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"The Missing Middle": India's Formal Manufacturing Sector

Student Research Internship Report

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"The Missing Middle": What's happening in India's Formal Manufacturing Sector

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Abstract

The manufacturing sector is considered a crucial pillar for an economy. The purpose of the study is to understand the missing middle and examine whether credit constraints can be a possible factor for the concentration of small firms. For this, we have taken ASI unit-level data for three years, 2016-17, 2017-18 and 2018-19 and along with descriptive analysis, fixed effects regression was run. Findings suggest a large concentration of small-sized firms in count, but their contribution to both employment and productivity is low. Again, regression results suggest that small firms carry the highest credit ratio while large firms have the lowest, which can constrain small firms from moving upward.

1. Introduction

The manufacturing sector is referred to as the backbone of an economy. Lewis (1954) stated that the movement of labour from low- productivity agriculture to the high-productivity manufacturing sector is central for the development of an economy (McMillan & Rodrik, 2011). The manufacturing sector is the primary engine of growth, as it employs a larger share of the population, contributes significantly to GDP, and drives modernisation and productivity; ultimately, it is the source of positive spillover effects (Kaldor, 1967; Rabbani & Raj S. N., 2023; Tybout, 2000). In the post-war era, the rapid industrialisation of East Asian Economies – notably South Korea, China and Taiwan reflected the strong capability of this sector in generating growth, productivity, employment and sustaining development. India, with its largest labour share and democratic developmental ambitions, was expected to follow the same pattern of manufacturing-led growth trajectory. However, the results were quite opposite in the case of India. Unlike East Asian economies, India's growth was mainly driven by the service sector, with the manufacturing sector consistently underperforming in employment generation

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and productivity growth (Kotwal et al., 2011). The Indian manufacturing sector contributes approximately 16-17% of the nation's GDP and employs an estimated 11-12% of the country's workforce (*Manufacturing Hubs*, 2026) – these staggering figures have drawn the attention of scholars and policymakers.

Central to understanding India's manufacturing underperformance is the phenomenon widely described as the "Missing Middle"- the lack of growth and development of small firms (Dasgupta, 2016; Mazumder & Sarkar, 2013; Rabbani & Raj S. N., 2023; Tybout, 2000). Evidence suggests that the term was first used by Dhar and Lydall (1961) in the firm structure of India(Mehrotra & Giri, 2023). Missing Middle, in general, refers to a structure characterised by a relative absence of medium-sized enterprises and an overwhelmingly large concentration of small-sized enterprises at one end and a small number of large firms at the other (Ghosh & Abraham, 2021). This odd pattern has important implications for aggregate productivity and growth. Medium-sized firms are the stepping stone in the firm growth ladder as they absorb a large number of workers, develop organisational capabilities, leading to economies of scale, and gradually turn into large-scale enterprises. But the concentration of small firms breaks the line of development, trapping resources in low-productive firms, and preventing the kind of structural upgrading that characterised East Asian industrialisation (Tybout, 2000). Some scholars have argued that in Indian firm structure, there is not merely a missing middle but the firm growth decline smoothly (Hsieh & Olken, 2014). Whether characterised as a missing middle or broader stunting of firm growth, the implications are the same – Indian Manufacturing is dominated by small, low productive enterprises that are unable or unwilling to scale up.

This challenge is evident from contemporary registration data. As of June 2026, the Udyam registration records approximately 8.59 Crore Micro firms, 5.38 Crore small firms and just 41.5 thousand medium firms; of these, 1.76 crore are engaged in manufacturing activities (Ministry of MSME). This stark distributional asymmetry – millions of micro firms at one end, a handful of medium enterprises at the other clearly reflects the missing middle in plain numbers and underscores its continued relevance as a policy challenge.

The existing literature on the missing middle has generated significant debate. Hsieh and Klenow (2012) compared the plant life of India and Mexico with that of the USA using combined ASI and NSSO data and found that average Indian plants exhibit little growth in both output and employment, whereas in the US, an average 40-year-old plant employs almost eight times as many workers. This low productivity was due to a certain type of misallocation, especially resource misallocation. Some barriers include financial friction and difficulty buying

land or finding skilled employees. Another study done by Hsieh and Olken (2014) found that in India, firms are smoothly declining; not only medium but also large firms are missing. More recently, Rabbani and Raj (2023) used ASI and NSSO, and the results highlighted that there is a large share of employment in small and large firms and medium-sized firms occupy a relatively small share in employment.

Despite this body of evidence, a critical gap remains. Hsieh and Klenow (2012) explicitly flagged financial friction as one of the issues, and Banerjee and Duflo (2014) provide direct evidence that Indian firms are credit constraints but do not link this specifically to firm size distributions. Another blind spot is that most of the studies are confined to the 2010-2014 timeline. This study aims to address this blind spot by using ASI unit-level panel data for the years 2016-2017, 2017-2018, and 2018-2019 - a recent pre-COVID period capturing the post GST-manufacturing landscape and employing a fixed-effects panel estimator. This study tries to examine the firm size distribution, document productivity differential across size categories and directly test credit access as a financial friction in determining firm size within the formal manufacturing scenario.

2. Literature Review

The structure of firm size in Indian manufacturing has been characterised by interesting patterns, particularly the phenomenon known as the "missing middle" – the relative absence of medium-sized firms. Understanding this pattern is crucial for industrial policy, as firm size can affect productivity, employment and economic growth. This study tries to review the existing research on the Indian manufacturing landscape, the missing middle debate, credit constraints, and regulatory factors that may explain the firm size distribution.

The review is organised according to themes in four sections. First, I tried to examine Indian manufacturing performance and productivity trends. In the second section I discussed the missing middle debate, including both supporting evidence and critical perspectives. Accordingly, in the third section, I tried to examine and understand credit constraints and financial frictions. Consequently, in the fourth section, I discussed about the existing literature on regulatory compliance and size-based thresholds that may affect firm growth. This approach was taken to understand the various issues and barriers faced by this sector, which can provide the foundation for this study.

This review draws on peer-reviewed journal articles, working papers, and empirical studies focusing on Indian manufacturing, primarily using firm–level data from sources such

as the Annual Survey of India (ASI) and the National Sample Survey (NSS). The selected literature spans from early definitions of missing middle to most recent empirical work.

2.1 Indian Manufacturing Performance

Bollard et al. (2013) examined productivity growth in Indian manufacturing using ASI data on formal manufacturing plants from 1993-2007 and compared it with the 1990-1992 period. They decompose output growth into input and productivity growth, and into within-plant and reallocation-across-plants growth, to estimate aggregate total factor productivity (TFP). The findings suggest that productivity growth came from within large firms, not from reallocation across firms. They regressed log industry productivity (TFP) on five policy measures, controlling for both year and industry fixed effects. Kotwal et al. (2011) noticed that India's growth differed from other East Asian Economies – while East Asia's growth was mainly driven by the manufacturing sector, in India the service sector played a crucial role. They questioned why manufacturing had not grown, attributing it to inadequate infrastructure, restrictive labour laws and small-scale reservation policy. Their paper evaluated a range of studies and datasets to assess the reforms implemented by the Indian Government during and after the 1990s and tried to understand how structural changes and productivity gains unfolded over time. Rabbani and Raj (2023) provided recent evidence on firm structure using both formal (ASI) and informal data (NSSO) for the years 2000-01, 2005-06, 2010-11 and 2015-16. They employed OLS regression methods and regressed the firm size on productivity and wages and documented the size and trends of informality. Their findings suggest that there is a significant presence of informality in Indian manufacturing. They observed a bimodal structure in size distribution – a large share of employment in small and large firms, while medium sized employing a relatively small share. Furthermore, they observed that as firm size increases, both productivity and earnings increase.

2.2 The Missing Middle debate

Tybout (2000) gave the classic definition of the missing middle as the low share of medium-sized firms in manufacturing sectors. The paper argued that the manufacturing sectors in LDCs have been protected traditionally and subjected to heavy regulation, much of which favoured large enterprises directly or indirectly. The findings suggest that this unfavourable regulatory environment keeps small firms from growing into medium–sized firms, creating the missing middle pattern.

Hsieh and Klenow (2012) examined firm growth patterns across countries, finding that in the US, the average 40-year-old plant employs almost eight times as many workers as a five-year-or-younger plant, but in India firms exhibit little growth in terms of either employment or output (Mexico is intermediate to India and the USA). For India, they used ASI and NSSO data to test the effect of life cycle on aggregate productivity by a simple GE model, and found that Mexico and India experience little productivity over the life cycle – with age, Indian firms don't grow. The lower productivity is attributed to certain types of misallocations – which harm especially the large establishment. Some of the barriers mentioned by them are financial frictions, difficulty in buying land or obtaining skilled managers and the cost of shipping to distant markets.

Ghosh and Abraham (2021) challenged the missing middle phenomenon using ASI data at both aggregate and disaggregate levels. They found that after dropping the classification of data based on a priori class intervals, there was no missing middle – most firms in India are small firms. The paper argued that institutional factors, especially labour market regulations, led to the growth of small-scale industries. Methodologically, they started with a conventional bin-based size distribution, then dropped the bins and used kernel density plots to visually present the firm distribution. They used Hartigan and Hartigan (1985) diptest for testing unimodality and conducted a two-sample Kolmogorov Smirnov test for inter-sectoral variations.

Hsieh and Olken (2014) provided the most critical analysis, arguing that not only medium-sized firms but large firms are also missing in India – the distribution is smoothly declining in firm size. They found that the distribution of average product of capital and labour is unimodal and large firms have higher average productivity. Examining the regulatory and tax notches in India, Mexico and Indonesia, they found no econometrically meaningful bunching of firms near the notch points. Their key conclusion was that the missing middle is due to arbitrary transformations made to the data in previous studies, and not a real phenomenon.

2.3 Credit Constraint

Banerjee and Duflo (2014) provided direct evidence of credit constraints among larger Indian firms using variation in access to a targeted lending program to estimate whether firms are credit constrained. Their main goal was to find solid evidence of the presence or absence of credit constraints among larger firms. To test for credit constraints, they examined whether

subsidised loans merely replace market loans or actually increase investment, and showed that profit gains from additional credit exceed borrowing costs, implying that firms would borrow more if they could. They used a unique panel data set from bank loan files (1996-2002) and used two changes in India's Priority Sector Lending rules (1998 expansion and 2000 rollback) to compare with firms that gained or lost access to subsidised bank credit with similar firms whose eligibility did not change, to identify the causal effect of credit access on borrowing, investment, output and profits. They found that when firms gained access to priority sector bank credit, their borrowing, sales, and cost of profits increased, and these effects were reversed when credit access was removed. Suggesting that firms were credit constrained and that capital was inefficiently allocated in the economy, especially during 1998-2002.

Hsieh and Klenow (2009) showed that labour and capital are allocated much less efficiently across firms in China and India than in the US, with large differences in the marginal productivity of inputs across similar firms. They used plant-level manufacturing data for India, China and the USA and employed a standard model of monopolistic competition with heterogeneous firms, essentially Melitz (2003) without international trade, to show how distortions driving wedges between marginal products of capital and labour across firms will lower aggregate TFP. They found that if resources were efficiently reallocated, manufacturing TFP in China and India could increase by 30-50% and 40-60% respectively. Moreover, despite reforms of the 1990s, evidence suggests rising misallocation from 1991 to 1994.

Midrigan and Xu (2014) examined financial friction using producer-level data. They evaluate the dynamics in which financial frictions reduce TFP through two channels: first, they distort entry and technology adoption decisions, and second, they generate dispersion in the returns to capital across existing producers and thus productivity losses from misallocation. The study was based on South Korea's well-developed financial system, which was compared with China and Colombia. The findings suggest that financial frictions cannot generate large losses from misallocation as relatively more productive producers accumulate internal funds over time and quickly grow out of their borrowing constraints. However, the effect is mostly at the entry margin because financial frictions prevent new productive firms from entering and growing quickly. Once firms are established, they can self-finance through retained earnings over time.

Beck et al (2005) used a firm-level survey database covering 54 countries to investigate the effects of financial, legal and corruption problems on firms' growth rates. Their analysis drew on La Porta et al (1998), arguing that a large portion of the diversity in business finance policies and performance between countries can be explained by variation in legal and financial

systems, and Wurgler (2000) shows that growth of the financial system determines how efficiently resources are distributed to productive industries. Their results indicated that small firms are adversely affected because of financial and legal underdevelopment and corruption; especially corruption of bank officials affects firm growth.

2.4 Regulatory Constraints

Besley and Burgess (2004) addressed the charge that India's business climate is unfavourable because of the granting of excessive bargaining power to organised labour, which blunted investment incentives. They developed an econometric analysis to examine if regulation can account for the cross-state pattern of manufacturing performance over time. They found that states which amended the Industrial Dispute Act in a pro-worker direction experienced lower output, employment, investment and productivity in formal or registered manufacturing, while output in informal manufacturing was found to be increased.

Hsieh and Olken (2014) examined regulatory and tax notches in India, Mexico and Indonesia, as it is often thought that this discourages firm growth. But they were unable to find any econometrically meaningful bunching of firms near the notch points. There can be small amounts of bunching, but it is not an important driver of small firm size in India.

Nagaraj (2018) critically reanalysed the existing data to examine two widely held propositions: first, the cost of regulatory compliance under size-based labour laws is prohibitively high, due to which small firms in India remain small and second, missing middle is caused by rigid labour laws, which adversely affected productivity growth. The findings suggested that the missing middle is not caused by rigid labour laws but an artefact of widespread registration evasion and data mismeasurement. Moreover, wages grew nearly five times more slowly than productivity over four decades, which suggests that organised sector workers are not overly protected. This challenges the conventional view that labour regulations are the primary driver of the missing middle phenomenon.

Biswas and Bandyopadhyay (2021) gave an evidence-based enquiry of causes of low productivity, polarised industry structure and their relations with labour market institutions in major states of India. They used unit-level data of NSSO 73rd round for the year 2015-16 and ASI (2015-16), which they later cross-checked with NSSO 67th round for the year 2009-10 and ASI (2009-10). The findings challenged the earlier debates which focused on whether pro-labour or anti-labour policies and rigid labour laws were responsible for poor industrial growth across states, as they found that it alone is unable to explain variations in productivity and

industrial growth across states. They highlighted the need for developing a pro-business ecosystem, better access to finance and growth opportunities for small firms, as unfavourable institutional and business environments lead to a missing middle and lower productivity than labour market rigidities.

2.5 Literature Gap

Despite extensive study on the missing middle phenomenon in the Indian manufacturing landscape, several gaps remain in the existing literature that this study tries to address. Most existing studies use data before 2015. Bollard et al. (2013) use ASI data from 1993-2007; Hsieh and Klenow (2012) analyse data from 1980-2008; and Banerjee and Duflo (2014) examine bank loan files from 1996-2002. Even recent studies like Biswas and Bandyopadyaya (2021) rely on 2015-16 data, and Rabbani and Raj (2023) used data up to 2015-16. No study has extensively examined the missing middle phenomenon using more recent ASI data. The temporal gap is important as credit markets, regulatory frameworks, and institutional environments have significantly evolved since 2015, particularly following the implementation of new financial inclusion policies and labour law reforms. This study addresses this gap by using ASI unit-level data from 2016-17, 2017-18 and 2018-19, providing more current evidence on firm size distribution and credit constraints.

The majority of studies employ OLS regression or logistic frameworks rather than panel fixed effects regression. Rabbani and Raj (2023) used OLS regression to examine firm size on productivity and wages; Banerjee and Duflo (2014) used variation in lending program access with panel data but without fixed effects. While Hsieh and Olken (2014) and Ghosh and Abraham (2021) provided critical perspectives on the missing middle as a statistical artefact, they did not test credit constraints using fixed-effects methodology. Fixed-effects regression is used when individual-specific effects are correlated with independent variables, addressing potential endogeneity concerns that OLS cannot resolve (Allison, 2009; Sommet & Lipps, 2024). This study addresses this methodological gap by employing firm-level fixed effects with year fixed effects, controlling for time-invariant firm characteristics and year-specific shocks.

While a majority of studies directly or indirectly mention financial frictions as a potential mechanism for the missing middle, they do not empirically test this mechanism with appropriate methodology. Hsieh and Klenow (2012) identified that barriers include financial frictions, difficulty in buying land and obtaining skilled managers, but did not test financial frictions as a variable. Again, Midrigan and Xu (2014) studied the effect of financial frictions

on entry margin but in South Korea, China and Colombia, not India-specific. This study addresses this mechanism gap by explicitly testing credit constraint as a variable in fixed effects regression, providing empirical evidence on whether credit access affects firm size in recent Indian manufacturing data.

This study contributes to the missing middle literature by addressing three key gaps: first, the temporal gap through using recent ASI data; second, the methodological gap through employing fixed effects regression; and third, the mechanism gap through empirically testing credit constraints. These contributions are built on the critical perspectives of Hsieh and Olken (2014), Hsieh and Klenow (2012) and Ghosh and Abraham (2021), while providing empirical evidence on the credit constraint mechanism that earlier studies mentioned but did not test.

3. Data and Methodology

a. Data Source

This study uses unit -level panel data from the Annual Survey of Industries (ASI), conducted by the Ministry of Statistics and Programme Implementation (MoSPI),

Government of India (सव, n.d.). The ASI is the most comprehensive dataset in Indian Manufacturing landscape, as it includes all the factories registered under the Factories Act 1948. The analysis covered three survey rounds corresponding to the years 2016-17, 2017-18, and 2018-19, referred to throughout as 2017, 2018 and 2019, respectively. After cleaning and filtering to retain only operating factories with at least one person engaged and non-missing GVA and capital data, the final sample consists of 160,444 firm-year observations across 77,803 unique factories.

b. Variable Construction

The dependent variable is the natural logarithm of total persons engaged, $ln(FirmSize)$, which captures firm size in terms of employment. The log transformation compresses the right skew of the employment distribution and allows coefficients to be interpreted as percentage changes.

The key independent variable is the credit ratio, defined as borrowed capital divided by total capital employed, where total capital is the sum of net fixed capital and working capital. This ratio captures the share of external financing in total capital and ranges from zero to one, with higher values indicating greater reliance on borrowed funds. Firms with zero total capital are assigned missing values for this variable.

Labour productivity is measured as gross value added (GVA) per person engaged, expressed in Rs. Lakh per worker. While, GVA is computed as total output minus total input. Capital intensity is measured as net fixed capital per person engaged, also expressed in Rs. Lakh per worker. Firm age is computed as the difference between the survey year and the year of initial production reported in the ASI schedule.

c. Firm Size Classification and Outlier Treatment

Firms are classified into three categories based on total persons engaged: small (fewer than 50 workers), medium (50 to 199 workers), and large (200 or more workers). The 200-workers threshold demarcates large-scale manufacturing.

Winsorisation at the 1st and 99th percentiles were applied to three variables – labour productivity, capital intensity and credit ratio-to prevent extreme observations from dominating regression estimates. This approach retains all observations while limiting the influence of outliers arising from near-zero denominators or data-entry anomalies. Firm size was not winsorised as the log transformation sufficiently compresses the distribution.

d. Econometric Framework

To examine the relationship between credit dependency and firm size, the following two-way fixed effects model is estimated:

$$\ln(firmSize)\, i_t = \beta_0 + \beta_1 Credit\, i_t + \beta_2 Productivity\, i_t + \beta_3 CapitalIntensity\, i_t + \beta_4 FirmAge\, i_t + \alpha_i + \lambda_t + \varepsilon i_t$$

Where i denotes the firm and t denotes the year. α_i represents the firm fixed effects that absorb all time-invariant unobserved firm-level heterogeneity such as managerial quality, location advantages, and industry-specific characteristics. λ_t represents year fixed effects that absorb common macroeconomic shocks affecting all firms in a given year, such as demonstration effects and GST implementation. εi_t is the idiosyncratic(random) error term.

The empirical analysis employs a two-way fixed effects model controlling for firm and year fixed effects. The model is estimated using the feols function in the R statistical package. To account for serial correlation in outcomes within the same factory across years, standard errors are clustered at the firm level. Again, ASI survey multiplier weights are assigned to account for the sampling design.

The choice between fixed effects and random effects estimator is determined by the Hausman specification test. The null hypothesis of random effects consistency was strongly rejected ($\chi^2 = 699.5, df = 4, p < 2.2 \times 10^{-16}$) confirming that firm-level unobservables are correlated with the regressors. Therefore, the fixed effects estimation model is appropriate and a consistent estimator for this panel.

To assess the robustness of the main findings, additional specifications were estimated. First, the regression is re-estimated on a balanced panel restricted to firms observed in all three years and second, the credit ratio is lagged by one year and used to predict current firm size, which addresses potential reverse causality. The detailed results of the robustness check are given in Appendix B (Table B2).

e. Formal and Informal Sector Comparison

To contextualise the scale of formal manufacturing relative to the informal sector, ASI 2016-17 formal sector estimates are compared with the figures from the MSME Annual Report 2018-19 about the National Sample Survey 73rd round taken during the period of 2015-16 (*MSME Annual Report*), which is the most recent available survey of informal manufacturing enterprises. The one-year gap between the two sources is a data limitation acknowledged in the analysis, as no informal sector survey precisely matching the ASI reference years is available. Formal sector statistics are population-weighted using ASI multipliers. The comparison table is provided in Appendix A.

4. Results and Analysis

a. Descriptive Analysis

This section provides the descriptive evidence of firms in India's manufacturing sector. The corresponding distribution of employment and productivity differential across firm size is derived from the unit-level data of ASI for the years 2016-17, 2017-18 and 2018-19. Based on a standard employment-based threshold, firms are classified into small, medium and large.

i. Firm Distribution by Size

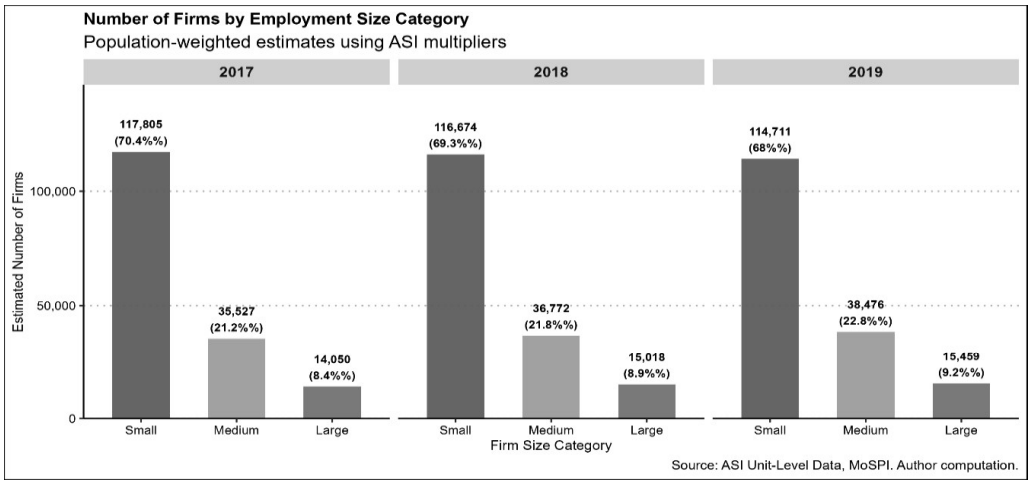

***Figure 1**: Number of Firms by Employment Size Category*

***Source(s):** Authors' own computation*

Figure 1 shows that small firms constitute an overwhelming part of registered manufacturing establishments, with 70.4% in 2017, moderating only marginally to 68% in 2019. Medium firms represent a smaller share compared to small firms, that is, 21.2%, rising modestly to 22.8% over the same period. On the contrary, large firms remain the smallest category by count, at 8.4% in 2017 and 9.2% in 2019. In absolute terms, the estimated number of small firms declined from 117,805 to 114,711 over the three periods. The counts of medium and large firms rose over the same period.

ii. Employment Distribution by Size

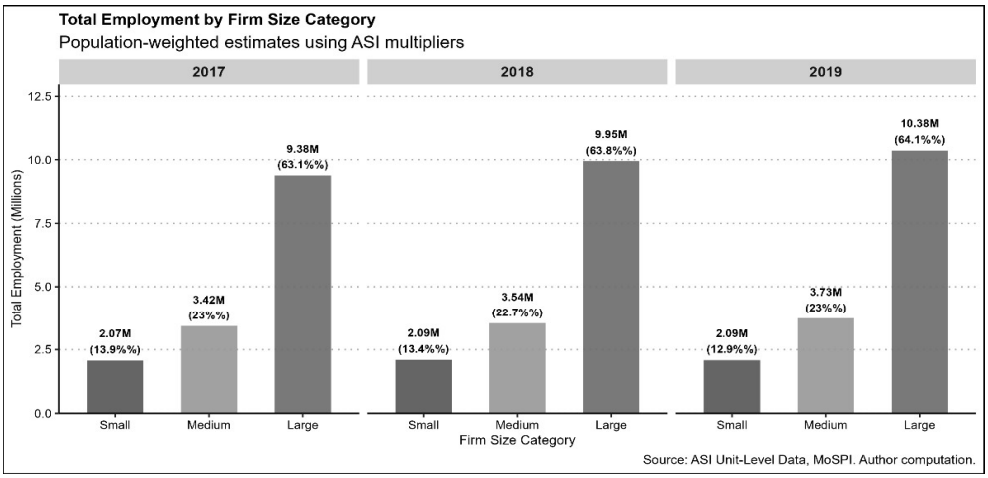

***Figure 2**: Total Employment by Firm Size Category*

***Source(s):** Authors' own computation*

Figure 2 reveals a striking inversion of the pattern observed in firm counts. Despite comprising over two-thirds of all firms, small firms employed only 13.9% of total employment in 2017, a share that declined to 12.9%. In contrast, large firms account for less than one-tenth, but they generate the majority of manufacturing employment, that is, 63.1% in 2017, rising to 64.1% in 2019. Medium firms remain static in both 2017 and 2019 (i.e. 23%), but faced a slight drop in 2018 to 22.7%, while in absolute terms of employment, medium firms rose from 3.42M to 3.73M.

iii. Productivity Differential by Size

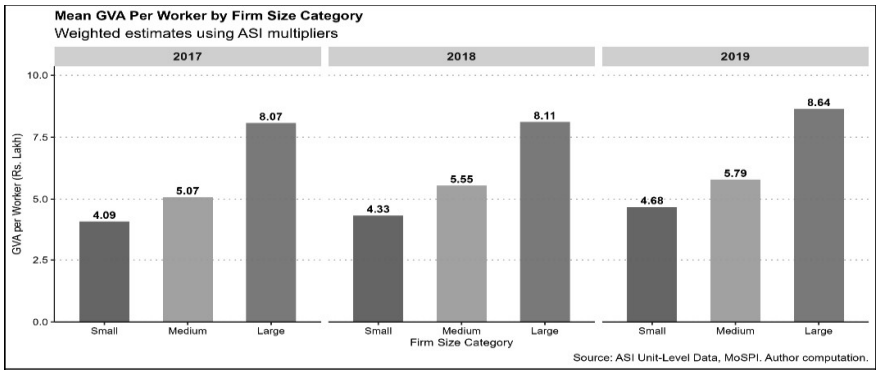

Figure 3: *Mean Gross Value Added Per worker by Firm Size Category*

Source(s): *Authors' own computation*

Figure 3 shows that labour productivity, that is measured as mean GVA per worker, rises sharply and monotonically with firm size across all the periods; the result is consistent with Rabbani and Raj (2023) and Bollard et al. (2013). Large firms generate more than double the productivity of small firms, that is, 8.07 against 4.09 in 2017. Medium size firm occupies an intermediate position at 5.07 lakh per worker in 2017 and 5.79 lakh per worker in 2019. The productivity rises for all three categories over the period – almost 14% for small and medium, 7% for large firms in percentage terms. But the absolute productivity gap between small and large firms more or less remained the same (3.98 lakh in 2017 to 3.96 lakh in 2019). Therefore, the productivity divide is something natural and structural rather than transitional.

iv. Credit Ratio, Productivity and Capital Intensity by Firm Size

Table 1 summarises the mean credit ratio, labour productivity and capital intensity across the three categories of firm size.

Table 1: *Summary by Size: Credit Ratio, Productivity and Capital Intensity*

Year	Firm Size	Mean Productivity (Rs. Lakh/Worker)	Mean Capital Intensity (Rs. Lakh/Worker)	Mean Credit Ratio (%)
2017	Small	4.1	7.6	39.6
2017	Medium	5.1	8.2	36.9
2017	Large	8.1	14.2	31.8
2018	Small	4.3	7.6	40.9
2018	Medium	5.6	8.3	37.4
2018	Large	8.1	13.9	31.0
2019	Small	4.7	8.3	39.3
2019	Medium	5.8	8.6	35.6
2019	Large	8.6	14.3	29.5

Source(s): *Authors' own computation*

From Table 1, three clear patterns emerge. The first one is that labour productivity rises consistently with firm size across all three periods, a pattern similar to Figure 3. In 2017, small firms' mean GVA per worker stood at 4.1 lakh, rising to 5.1 Lakh for medium firms and 8.1 lakh for large firms. This pattern persisted in 2019 also, as small firms stood at 4.7 lakh and large firms' productivity rose to 8.6 lakh. Second, capital intensity – measured as net fixed capital per worker- also increases with firm size. In 2017, the capital intensity of small firms was 7.6 lakh per worker compared to 14.2 lakh for large firms. By 2019, these figures stood at 8.3 lakh for small firms and 14.3 lakh for large firms; compared to small firms, large firms were employing nearly twice the capital per worker across all three years. Third, the mean credit ratio – borrowed capital as a share of total capital employed- displays an inverse relationship with firm size. Small firms exhibit the highest borrowing ratio at 39.6% in 2017, compared to 36.9% for medium firms and 31.8% for large firms. This pattern persists across all three years, as in 2019 the large firms' credit ratio declined to 29.5, while the small firms remain elevated at 39.3. This suggests that smaller firms rely more heavily on external financing as compared to their total capital base – these findings motivate the econometric analysis presented in section 4.2.

b. Regression Analysis

This section deals with the analysis of regression results. Table 2 reports a three-way specification: the preferred two-way fixed effects model, a firm fixed effects model only excluding year effects, and a specification excluding capital intensity.

Table 2: *Determinants of Firm Size — Fixed Effects Panel Regression*

Variable	Two-Way FE	Firm FE Only	No Cap Intensity
Credit (Borrowed/Total Capital)	-0.0449***	-0.0451***	-0.0482***
	(0.0091)	(0.0091)	(0.0090)
Labor Productivity (Rs. Lakh/Worker)	0.0220***	0.0221***	0.0191***
	(0.0008)	(0.0008)	(0.0007)
Capital Intensity (Rs. Lakh/Worker)	-0.0025***	-0.0025***	
	(0.0003)	(0.0003)	
Firm Age (Years)	-0.0008**	-0.0008**	-0.0005
	(0.0004)	(0.0004)	(0.0004)
Observations	139385	139385	139385
Adj. R2	0.2801	0.2800	0.2791
RMSE	1.0479	1.0480	1.0477
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	No	Yes

Source(s): *Authors' own computation*

Note: ** p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors clustered at firm level in parentheses. Survey multiplier weights applied throughout. Productivity and Capital Intensity in Rs. Lakh per worker. Credit is ratio of borrowed to total capital (0 to 1).*

The credit ratio coefficient is negative and statistically significant across all three specifications at the 1% level, ranging from -0.0449*** to -0.0482***. In the preferred two-way fixed-effects model, a one-unit (100%) increase in the credit ratio is associated with a 4.49% decrease in firm size, holding firm and year fixed effects constant. The coefficient is remarkably stable across all three specifications – it changes negligibly when year fixed effects are dropped and strengthens only a little when capital intensity is excluded.

Labour productivity is positively and significantly associated with firm size across all specifications (0.0191 to 0.0221, $p<0.01$), which means a one lakh per worker increase in GVA

per worker is associated with a 2.0 to 2.2 % increase in firm size. Capital intensity is negatively and significantly associated with firm size (-0.0025***) in both specifications where it is included, suggesting a degree of substitutability between capital and labour; firms that deepen more on capital per worker do not necessarily expand employment proportionately. Firm age is negatively associated with firm size (-0.0008**) in two specifications when capital intensity is included, but loses statistical significance when capital intensity is dropped. This suggests that age's effect on firm size is modest and somewhat sensitive to model specification.

The model explains approximately 28% of within-firm variation in employment size and a nearly identical RMSE across all three specifications, indicating that the firm and year fixed effects absorb the bulk of variation in firm size.

5. Discussion and Synthesis

The descriptive and regression evidence presented above tells us a consistent picture of India's manufacturing landscape. At one end, a large number of small firms in count but contribute less to employment and productivity, while on the other end a small number of large firms provide the highest contribution to both employment and productivity. Both these extreme ends are connected by a thin base of medium-sized firms.

On a positive note, the manufacturing sector as a whole is not stagnant; both medium and large firms exhibit growth over the panel period in absolute firm counts, employment and productivity. Medium firm employment rose by 3.42 million workers to 3.73 million workers, and large firm employment rose from 9.38 million workers to 10.38 million workers. But the issue is that the underlying structure is barely shifting. Small firms continue to dominate by count (almost 70%), while contributing a small share to both employment and productivity. Medium firms – the category that should represent the pathway of transition remain thin and slow, with their static share of both firm count (Figure 1) and employment (Figure 2) across all the years. If small firms were scaling up successfully, then the medium category would expand meaningfully as firms transition through it; instead, its near-static share suggests that very few firms are making the small-to-medium or medium-to-large transition phase. The issue is not the absence of medium-sized firms, but that too few firms are passing through this category on a growth trajectory, leaving it thin relative to both ends of the distribution.

The regression results from Table 2 offer a possible reason for this pattern. The negative and highly significant credit ratio coefficient indicates that the firms that rely more on borrowings are small in size - a relationship that is corroborated descriptively by the monotonic

decline in mean credit ratio with firm size (Table2). Since the small firms carry the highest credit ratio and large firms the lowest, this is consistent with a credit constraint interpretation that the firms face constraints in accessing cheaper capital or there is a burden of debt servicing. This can be a reason why the small firms remain small rather than transitioning upward. Since productivity also monotonically rises with firm size and productivity gains from small size haven't closed the absolute gap with large firms over the panel. Therefore, low productivity may itself constrain a firm's ability to generate enough internal resources and creditworthiness needed to grow, indicating a potential feedback loop between low productivity, high debt reliance and persistent small size.

6. Conclusion

This study tries to examine the missing middle phenomenon in the Indian formal manufacturing sector using ASI unit-level data for the years 2016-17, 2017-18 and 2018-19. The main motive was to examine firm size distribution, document productivity differential across size categories and directly test credit access. For the ease of analysis, all firms are classified into small, medium and large based on standard employment-based thresholds. The descriptive analysis showed that in the Indian formal manufacturing sector, small firms are the highest by count, but their contribution to productivity and employment is too low. On the other hand, large firms are small in count but contribute the highest to both employment and productivity; both these extreme ends are connected with a thin layer of medium-sized firms. Medium size firm is considered as the stepping stone for growth as this is the transition phase from which small firms grow into large firms. The regression results showed that small firms carry the highest credit ratio while large firms the lowest, which can be a reason why small firms are not able to transition upward.

This study is also subject to several limitations. First, only the formal manufacturing sector was discussed, while the informal sector constitutes a vast majority in the Indian manufacturing landscape. Second is that the credit variable measures the ratio of borrowed to total capital rather than the unmet credit demand - which is not directly observable in ASI data. Therefore, future research should focus on both formal and informal data, and a more direct test of credit constraint should be employed. Moreover, a bunching analysis to examine whether the firm size distributions display a clustering around just below the employment regulatory threshold - particularly the 100-worker threshold under the Industrial Dispute Act - would provide strong empirical evidence.

Appendix A

Formal and Informal Comparison Table

Sector	No. Enterprises	Total Employment	Output Per Worker
Formal Manufacturing (ASI 2016-17)	167382	14870604	463424.4639
Informal Manufacturing (NSS 73rd Round 2015-16)	19665000	36041000	NA

Appendix B

Table B2: *Robustness Check Table*

	Balanced Panel	Lagged Credit
Credit (Borrowed/Total Capital)	-0.0583***	
	(0.0118)	
Labour Productivity (Rs. Lakh/Worker)	0.0223***	0.0220***
	(0.0011)	(0.0008)
Capital Intensity (Rs. Lakh/Worker)	-0.0021***	-0.0025***
	(0.0004)	(0.0003)
Firm Age (Years)	-0.0006	-0.0008**
	(0.0005)	(0.0004)
Credit Lag (Borrowed/Total Capital)		-0.0449***
		(0.0091)
Observations	75441	139385
Adj. R2	0.2739	0.2801
RMSE	1.1178	1.0479
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
* p < 0.1, ** p < 0.05, *** p < 0.01		

Note: **p<0.1, **p<0.05, ***p<0.01. Standard errors are clustered at the firm level in parentheses. Survey multiplier weights applied throughout. Balanced panel restricted to firms observed in all three years. Lagged credit addresses potential reverse causality.*

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