

Manufacturing Stagnation, Gig Economy Stratification, and Financial Precarity in India: A Simulation-Based Quantitative Analysis

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Abstract

India's labour market is undergoing significant structural transformation characterised by limited manufacturing employment growth, expansion of service-sector employment, and the rapid emergence of platform-mediated work. At the same time, access to economically advantageous forms of employment remains uneven across social and educational groups. This study develops a simulation-based quantitative framework to examine three interconnected dimensions of these transformations: manufacturing stagnation and urban service-sector growth, socio-economic barriers to participation in high-skill gig work, and financial disparities across formal, gig, and traditional informal employment. The study uses simulated datasets designed to reflect the broad characteristics and analytical structure of large-scale Indian labour-market and household surveys, including the Periodic Labour Force Survey and the Consumer Pyramids Household Survey. Three analytical approaches are employed. First, time-trend regression is used to compare changes in manufacturing and informal urban service employment. Second, logistic regression is used to examine the association of social group, education, vocational training, and demographic characteristics with participation in high-skill gig work. Third, analysis of variance and post-hoc comparisons are used to assess differences in income volatility, savings rates, and debt-to-income ratios across employment categories. The simulated results illustrate a pattern of relatively stagnant manufacturing employment alongside growth in informal urban services. They further demonstrate how educational attainment and vocational training may be associated with greater participation in high-skill gig work, while historically disadvantaged social groups may face structural barriers to entry. The financial analysis illustrates greater income volatility, lower savings, and higher debt burdens among gig workers relative to formal salaried workers. The study demonstrates an analytical framework for investigating structural transformation, labour-market stratification, and financial precarity. This framework is applicable to actual unit-level survey data in future research.

Keywords: India; labour market; manufacturing; gig economy; platform work; social stratification; financial precarity; income volatility; vocational training; simulation-based analysis.

1. Introduction

India's pattern of economic transformation differs in important respects from the conventional trajectory of industrialisation observed in several East Asian economies. While the services sector has expanded rapidly, the manufacturing sector has not generated employment at a comparable scale. This pattern has contributed to continuing concerns regarding structural transformation, employment generation, and the capacity of manufacturing to absorb India's expanding workforce. The limited expansion of manufacturing employment has coincided with the growth of informal and service-sector employment. More recently, digital platforms have created new forms of work and income generation. Platform-mediated employment, commonly described as gig or platform work, includes a diverse range of activities requiring different levels of skill, education, capital, and technological access. These opportunities range from delivery and transportation services to skilled home services, technical work, and professional services.

However, the expansion of the gig economy does not necessarily imply equal access to economic opportunities. Participation in more skilled and potentially higher-paying forms of platform work may depend on educational attainment, vocational training, financial resources, social networks, digital access, and broader social structures. Consequently, the growth of platform-mediated employment may reproduce or transform existing forms of labour-market inequality.

A second concern relates to the quality and stability of employment. Gig work may offer flexibility and new income opportunities, but workers may also experience irregular earnings, limited employment protection, and responsibility for managing work-related risks. Financial well-being, therefore, cannot be assessed solely through average income. Income volatility, savings capacity, and debt burdens are also important indicators of economic security.

This study develops a quantitative framework for examining these interconnected dimensions of labour-market transformation. It focuses on three broad questions. First, how can changes in manufacturing and urban service employment be analysed within a structural transformation framework? Second, how can socio-economic characteristics be incorporated into an analysis of participation in higher-skilled forms of gig work? Third, how can financial vulnerability be compared across formal, gig, and traditional informal employment?

Because the present study uses simulated datasets, its purpose is methodological and illustrative rather than empirical. The analysis demonstrates how time-trend regression, logistic regression, analysis of variance, and post-hoc comparisons can be integrated to study labour-market transformation and financial inequality.

The study contributes in three ways. First, it brings together structural transformation and the gig economy within a common analytical framework. Second, it demonstrates how social and human-capital variables can be incorporated into the analysis of labour-market stratification. Third, it moves beyond average income by considering income volatility, savings, and debt as indicators of financial precarity.

2. Literature Review

2.1 Structural Transformation and Manufacturing Employment

Economic development has historically been associated with the movement of labour from agriculture to manufacturing and subsequently towards higher-productivity services. Manufacturing has traditionally played a central role in employment generation because it can absorb large numbers of workers while contributing to productivity growth and industrial development.

India's structural transformation has followed a more complex pattern. The rapid expansion of services has not always been accompanied by proportional growth in manufacturing employment. This has generated concerns about premature deindustrialisation and the possibility that developing economies may shift towards services before establishing a sufficiently large manufacturing base.

The consequences of this pattern are particularly important in a country with a large and diverse labour force. If manufacturing employment remains limited, workers may increasingly depend on informal services, self-employment, casual work, and platform-mediated activities. These forms of employment may provide income opportunities but may also involve greater insecurity and limited access to social protection.

2.2 The Emergence of the Gig and Platform Economy

Digital platforms have transformed the organisation of work by connecting consumers and workers through technology-based systems. The platform economy includes transportation, delivery, home services, professional services, digital freelancing, and other forms of on-demand work.

The growth of platform work has created opportunities for workers to access markets and customers that may previously have been difficult to reach. Platforms may also provide training, digital infrastructure, customer acquisition, and payment systems.

At the same time, platform work has raised important concerns regarding employment security, income stability, social protection, and worker autonomy. Workers may experience fluctuating demand, dependence on platform algorithms, changes in commission structures, and limited access to traditional employment benefits.

The gig economy should therefore not be treated as a homogeneous category. Workers differ substantially in their skills, occupations, earnings, bargaining power, and dependence on platforms.

2.3 Social Stratification and Access to Economic Opportunity

Labour-market opportunities are shaped by more than individual productivity and education. Social background, access to networks, historical disadvantage, and unequal access to resources may influence occupational mobility.

Education and vocational training are particularly important in determining access to skilled employment. Workers with technical qualifications or specialised skills may be better positioned to enter professional or higher-skilled service occupations. However, access to education and training may itself be unequal. Historically disadvantaged groups may

face barriers related to educational opportunities, financial resources, social networks, and occupational segregation. The emergence of digital platforms does not automatically eliminate these inequalities. Instead, new forms of work may interact with existing social structures. An analysis of gig work should therefore consider both individual human capital and broader social characteristics.

2.4 Financial Precarity and Employment

Employment quality cannot be measured solely through monthly income. A worker may earn a relatively high income but still experience financial insecurity if earnings fluctuate substantially or if debt obligations are high.

Three indicators are particularly relevant:

1. **Income volatility**, which captures fluctuations in earnings over time.
2. **Savings rate**, which indicates the ability to retain income after consumption expenditure.
3. **Debt-to-income ratio**, which reflects the relationship between financial liabilities and income.

Formal salaried employment may provide relatively predictable earnings and access to employment-related benefits. In contrast, gig workers may experience fluctuations in demand and income. Traditional informal workers may face different forms of insecurity, including irregular employment and limited social protection. Comparing these employment categories provides a broader understanding of financial vulnerability.

3. Research Gap

Existing research has examined structural transformation, informal employment, caste-based inequality, and platform work. However, these issues are often analysed separately.

There is a need for analytical frameworks that connect:

- manufacturing stagnation and employment transformation;
- the growth of service and platform-mediated work;
- social and educational inequalities in access to skilled employment; and
- financial consequences of different forms of employment.

The present study addresses this gap by developing an integrated quantitative framework. It demonstrates how multiple statistical techniques can be used to examine these relationships within a common analytical design.

4. Research Objectives

The study has the following objectives:

1. To examine the relationship between manufacturing employment stagnation and the growth of informal urban services.
2. To analyse the socio-economic and demographic factors associated with participation in high-skill gig work.
3. To compare income volatility, savings rates, and debt-to-income ratios across formal salaried workers, high-skill gig workers, low-skill gig workers, and traditional informal workers.
4. To demonstrate a quantitative methodological framework that can subsequently be applied to actual labour-market and household survey data.

5. Research Questions

The study addresses the following research questions:

1.RQ1: How can employment trends in manufacturing and informal urban services be compared using time-trend analysis?

2.RQ2: What role do social group, education, and vocational training play in explaining participation in high-skill gig work?

3.RQ3: How do income volatility, savings rates, and debt-to-income ratios differ across formal, gig, and traditional informal employment?

6. Hypotheses

H1: Manufacturing Stagnation and Urban Service Growth

Manufacturing employment is expected to show a statistically insignificant change or a declining trend, while informal urban service employment is expected to demonstrate a positive trend.

H2: Stratification in Access to High-Skill Gig Work

Education and vocational training are expected to be positively associated with participation in high-skill gig work. Social disadvantage is expected to be associated with a lower probability of participation after controlling for demographic characteristics.

H3: Financial Precarity of Gig Workers

Gig workers are expected to demonstrate:

H3a: Higher income volatility than formal salaried workers.

H3b: Lower savings rates and higher debt-to-income ratios than formal salaried workers.

7. Data and Methodology

This study used simulated datasets modelled after the PLFS and CMIE-CPHS (CMIE, 2022). Regression and ANOVA analyses were conducted to test the hypotheses of this study. Logistic regression was used to assess socioeconomic predictors of high-skill gig participation, following frameworks similar to those used in the ILO's global digital labor research (Berg et al., 2018; Rani & Furrer, 2021). For this demonstration, data were simulated to mimic the characteristics of the following real-world datasets:

Data Source:

- Periodic Labor Force Survey (PLFS), National Sample Survey Office (NSSO): This simulated dataset is designed to represent annual unit-level data, providing information on employment, industry (NIC), occupation (NCO), education, and social groups (caste).
- Center for Monitoring Indian Economy - Consumer Pyramids Household Survey (CMIE-CPHS): This simulated dataset is structured as a panel, allowing for the tracking of individuals over time and providing detailed data on income, consumption, assets and liabilities.

7.1 Research Design

The study adopts a quantitative simulation-based research design combining longitudinal and cross-sectional analytical approaches. The datasets used in this study are simulated to reflect the broad structure and characteristics of large-scale labour-market and household surveys. The simulations are designed exclusively to demonstrate the application of statistical methods.

7.2 Analytical Framework

The study consists of three analytical components.

Component 1: Employment Trends

A time-trend regression framework is used to compare manufacturing employment shares with informal urban service employment shares.

Component 2: Participation in High-Skill Gig Work

A logistic regression model is used to estimate the association between socio-economic characteristics and the probability of participation in high-skill gig work.

Component 3: Financial Outcomes

ANOVA and post-hoc comparisons are used to examine differences in financial indicators across employment groups.

7.3 Employment Categories

Workers are classified into four analytical categories:

Formal Salaried Workers: Regular wage and salaried workers with relatively stable employment arrangements.

High-Skill Gig Workers: Workers engaged in skilled service activities represented through occupational proxies.

Low-Skill Gig Workers: Workers represented through service occupations requiring comparatively lower levels of formal or technical skills.

Traditional Informal Workers: Casual workers and non-platform informal self-employed workers.

These classifications are analytical proxies. Future empirical research should use direct measures of platform work wherever possible.

7.4 Variables

Dependent Variables

The primary dependent variables include:

- Manufacturing employment share
- Urban service employment share
- Participation in high-skill gig work
- Income volatility
- Savings rate
- Debt-to-income ratio

Independent Variables

The explanatory variables include:

- Social group
- Education
- Vocational training
- Age
- Age squared
- Gender
- Geographic controls

8. Analytical Methods

8.1 Time-Trend Regression

The employment trend model is expressed as:

$$\text{Employment Share}_t = \alpha + \beta \text{Year}_t + \varepsilon_t$$

where:

- Employment Share represents the sector's share of employment;
- Year represents the time trend;
- β represents the direction and magnitude of change;
- ε represents the error term.

The analysis is used to illustrate whether employment shares demonstrate a statistically meaningful trend over the simulated period.

8.2 Logistic Regression

The probability of participation in high-skill gig work is estimated using a logistic regression model:

$$\text{Logit}(P_i) = \beta_0 + \beta_1 \text{SocialGroup}_i + \beta_2 \text{Education}_i + \beta_3 \text{Training}_i + \beta_4 \text{Age}_i + \beta_5 \text{Age}^2_i + \beta_6 \text{Gender}_i + \beta_7 \text{Location}_i + \varepsilon_i$$

The model estimates the association between individual characteristics and the probability of belonging to the high-skill gig worker category.

8.3 Financial Outcome Analysis

The study examines four indicators:

Indicator	Description	Formula/Measurement
Mean Monthly Income	Average monthly earnings of workers in each employment category.	Total Monthly Income $\div$ Number of Workers
Income Volatility	Measures the variation or fluctuation in income. It is represented by the Coefficient of Variation (CV).	CV = Standard Deviation of Income $\div$ Mean Income
Savings Rate	Measures the proportion of income that remains after consumption expenditure.	Savings Rate = (Income – Consumption Expenditure) $\div$ Income
Debt-to-Income Ratio	Measures the proportion of total liabilities relative to annual income.	Debt-to-Income Ratio = Total Liabilities $\div$ Annual Income

Differences across employment groups are assessed using ANOVA. When the overall test indicates statistically significant differences, post-hoc comparisons are used to identify group-level differences.

9. Results

9.1 Manufacturing and Urban Service Employment Trends

The simulated time-trend analysis illustrates a relatively weak and statistically insignificant trend in manufacturing employment. In contrast, informal urban service employment demonstrates a positive and statistically significant trend. The manufacturing model has limited explanatory power, suggesting that the simulated manufacturing share does not exhibit a strong linear change over the study period. The urban services model, however, demonstrates a substantially stronger association with time. These results provide illustrative support for the structural transformation hypothesis that employment growth may increasingly occur outside manufacturing, particularly in urban service activities.

9.2 Socio-Economic Predictors of High-Skill Gig Work

The simulated logistic regression illustrates significant associations between social group, education, vocational training, and participation in high-skill gig work. Higher educational attainment is positively associated with the probability of participation in the high-skill gig category. Vocational training also demonstrates a positive association. The simulated results further indicate that historically disadvantaged social groups may face lower probabilities of participation in high-

skill gig work after accounting for other characteristics. These findings illustrate the importance of considering structural inequalities alongside individual human capital when analysing access to new forms of employment.

9.3 Financial Outcomes Across Employment Categories

The simulated ANOVA results indicate statistically significant differences in financial outcomes across employment categories. The most consistent pattern is observed in the following indicators:

Income Volatility

Both high-skill and low-skill gig workers demonstrate greater income volatility than formal salaried workers in the simulated data.

Savings Rate

Gig workers demonstrate lower savings rates than formal salaried workers. The difference between high-skill and low-skill gig workers is not statistically significant in the simulated analysis.

Debt-to-Income Ratio

Both categories of gig workers demonstrate higher debt-to-income ratios than formal salaried workers. Together, these patterns illustrate how financial vulnerability may persist even when workers have access to income-generating opportunities through digital platforms.

9.4 Interpretation of Income Differences

The ANOVA indicates statistically significant differences in mean income across employment categories.

10. Discussion

The simulation-based analysis provides an integrated framework for examining contemporary changes in India's labour market.

First, the simulated employment trends illustrate a divergence between manufacturing and urban services. Second, the analysis demonstrates the potential importance of education, vocational training, and social background in shaping access to skilled forms of platform-mediated work. The expansion of digital labour markets does not necessarily eliminate existing inequalities. Access to skills, resources, technology, and networks may continue to influence employment opportunities. Third, the financial analysis highlights the importance of moving beyond average income when evaluating employment quality. Income volatility, limited savings, and high debt burdens can create financial insecurity even when workers have access to regular work opportunities. The combined analysis suggests that labour-market transformation should be evaluated across multiple dimensions: employment quantity, employment quality, social access, and financial security.

11. Policy Implications

Although the results are illustrative, the analytical framework identifies several important areas for future policy and empirical investigation. Industrial policy should consider employment generation alongside investment and output growth. Labour-intensive manufacturing may remain important for expanding opportunities for workers with different levels of education and skills. Vocational and technical training programmes should be designed to improve access to emerging occupations. Special attention should be given to groups that may face barriers to acquiring market-relevant skills. The growth of platform work raises important questions regarding income security and financial vulnerability. Policies relating to insurance, social security, emergency income support, and retirement protection require continued attention.

12. Limitations

The study has several important limitations.

First, the analysis is based on simulated data. The findings therefore cannot be generalised as direct evidence of actual labour-market conditions in India. Second, high-skill and low-skill gig work are represented through analytical proxies. Actual survey data may classify platform workers differently. Third, the analysis identifies statistical associations rather

than causal relationships. Fourth, the limited number of simulated observations in the time-trend analysis restricts the reliability of regression-based inference. Fifth, the income comparison requires further verification because the original results contain inconsistent interpretations of pairwise differences.

13. Future Research

Future research should prioritise the following areas:

1. Analysis using actual PLFS unit-level data.
2. Use of verified household and financial data.
3. Direct identification of platform workers.
4. Longitudinal analysis of income and employment transitions.
5. Investigation of gender and regional differences.
6. Analysis of social security coverage.
7. Examination of the relationship between platform dependence and financial vulnerability.
8. Comparative studies across different types of digital platforms.

14. Conclusion

India's labour market is experiencing important structural changes associated with the limited expansion of manufacturing employment, the growth of services, and the emergence of platform-mediated work. Understanding these transformations requires attention not only to employment levels but also to social access, skill formation, income stability, and financial security. This study develops a simulation-based quantitative framework for examining these interconnected issues. The analysis illustrates how time-trend regression can be used to study employment transformation, how logistic regression can examine socio-economic predictors of participation in skilled gig work, and how comparative statistical methods can assess financial differences across employment categories. The simulated findings suggest a framework in which manufacturing stagnation may coexist with service-sector expansion, while access to higher-skilled forms of gig work may be associated with education, training, and social characteristics. The financial analysis further illustrates the possibility that gig workers may experience greater income volatility, lower savings, and higher debt burdens than formal salaried worker. However, these findings are illustrative, it provides an integrated analytical framework that can be applied to actual labour-market and household survey data. Future research using verified unit-level data will be necessary to test these relationships empirically and provide stronger evidence for labour-market and social protection policy.

References:

1. Autor, D. H., Dorn, D., & Hanson, G. H. (2016). The China shock: Learning from labor-market adjustment to large changes in trade. *Annual Review of Economics*, 8(1), 205–240.
2. Berg, J., Furrer, M., Harmon, E., Rani, U., & Silberman, M. S. (2018). Digital labour platforms and the future of work: Towards decent work in the online world. International Labour Organization.
3. Centre for Monitoring Indian Economy. (2022). Consumer Pyramids Household Survey (CPHS): Database and methodology. CMIE.
4. Das, M. B., & Mehta, S. K. (2012). A glass half full: The promise of regional cooperation in South Asia. World Bank.
5. Deshpande, A. (2011). The grammar of caste: Economic discrimination in contemporary India. Oxford University Press.
6. International Labour Organization. (2021). World employment and social outlook 2021: The role of digital labour platforms in transforming the world of work. ILO.

7. Kannan, K. P., & Raveendran, G. (2021). From jobless growth to job loss growth: Gainers and losers during 2012–18. *Economic and Political Weekly*, 56(9), 45–54.
8. Mehrotra, S., & Gandhi, A. (2020). *India's employment crisis: Rising education and declining opportunities*. Cambridge University Press.
9. National Sample Survey Office. (Various years). *Periodic Labour Force Survey (PLFS): Annual report*. Ministry of Statistics and Programme Implementation, Government of India.
10. NITI Aayog. (2022). *India's booming gig and platform economy: Perspectives and recommendations for the future of work*. Government of India.
11. Organisation for Economic Co-operation and Development. (2023). *The platform economy and employment: Policy implications*. OECD Publishing.
12. Papola, T. S., & Sharma, A. N. (Eds.). (2020). *Structural change and employment in India*. Oxford University Press.
13. Rani, U., & Furrer, M. (2021). Digital labour platforms and new forms of flexible work in developing countries: Algorithmic management of work and workers. *Competition & Change*, 25(2), 212–236.
14. Rani, U., & Furrer, M. (2021). *On-demand work: Precarious but profitable? Understanding platform work in India*. ILO Working Paper Series.