544 observations across 40,908 companies. During the preliminary data review, we identified a notable issue: some firms had submitted two financial statements within a single fiscal year. This situation poses a problem when calculating market concentration indices for specific industries each year. The duplication of financial statements leads to double counting, giving undue weight to firms that filed twice, thereby distorting the concentration indices. To address this, we removed the earlier financial statement for firms that had submitted multiple reports in the same year, resulting in the elimination of 521 observations. The adjusted dataset now contains 313,023 observations.

It presents the distribution of these observations across the financial years. A significant observation is the reduced number of data points for FY 2021-22 compared to earlier years. This reduction could be attributed to two plausible factors. First, many firms may not have released their annual reports by the release date of the "Sep 2022" vintage. Alternatively, some firms may have published their reports, but these were not yet included in the Prowess database as of that vintage. Regardless of the reason, this discrepancy introduces a potential bias in the estimation of market concentration indices for FY 2021-22, possibly due to systematic patterns in the omission of data. For instance, certain types of firms might release their reports earlier, while others do so later. To mitigate such biases, we excluded all 6,320 observations from FY 2021-22, leaving a dataset of 306,703 observations.

Further inspection of the data revealed missing values for key variables necessary for constructing our market concentration indices. After removing these incomplete records, we were left with 268,627 observations spanning a decade of financial data extracted from Prowess. These filtered observations form the basis for our concentration ratio estimates. However, missing data presents a potential problem. If the data is missing systematically (e.g., smaller firms are more likely to have incomplete data), our estimates of concentration ratios could be biased and inconsistent. On the other hand, if the data is missing randomly, our estimates should accurately reflect the "true" concentration ratios. Since we cannot definitively determine whether the data is missing systematically, we proceed under the assumption of random missingness, ensuring our estimates are unbiased and consistent. Table 2 summarizes the steps taken to arrive at our final dataset.

Table 1: Prowess data extract, observations per year

Financial year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Number of obs.	27,147	26,038	28,661	31,761	33,833	33,809	33,554	32,747	31,029	28,124	6,320

Table 2: Steps taken to arrive at final data set

Step	Observations
Prowess data download	313,544
- Double counts	313,023
- FY2021-22	306,703
- Missing data	268,627

4.2 Industry Classifications

This paper aims to measure market power by sector, using industry classifications to define sectors. In the Prowess database, each firm's industry is categorized using the National Industry Classification (NIC) code, a standardized system developed by the Ministry of Statistics and Programme Implementation (MoSPI). The NIC system classifies all economic activities in India into a hierarchical structure. At the highest level, the NIC system consists of 21 Sections, labeled from "A" to "U." For example, Section A represents "Agriculture, Forestry, and Fishing." These Sections are further divided into Divisions, identified by 2-digit codes; for instance, Division 02 within Section A corresponds to "Forestry and Logging." Divisions are subdivided into Groups, marked by 3-digit codes, such as Group 022 for

"Logging" within Division 02. Groups are then broken down into Classes, identified by 4-digit codes, like Class 0220 for "Logging." Finally, Classes are split into Sub-classes with 5-digit codes; for example, Sub-class 02201 represents "Gathering and preparation of firewood" under Class 0220.

In our dataset, firms are distributed across NIC Sections "A" to "P." Sections "Q" to "U" have no representation in Prowess, likely because these Sections pertain to non-market, non-corporate, and/or unorganized activities. For instance, Section Q covers "Human Health and Social Work Activities," which are often not captured in corporate databases like Prowess. Table 3 illustrates the distribution of firms across Sections A-P in the dataset. A key observation is that economic activity in India, as captured by Prowess, is heavily concentrated in a few sectors: manufacturing, trade, finance, and construction. In contrast, sectors such as real estate services and water & waste management have minimal representation. For example, the real estate sector has only 188 observations over a decade, averaging less than 20 observations per year. We expect that sectors with sparse representation will exhibit high Herfindahl-Hirschman Indices (HHIs) at all levels of aggregation, from the Section level to the Sub-class level, due to the limited number of firms.

Table 3: Firms in Prowess by NIC sector, FY2012-21

NIC Sector	Number of Observations
Admin & support	14166
Agriculture	4288
Construction	23648
Education	6097
Finance	65142
NIC Sector	Number of Observations
Hospitality	4633
InfoComm	16192
Manufacturing	99936
Mining	2020
Power	7397
Public admin	391
Real estate	188
Skilled services	9644
Trade	50277
Transport	8799
Water & waste	205

Prowess provides no explicit explanation for the sparse representation of certain NIC Sections. However, several hypotheses can be proposed. One possibility is that firms in certain NIC Sections exist but are not captured in Prowess. This could be the case for sectors like real estate services and agriculture, where many firms are small, unorganized, or operate informally. Prowess primarily compiles firm-level data from public sources, including stock market filings and submissions to the Ministry of Corporate Affairs. As a result, smaller firms that do not engage in such formal reporting are underrepresented in the database. Another hypothesis is that some sectors genuinely have fewer firms, and Prowess accurately reflects the state of the industry. For instance, the water & waste management sector may consist predominantly of city-level public sector entities, where market concentration is naturally high due to the limited number of participants. Therefore, the high concentration ratios observed in these sectors might indeed reflect the true market structure.

In conclusion, while Prowess is a valuable resource for analyzing Indian firms, the dataset has limitations, particularly concerning the representation of smaller or informal firms. The industry classifications used in this paper, based on NIC codes, provide a structured way to analyze market power across sectors. However, the sparse data in certain sectors necessitates careful interpretation of the results, particularly regarding market concentration indices. Understanding these limitations is crucial for deriving accurate and meaningful insights from the data.

V. RESULTS

5.1 Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index (HHI) is used to measure market concentration, calculated as the sum of the squares of the market shares of all firms in the market. This section presents HHI calculations based on three variables: total income, total assets, and a composite measure (total income + total assets).

5.1.1 Total Income

- **NIC Sections (Figure 1):** Real Estate Services and Water & Waste have the highest HHIs (above 2500), indicating high market concentration. Mining and Public Administration show moderate concentration in some years.
- **NIC Divisions (Figure 2):** Division 75 (Veterinary Activities) has an HHI of 10000, indicating a monopoly. Other high-concentration divisions include Manufacture of furniture (Division 31), Tobacco Products (Division 12), and others.
- **NIC Classes (Figure 3):** Some classes, like Coke & Refined Petroleum and Weapons & Ammunition, also exhibit monopolistic concentration levels.

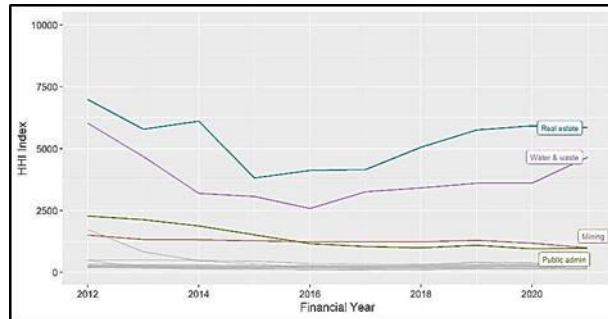


Figure 1: HHI as measured by total income for NIC sections, FY2012-21

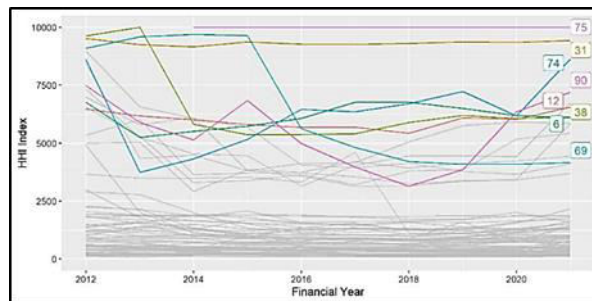


Figure 2: HHI as measured by total income for NIC divisions, FY2012-21

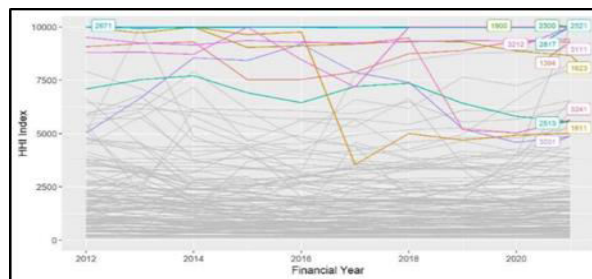


Figure 3: HHI as measured by total income for NIC classes associated with manufacturing, FY2012-21

5.1.2 Total Assets

- **NIC Sections (Figure 4):** Results are similar to those based on total income, but with lower HHI values. Water & Waste and Real Estate Services still show high concentration, though to a lesser extent.

- **NIC Divisions (Figure 5):** Similar to the income-based results, with additional concentration in Water Collection and Personal Services.
- **NIC Classes (Figure 6):** Classes such as Services related to Printing and Magnetic & Optical Media show high concentration, similar to the income-based analysis.

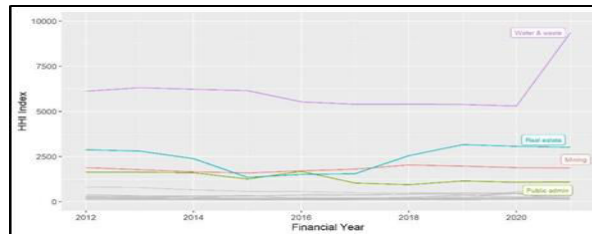


Figure 4: HHI as measured by total assets for NIC sections, FY2012-21

5.1.3 Composite Measure (Total Income + Total Assets)

- **Overall:** The sectors with high HHIs under income and asset-based calculations also have high HHIs under the composite measure, confirming that the high concentration sectors are consistent across different measures.

5.2 Aggregate Concentration

Four aggregate indices of concentration were calculated:

1. **Simple Average:** An unweighted average across all sectors.
2. **Weighted Average Method 1 (WAJ):** Weighted by the number of firms in each sector.
3. **Weighted Average Method 2 (WATI):** Weighted by total income of each sector.
4. **Weighted Average Method 3 (WATA):** Weighted by total assets of each sector.

Key Observations:

- **Trends:** The simple average index decreased until 2016 and then increased, especially in 2020-21, though this trend is not consistently observed in the weighted indices.
- **HHI Comparisons:** Aggregate concentration indices are lower when weighted by assets or income, and the trends are mostly flat, indicating no significant change in overall concentration over the period.

VI. CONCLUSION

To date, we have collected and organized a decade's worth of data from Prowess. We have then used these data to estimate HHIs using three variables (total income, total assets, and total income + total assets) at three levels of aggregation (NIC Sections, NIC Divisions, and NIC Classes). We have found results across the three variables to be similar in the sense that it is the same group of industry sectors that have high HHIs across the three variables. We have also found some evidence of falling HHIs over time, but this trend reverses in the COVID-19 year of FY2020-21. There is further work to be done in expanding and tightening this analysis. First, we are yet to estimate market concentration using other measures like K-concentration ratios and the Lerner Index. Second, we still need to grapple with the nature of Prowess data. As we have observed in the case of the NIC section "Real Estate Services", a high HHI appears to be an artefact of missing data. Many real estate service providers like property brokers are small and unorganized and will not appear in a database like Prowess. In other cases, like in manufacturing of tobacco, high HHIs may indeed indicate market concentration. How are we to distinguish between the two cases? It is likely that our intuition and sectoral knowledge will need to guide us. Third, there is much supplementary analysis that can be done, given the scale and density of our results. These include robustness checks and merger simulation exercises.

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