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Inclusion, access and accumulation: a study of informal enterprises in India

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Abstract: This study examines the facets of SDG 8 by assessing the socio-economic access accessible to informal companies in India. The research is founded on the theory of access articulated by Ribot and Peluso (2003). It examines access to credit, institutions, technology, workforce, regional development, and access via social identities by Indian informal firms to assess the inclusive growth of small Indian businesses. We utilised data from the National Sample Survey Organisation (NSSO) regarding the economic characteristics of informal enterprises in India. The quantile regression model was the most effective instrument for analysing the impact of explanatory factors across various degrees of capital accumulation. Our findings indicate that access to capital, institutions, technology, labour, and regional development favourably impacts the growth of informal companies and fosters inclusive growth in India. Nonetheless, access through identities related to gender and social background remains a significant issue that necessitates a focused and comprehensive policy response.

Keywords: capital accumulation; theory of access; Sustainable Development Goal; inclusive growth; women entrepreneurship; small business; India.

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1 Introduction

Sustainable Development Goal (SDG) 8 aims to achieve inclusive and sustainable economic growth and ensure decent work for all individuals. In a developing nation such as India, it constitutes a primary policy priority. In India, inclusive economic growth and development is an imperative for sustainable economic growth. This can be accomplished by ensuring that the advantages of economic growth are accessible to everybody, rather than a privileged few. This renders it imperative to tackle the difficulties associated with social and economic exclusions. SDG 8 emphasises the significance of access to work opportunities, financial services, economic resources and rights. To achieve this objective, governments must prioritise enhancing access to resources and opportunities for all societal segments, particularly the disadvantaged and marginalised groups. The Indian economy consists of both formal and informal sectors. The informal sector constitutes the predominant source of employment in India. It engages over 92% of the workforce and generates roughly 60% to the net domestic product (Kulshreshtha, 2011). Examining the duality of sectors articulated by Lewis (1954), it becomes evident that the capitalist sector must increase for a country to achieve growth. Nonetheless, it cannot develop in isolation while disregarding the advancements of the subsistence sector. In examining the growth drivers of rising economies such as India, it is essential to comprehend the significance of the informal sector inside these economies. Since gaining independence, India has experienced significant transformations in its economic policies, evolving from central planning, five-year plans, and the licence raj to liberalisation, privatisation and globalisation. The Indian economy is steadily charting its course in this dynamic global landscape. India has transitioned from an agrarian economy to a service-based economy. The informal sector remains excluded from mainstream growth initiatives. The sector that significantly contributes to national income is abandoned to fend for itself. The sector has demonstrated consistent growth irrespective of policy or financial assistance. Informal enterprises in India have consistently had difficulties in securing financing for their operations and expansion. They possess a constrained capacity to generate capital. These firms are deprived of access to the financial market, rendering them incapable of obtaining credit at the market rate. This leads to numerous enterprises facing a significantly elevated cost of capital (Banerjee and Munshi, 2004). The Indian informal sector operates alongside contemporary industry and compensates for the collapse of the formal sector (Marjit and Kar, 2007).

In examining inclusive economic growth in India, we are analysing the numerous socio-economic resources accessible to Indian informal companies. Our paper is grounded in the theory of access articulated by Ribot and Peluso (2003). We are examining capital accumulation (CA) as the variable of interest to comprehend the expansion of informal companies. Several studies have examined productivity and financial access for small enterprises in India (Maurya and Mohanty, 2019; Badola and

Mukherjee, 2021; Maurya and Mohanty, 2021; Garg et al., 2024; Gang et al., 2022; Posti et al., 2025), yet we identified no research addressing CA in the Indian informal sector, apart from the work by Maiti and Sen (2010). This study is the inaugural effort to evaluate the combined impact of many social and economic factors on access to informal firms in India, despite numerous articles examining loan access, institutions and workforce separately. Since the inception of the first industrial revolution, the accumulation of physical capital has been regarded as a principal catalyst for economic growth in nations and enterprises (Gundlach, 2005; Impicciatore et al., 2012; King and Levine, 1994; Solow, 1956; Swan, 1956). An increase in total factor productivity (TFP) is observed in enterprises that accumulate capital (Arrow et al., 1961; Hulten, 2000; Kendrick and Sato, 1963; Solow, 1957). CA facilitates industrial expansion. Smith (1776) stated, "Wherever capital predominates, industry prevails; wherever revenue, idleness." The accumulation of money derived from industrial profits is essential for the advancement of industry (Veblen, 1908). Capital and savings are essential for financing technological advancement, which collectively influences economic growth (Harrod, 1939). In the broader perspective, economic growth mostly relies on total investments, which does not result in reduced employment (Domar, 1946). The profit rate of firms is dictated by the relationship between technological advancement and the rate of CA (Robinson, 1969). Considering the significance of CA, we sought to comprehend how firms in the Indian informal sector accumulate capital, taking into account the many forms of access they possess or lack.

This study aims to analyse the impact of socio-economic access on CA in informal companies in India. We are examining the several forms of access available to informal companies, which encompass:

1 access to credit

2 access to institutions

3 access to technology

4 access to the workforce

5 access through social identity

6 access to regional development.

Our study concentrates on the research question: what is the influence of socio-economic access on CA by informal companies in India?

We have utilised data regarding the economic and operational attributes of Indian informal firms. The data was gathered by India's National Sample Survey Organisation (NSSO) over the years 2010–2011 and 2015–2016. We employed quantile regression models to analyse the impact of social and economic access on different tiers of informal enterprises. Our findings indicate that access to financing is crucial for firms at all quantiles. Access to institutions is increasingly vital for firms in the middle and upper quantiles. Access to technology has impacted the expansion of businesses at all tiers. Access through social identification indicates that firms in the lower quantiles have encountered more significant problems than those in the higher quantiles. Access to labour and regional growth is a crucial factor for firms across all quantiles. The remainder of the study follows: in Section 2, we quickly discuss the literature review on the theory of access and capital, along with the theoretical foundations and hypotheses.

Section 3 delineates the methods employed for this study and model specifications. Section 4 contains an outline of variables and descriptive statistics. Section 5 presents the model findings and subsequent discussion. Section 6 addresses the robustness check for the models, followed by the conclusions in Section 7.

2 Theoretical background and hypotheses development

2.1 Capital accumulation

CA is a cyclical process of transforming monetary resources into productive capability that creates value. The generated value is transformed into surplus capital and reintegrated into the original capital (Marx, 1867). It is a process in which production capacity, comprising physical assets, must be preserved through repairs and renewals (Robinson, 1969). The saving rate influences investment in new capital. Net investment is the rate of growth in the capital stock, calculable by dk / dt, which denotes the temporal change in capital stock. Thus, capital (K) is a function of savings, which constitutes a portion of income, expressed as K = sY (Solow, 1956). The yearly increment to the capital stock is referred to as the rate of CA. It is the portion of income that is conserved and reinvested in the firm's physical assets (Swan, 1956). The accumulation of capital is determined by subtracting withdrawals and depreciation from the organisation's net revenue. It constitutes the net investments in physical assets. The present aggregate capital level is determined by the historical accumulation of physical assets, which indicates the pace of CA change (Uzawa, 1964).

2.2 Informal sector

The informal sector enterprise engages in the manufacturing and distribution of goods and services to create income and employment for individuals unable to secure positions in the official sector. These enterprises are typically unregistered, evade the taxation system, and offer minimal or no social security to their employees (Hart, 1973; Hussmanns and Mehran, 1993; International Labour Organization, 1993; National Commission for Enterprises in the Unorganised Sector, 2008; Schneider et al., 2010). The Indian informal sector is not merely a necessity-driven endeavour; it is a manifestation of the country's entrepreneurial ethos. The distinctive entrepreneurial culture is the foundation of numerous entrepreneurial ventures in the nation (Gurtoo, 2009). It is essential to reframe the understanding of Indian entrepreneurs in the informal sector, as their motivations extend beyond mere profit focus. They possess a propensity to confront whatever obstacles presented to them. Indian entrepreneurs in the informal sector, particularly women, navigate numerous social and cultural obstacles to conduct their company operations (Williams and Gurtoo, 2011). Thus, it is evident that the significant development in informal companies in India is not attributable to fluctuations in the business cycle (Kar and Marjit, 2009).

The large informal sector in India results from the CA process. The informal sector in India generates economic profit for numerous capitalist enterprises. The substantial magnitude of the Indian informal sector is attributable to inadequate formal legal institutions (Maiti and Sen, 2010). The extensive informal sector results from the intensification of the capitalist growth process. During this accumulation process, they

collaborate with a significant segment of the population via the informal sector, which offers enhanced flexibility in forms. Although they contribute to CA, the sector is consistently abused by the formal sector (Kesar and Bhattacharya, 2020).

Sanyal (2007) discusses the process of CA and the function of the Indian informal sector. The process of CA includes the accumulation of profits by enterprises, the transformation of these gains into capital, production within the capitalist framework, and ultimately, the establishment of a market for the produced goods. The Indian informal sector provides inexpensive inputs to formal firms in the country. Notwithstanding its significant contribution to the expansion of the formal sector, the reciprocal interaction between the informal and formal sectors is characterised by inequitable trade practices. Large formal firms amass greater wealth by generating larger profits from inexpensive materials sourced from the informal sector. The increased profit is not passed on to the customer, resulting in more CA for the formal sector (Shaw, 1985).

2.3 Inclusion and socio-economic access

Inclusive growth emphasises the comprehensive advancement of all segments of society. It examines the economic prospects accessible to the impoverished, disadvantaged and marginalised segments of society (Ranieri and Ramos, 2013). McKinley (2010) characterised inclusive growth as "(i) attaining sustainable growth that generates and enlarges economic opportunities, and (ii) guaranteeing wider access to these opportunities, enabling societal members to engage in and benefit from growth." Consequently, the notion of access emerges as a crucial factor in the examination of inclusive growth and development. Although the notion of access was originally employed in relation to property rights, its breadth has expanded through its application in a broader context. Ribot and Peluso (2003) characterised access as "the ability to obtain advantages from resources." They altered it from right to ability. This alteration in the notion of access enables us to examine the diverse ways in which socio-economic access to resources and opportunities impacts the development of small informal companies. Businesses utilise socially embedded resources derived from their structural and relational social (Granovetter, 1985; Bourdieu, 1986; Coleman, 1988; Putnam, 1995). To comprehend the influence of socio-economic access on business success, we shall examine the many forms of access available to enterprises and the implications they have.

Access to credit is arguably the most crucial resource for an informal enterprise. Access to capital enables them to obtain resources for productive purposes. Credit can be obtained from sources such as personal and familial savings, bank loans, venture capital, angel investments, trade credit, commercial paper, loans from financial institutions, public equity, public debt and government grants (Berger and Udell, 1998). Access to finance facilitates CA for enterprises and enables them to undertake greater risks in innovation (Ullah, 2019). Access to credit is contingent upon the country's institutional framework. Access to financial institutions positively influences company activity (Haini and Pang, 2022). Weak institutional systems compel small business owners to seek informal loans (Mpofu and Sibindi, 2022; Nguyen et al., 2022; Madestam, 2014). Constructive informal credit serves as a link between formal loan sources and small enterprises (Allen et al., 2019; Turkson et al., 2022). Small enterprises and

family-operated businesses encounter limitations in financing their investments (Gang et al., 2022). These enterprises are typically founded on the personal relationships between business proprietors and their principal stakeholders, including lenders such as local banks. It has been noted that, owing to inexperience and several external factors, these enterprises have failed to utilise conventional capital sources efficiently (Harvey and Evans, 1995). Frequently, external borrowing from financial institutions for small firms is secured by personal guarantees or the pledging of personal collateral (Berger and Udell, 1998). Family-owned and small enterprises must meet the expectations and criteria of prospective lenders. The standard prerequisites include a business plan, personal collateral and periodic financial reporting (Coleman and Carsky, 1999). Empirical evidence indicates that the composition of business assets, profitability, and growth potential significantly influence the financing and capital structure of small and medium enterprises (Cassar and Holmes, 2003). Small and medium enterprises lack collateral and recorded accounts of credit, which are prerequisites for obtaining formal credit (Tang, 1995). Following personal savings, family and social networks are identified as the second most favoured source of credit (Amorós et al., 2008; Degryse et al., 2016; Kashuliza, 1993; Baker et al., 2017; Lee and Persson, 2016). An effective financial system optimally distributes financial resources. The growth of the business relies on the accessibility of banking services and the presence of financial markets in the region (Aghion et al., 2007). The financial growth in the region directly or indirectly influences the investment efficiency of enterprises. Businesses thrive more effectively in financially advanced states, as this diminishes their need on informal financing. Financial development enhances organisations' capacity to capitalise on growth possibilities (Khan et al., 2017; Aristei and Angori, 2022). The array of studies examining different facets of credit presents an opportunity to investigate how access to credit influences the accumulation of physical capital by informal enterprises.

H1 Access to credit has a significant impact on the accumulation of physical capital by informal enterprises.

Access to institutions that emphasise political and governmental affiliations of enterprises. In numerous nations, micro and small enterprises are the focal demographic of governmental policies. Governments implement policies to formalise informal firms. In this context, the political and governmental affiliations of small business proprietors serve as a prerequisite for obtaining the advantages of governmental programmes (Sohail et al., 2020). Government loans and financing provide as a beneficial source of capital for informal enterprises (Park et al., 2020; Bonfim et al., 2023). In addition to direct financial assistance, government policies and institutions offer different service-related indirect support to micro and small enterprises. Such forms of indirect support foster a climate conducive to business and entrepreneurship (Prasannath et al., 2024). We will examine the influence of institutional access on the accumulation of physical capital by informal enterprises.

H2 Access to institutions has a significant impact on the accumulation of physical capital by informal enterprises.

Access to technology empowers organisations to seize opportunities and confront difficulties. Technological access facilitates access to financing and enhances productivity. The formation of capital is influenced by technological progress (Pasinetti, 1959). Digital technology enhances corporate productivity (Nucci et al., 2023). The modernisation of equipment leads to an increased return on investments, which might encourage the accumulation of physical capital (Wolff, 1991). The integration of information and communication technology (ICT) and the growth of internet technologies have benefited small enterprises in numerous ways. It enhances entrepreneurial endeavours and results in the establishment of new enterprises (Haini and Pang, 2022). The growth of the internet has enhanced access to finance in rural regions, including digital credit options (Ma et al., 2023; Babilla, 2023; Liu et al., 2024). This study seeks to examine the influence of technological access on the accumulation of physical capital by informal enterprises.

H3 Access to technology has a significant impact on the accumulation of physical capital by informal enterprises.

Access to the workforce is crucial for informal firms, as many of these businesses are labour-intensive. Securing appropriately skilled workers at an equitable wage rate poses a significant challenge for informal business proprietors. The quality of labour, in conjunction with capital, determines the productivity of informal enterprises. Productive labour enables business proprietors to replenish their capital and accumulate it over time (Smith, 1776). Capital is generated by labour in production as productivity is utilised in the workplace (Luxemburg, 2003; Marx, 1867). The size of an enterprise may influence its access to the workforce, contingent upon budgetary limitations. Therefore, it is crucial to comprehend how worker access influence physical CA in informal enterprises.

H4 Access to the workforce has a significant impact on the accumulation of physical capital by informal enterprises.

Access through social identity examines the influence of a business owner's social identity on their business operations and profitability. Business proprietors experiencing social exclusions encounter a distinct array of problems in managing their enterprises. It dictates their access to loans, opportunities and resources. Disparities in access based on gender result in performance discrepancies across genders (Allison et al., 2023). Gender and caste inequities remain in nearly all enterprise parameters (Deshpande and Sharma, 2013). Individuals from socially disadvantaged classes are deprived of social capital, since numerous such assets are possessed by those from socially privileged classes (Chaudhuri, 1976). Owners within the majority class of merchant guilds has superior access to trade credit (Xiu et al., 2023). Individuals from socially disadvantaged strata are markedly under-represented in firm ownership across all Indian states (Iyer et al., 2013). Female entrepreneurs and individuals from socially disadvantaged classes worldwide encounter difficulties in obtaining loans. Credit lending procedures exhibit gender and class-based prejudice (Bates and Robb, 2016; Chundakkadan and Sasidharan, 2022). The challenges may differ according to the scale of the enterprise (Seema et al., 2021). Due to the lack of formal finance, women are compelled to conduct their commercial operations in an informal setting (Babbitt et al., 2015). Women must confront challenges and surmount several difficulties to establish and achieve success in their enterprises. Ghosh and Mitra (2020) noticed that women-owned enterprises lack expansion ambitions,

functioning primarily for survival. Maurya and Mohanty (2019) highlighted that the banking system in India does not address the demands of female entrepreneurs. Garg et al. (2024) noted that enhanced banking penetration has improved access to finance, leading to an increase in the number of women entrepreneurs in the non-farm sector. Numerous entrepreneurs want to conduct their business in proximity to friends and family, even at a little elevated rental cost, as this grants them access to social networks essential for business operations (Sorenson, 2018). The network of entrepreneurs provides access to capital, information and collaborators (Merrett and Gruidl, 2000). Considering the obstacles encountered by female entrepreneurs and those from socially disadvantaged backgrounds, we want to comprehend how access through social identity influence the accumulation of physical capital by informal enterprises.

H5 Access via social identity has a significant impact on the accumulation of physical capital by informal enterprises.

Access to regional development is contingent upon the firm's location and the developmental status of the region. Regional institutions, an entrepreneurial culture, and the environment promote and enhance entrepreneurial activities (Korent et al., 2015). The political environment influences entrepreneurial operations in the region (Vuong, 2016). Local, city, and state economic policies promote knowledge spillover to enhance entrepreneurship and cultivate a start-up culture (Audretsch, 2014; Sternberg, 2022). Informal enterprises in relatively developed regions and urban locations possess superior access to capital and possibilities. Raj et al. (2014) discovered that banking development positively influences business performance. Yadav and Prakash (2020) emphasised the significance of a favourable business climate present in relatively developed states. Considering the significance of location and its associated aspects, we want to examine the influence of these factors on CA by enterprises according to their geographic positioning. Considering the significance of regional development, we intend to examine its influence on the accumulation of physical capital by informal enterprises.

H6 Access to regional development has a significant impact on the accumulation of physical capital by informal enterprises.

3 Data and research methodology

3.1 Data source

We utilised the 67th (2010–2011) and 73rd (2015–2016) rounds of data from the NSSO about 'Unincorporated Non-Agricultural Enterprises (Excluding Construction)'. The NSSO operates under the Ministry of Statistics and Programme Implementation (MoSPI) of India. This is presently the most extensive dataset on informal enterprises in India. Due to the unregistered status of informal enterprises, the NSSO gathers primary data through multi-state stratified sampling. Data is collected on a block-wise basis from each district, categorised into rural and urban strata. The quantity of enterprises in these categories is determined by the population census and the economic census of enterprises. Every district from all states and union territories in India is regarded as a stratum.

The unit-level surveys gathered operational and economic characteristics data from 334,474 enterprises in 2010–2011 and 290,113 enterprises in 2015–2016. However, for our analysis, after filtering for the necessary information, we examined 46,976 enterprises for 2010–2011 and 62,754 for 2015–2016. The absence of the enterprise's name renders it ambiguous whether the same entity is reiterated in these two rounds. We employed a quantile regression model to examine variables indicated in the literature review. Model 1 utilises data from the 67th round (2010–2011), whereas Model 2 employs data from the 73rd round (2015–2016).

3.2 Methodology

Utilising the available cross-sectional data, we employed a quantile regression model to examine the impact of diverse access determinants on CA in informal companies. Quantile regression enables the analysis of heterogeneous effects at multiple degrees of CA, based on the conditional distribution at distinct points. In contrast to the ordinary least squares (OLS) model, which only examines the average influence of determinants, quantile regression enables the capturing of fluctuations across all quantiles for both periods. This study examined the influence of access determinants on informal enterprises of differing sizes and their temporal variations. This model is better suited for skewed and heteroskedastic data.

3.3 The empirical model

$$\begin{aligned} CA_i = {} & \beta_0 + \beta_1 \text{Loan}_i + \beta_2 \text{Registration}_i + \beta_3 \text{Government assistance}_i + \beta_4 \text{Computer}_i \\ & + \beta_5 \text{Internet}_i + \beta_6 \text{Hired workers}_i + \beta_7 \text{Female owner}_i + \beta_8 \text{Social group}_i \\ & + \beta_9 \text{State development}_i + \varepsilon_i \end{aligned}$$

The dependent variable in our model is the logarithmic representation of CA, which is explained by the independent variables:

1 access to credit (loan, registration)

2 access to institutions (government assistance)

3 access to technology (computer, internet)

4 access to workforce (hired workers)

5 access via social identity (female owner, social group)

6 access to regional development (state development).

All explanatory factors are categorical variables.

The data is examined utilising the STATA 15 statistical software. We employed interquartile regression to compare the 25th and 75th quartiles to assess the stability of variables across quartiles and assure robustness. Due to the substantial sample size and possible heteroskedasticity, we employed bootstrap standard errors with 20 replications to enhance the precision of inference. We employed a combined significance test to assess the collective explanatory power of all independent variables. This test is statistically significant, indicating that all explanatory variables collectively affect the dependent variable. We employed uncentred variance inflation factor (VIF) to assess

multicollinearity. As all values adhere to standard thresholds of 10, multicollinearity is not a significant issue.

3.4 Diagnostic checks

We have performed multiple diagnostic tests and robustness assessments to verify the reliability of the quantile regression estimations. Initially, we assessed multicollinearity using the VIF. All values are below the threshold level of 10, indicating the lack of multicollinearity in the observed data. Traditional heteroskedasticity tests are ineffective for the quantile regression model, as it does not presuppose homoskedasticity. We evaluated coefficient stability across quartiles using interquartile regression. The coefficient exhibited changes, indicating the presence of heteroskedasticity. We resolved this issue by utilising robust standard errors in all estimations. The kernel density plot and Shapiro-Wilk tests revealed skewness and non-normality. Nevertheless, given quantile regression does not presume a normal distribution, this will not undermine the validity of our findings. We have examined these numbers across many quantiles; this evaluates the robustness of our results, which remain consistent at different levels. We evaluated absolute residuals by detecting extreme values to assess the impact of potential outliers. High residuals are present; however, they will not affect the principal connections identified by our model.

3.5 Data limitations

The NSSO does not disclose the identification of the enterprise. Data is gathered through random selection in each round, resulting in the potential for the same firm to be included or excluded. This data constraint restricts the feasibility of a panel study.

4 Variables and data summary

The variables identified for the model are described in Table 1. We have also provided references to studies where these variables have been used previously for various analysis purposes.

We have discerned the aforementioned variables through our literature review. Each variable was examined in relation to multiple facets of the business, including financial accessibility, the success of women-led enterprises, and the influence of banking development. In the literature review, we found specific connections between these factors, based on which we assigned the anticipated sign for each variable. The scale variables are derived from NSSO data. The computation method is elucidated in the description column of Table 1. We have applied the logarithmic transformation to CA to achieve normality in the data. The dummy variables are classified according to the specifications of our model. Each dummy variable designates the reference category as one.

The summary statistics are provided for each of the variables for both the periods, 2010–2011 and 2015–2016.

Table 1 Variables

Variables	*Description*	*Codes*	*Data type*	*Expected sign*
Capital accumulation (LogCA)	The net addition to owned land and fixed assets in the last 365 days. The data is adjusted for prices based on the price index provided by National Accounts Statistics.		Scale variable	
Loan	Whether the enterprise has taken any loan.	0 – no 1 – yes	Dummy variable	+
Registration	Whether the enterprise is registered with any government body.	0 – no 1 – yes	Dummy variable	+
Govt_Assistance	Whether the enterprise received any government assistance.	0 – no 1 – yes	Dummy variable	+
Computer	Whether the enterprise used computer(s) during the last 365 days.	0 – no 1 – yes	Dummy variable	+
Internet	Whether the enterprise used the internet during the last 365 days.	0 – no 1 – yes	Dummy variable	+
Female_Owner	Whether the enterprise is owned by a female owner.	0 – no 1 – yes	Dummy variable	–
Social_Group	Whether the owner of the enterprise belongs to the socially backward class.	0 – no 1 – yes	Dummy variable	–
Hired_Workers	Whether the enterprise has hired workers.	0 – no 1 – yes	Dummy variable	+
State_Development	Whether the enterprise is situated in a developed state.	0 – no 1 – yes	Dummy variable	+

Table 2 Summary statistics

Variable	*2010–2011*			*2015–2016*		
	Obs.	*Mean*	*Std. dev.*	*Obs.*	*Mean*	*Std. dev.*
Capital accumulation	46,976	8.0601	2.3808	62,754	8.5187	2.1436
Loan	46,976	0.1785	0.3829	62,754	0.2123	0.4090
Registration	46,976	0.4372	0.4960	62,754	0.4941	0.5000
Govt. assistance	46,976	0.0291	0.1680	62,754	0.0193	0.1376
Computer	46,967	0.0885	0.2840	62,754	0.1485	0.3556
Internet	46,967	0.0486	0.2151	62,754	0.1207	0.3258
Female owner	46,976	0.0976	0.2968	62,754	0.1043	0.3056
Social group	46,976	0.6067	0.4885	62,754	0.6032	0.4892
Hired workers	46,976	0.4576	0.4982	62,754	0.5551	0.4970
State development	46,976	0.6586	0.4742	62,754	0.6601	0.4737

5 Results and discussion

Tables 3–8 illustrate the influence of explanatory variables on CA in informal enterprises in India over the years 2010–2011 and 2015–2016. The model has six characteristics that facilitate CA. The initial element examines the impact of loan accessibility on CA across different tiers. Firms with superior access to credit will invest more in fixed assets. The findings indicate that access to loans is crucial for enterprises across all quantiles, with greater intensity observed in the upper quantiles. This indicates that loan accessibility is more beneficial for larger informal enterprises. A slight decrease in its efficacy is observed from 2010–2011 to 2015–2016, indicating the gradual proliferation of lending facilities over time. Firm registration is crucial for businesses across all quantiles. The correlation is more pronounced among smaller enterprises, indicating greater advantages for early business formalisation. Companies that have secured legal or informal loans have accumulated greater capital than those that have not obtained loans. Informal enterprises have greater access to informal financing and favour it over formal credit (Elston et al., 2016; Rand, 2007). This underscores the significance of informal financing mechanisms in the expansion of the physical capital of informal enterprises (Nguyen and Canh, 2021). The firm's registration under diverse laws or regulatory organisations provides a significant advantage by facilitating improved access to finance (Raj and Sen, 2016; Unni and Naik, 2018). Registration correlates positively with CA. It signifies that the registered companies accumulate greater capital than their unregistered counterparts. This outcome aligns with the findings of Laing et al. (2022), who emphasised the significance of registration for entrepreneurial success.

The second factor pertains to access to institutions. Government support yields beneficial outcomes. It is essential for enterprises of all scales. The impact has enhanced throughout the period from 2010–2011 to 2015–2016, signifying an expanded reach and greater targeting of government initiatives. Empirical evidence has confirmed that enterprises with access to institutions have accumulated more capital than their counterparts. Unni and Naik (2018), Maurya and Mohanty (2019) and Badola and Mukherjee (2021) have similarly noted government aid in many circumstances.

The third factor is technological accessibility. Companies with access to ICT derive advantages from it. A positive correlation exists between computer and internet usage and CA. The data show the growing impact of computer adoption from 2010–2011 to 2015–2016. The impact of internet usage is greater in the upper quantiles. This indicates that larger organisations utilise technology more extensively. Unni and Naik (2018) noted that informal enterprises in India have begun to modernise through the utilisation of ICT. Gupta and Kumar (2018) discerned a disparity in productivity between organisations that utilise ICT and those that do not. Labour productivity is elevated in enterprises that utilise ICT. Badola and Mukherjee (2021) identify a potential in the enhancement of ICT use to close the knowledge gap and facilitate access to loans. The fourth aspect pertains to worker accessibility. The findings indicate a robust positive correlation between labour access and CA across all quantiles. This highlights the significance of access to a skilled workforce for company success.

Table 3 The quantile regression model result (2010–2011)

Variables	*q1*	*q2*	*q3*	*q4*	*q5*	*q6*	*q7*	*q8*	*q9*
Loan	0.458***	0.622***	0.770***	0.827***	0.949***	1.022***	1.102***	1.241***	1.342***
	(0.0372)	(0.0300)	(0.0343)	(0.0340)	(0.0292)	(0.0340)	(0.0419)	(0.0497)	(0.0588)
Registration	0.511***	0.690***	0.693***	0.659***	0.660***	0.606***	0.511***	0.429***	0.452***
	(0.0300)	(0.0242)	(0.0277)	(0.0274)	(0.0236)	(0.0274)	(0.0338)	(0.0401)	(0.0474)
Govt. assistance	–0.122	0	0.0770	–0.0547	0.0134	0.0185	0.192**	0.263**	0.285**
	(0.0824)	(0.0665)	(0.0760)	(0.0754)	(0.0648)	(0.0753)	(0.0928)	(0.110)	(0.130)
Computer	1.488***	1.447***	1.463***	1.623***	1.609***	1.609***	1.632***	1.607***	1.410***
	(0.0686)	(0.0553)	(0.0633)	(0.0628)	(0.0540)	(0.0627)	(0.0773)	(0.0918)	(0.109)
Internet	0.463***	0.521***	0.674***	0.508***	0.531***	0.541***	0.511***	0.462***	0.477***
	(0.0893)	(0.0720)	(0.0823)	(0.0816)	(0.0702)	(0.0815)	(0.101)	(0.119)	(0.141)
Female owner	–0.640***	–0.514***	–0.491***	–0.321***	–0.0870**	0	0.192***	0.314***	0.507***
	(0.0458)	(0.0369)	(0.0422)	(0.0418)	(0.0360)	(0.0418)	(0.0515)	(0.0612)	(0.0724)
Social group	–0.0527*	–0.112***	–0.146***	–0.0745***	–0.0328	–0.0110	0	0	–0.0329
	(0.0278)	(0.0224)	(0.0257)	(0.0254)	(0.0219)	(0.0254)	(0.0313)	(0.0372)	(0.0440)
Hired workers	0.928***	0.987***	1.022***	1.104***	1.099***	1.098***	1.163***	1.111***	0.895***
	(0.0294)	(0.0237)	(0.0271)	(0.0269)	(0.0231)	(0.0268)	(0.0331)	(0.0393)	(0.0465)
State development	0.405***	0.402***	0.511***	0.593***	0.693***	0.704***	0.788***	0.867***	0.687***
	(0.0291)	(0.0235)	(0.0269)	(0.0266)	(0.0229)	(0.0266)	(0.0328)	(0.0390)	(0.0461)
Constant	4.605***	5.122***	5.521***	5.878***	6.247***	6.802***	7.313***	8.089***	9.473***
	(0.0334)	(0.0270)	(0.0308)	(0.0306)	(0.0263)	(0.0305)	(0.0376)	(0.0447)	(0.0529)
Observations	46,967	46,967	46,967	46,967	46,967	46,967	46,967	46,967	46,967

Notes: Standard errors in parentheses.
***p < 0.01, **p < 0.05 and *p < 0.1.

Table 4 The quantile regression model result (2015–2016)

Variables	*q1*	*q2*	*q3*	*q4*	*q5*	*q6*	*q7*	*q8*	*q9*
Loan	0.336***	0.405***	0.511***	0.529***	0.626***	0.741***	0.799***	0.917***	0.990***
	(0.0171)	(0.0206)	(0.0200)	(0.0223)	(0.0249)	(0.0265)	(0.0311)	(0.0313)	(0.0423)
Registration	0.624***	0.563***	0.618***	0.606***	0.519***	0.540***	0.411***	0.365***	0.349***
	(0.0154)	(0.0186)	(0.0180)	(0.0201)	(0.0225)	(0.0239)	(0.0281)	(0.0282)	(0.0381)
Govt. assistance	0	0.0953	0.148**	0.200***	0.209***	0.309***	0.411***	0.485***	0.472***
	(0.0498)	(0.0601)	(0.0584)	(0.0649)	(0.0726)	(0.0773)	(0.0907)	(0.0912)	(0.123)
Computer	0.762***	0.844***	0.951***	0.981***	1.012***	1.029***	1.006***	1.027***	0.980***
	(0.0343)	(0.0414)	(0.0402)	(0.0447)	(0.0500)	(0.0532)	(0.0625)	(0.0628)	(0.0848)
Internet	0.511***	0.491***	0.511***	0.533***	0.551***	0.541***	0.534***	0.582***	0.630***
	(0.0371)	(0.0447)	(0.0434)	(0.0483)	(0.0540)	(0.0575)	(0.0675)	(0.0678)	(0.0916)
Female owner	–0.659***	–0.560***	–0.586***	–0.588***	–0.478***	–0.307***	–0.180***	–0.0645	0.108*
	(0.0226)	(0.0272)	(0.0265)	(0.0294)	(0.0329)	(0.0350)	(0.0411)	(0.0414)	(0.0558)
Social group	–0.0345**	–0.131***	–0.0754***	–0.0870***	–0.0607***	–0.0387*	–0.00281	0.0308	0.0645*
	(0.0141)	(0.0170)	(0.0165)	(0.0184)	(0.0205)	(0.0219)	(0.0257)	(0.0258)	(0.0348)
Hired workers	0.951***	1.050***	1.023***	0.981***	1.015***	1.051***	1.101***	1.068***	0.973***
	(0.0151)	(0.0182)	(0.0177)	(0.0196)	(0.0220)	(0.0234)	(0.0275)	(0.0276)	(0.0373)
State development	0.0345**	0.154***	0.0754***	0.182***	0.215***	0.154***	0.282***	0.374***	0.397***
	(0.0148)	(0.0179)	(0.0174)	(0.0193)	(0.0216)	(0.0230)	(0.0270)	(0.0272)	(0.0367)
Constant	5.298***	5.834***	6.290***	6.707***	7.090***	7.505***	8.006***	8.582***	9.616***
	(0.0177)	(0.0213)	(0.0207)	(0.0230)	(0.0258)	(0.0274)	(0.0322)	(0.0324)	(0.0437)
Observations	62,754	62,754	62,754	62,754	62,754	62,754	62,754	62,754	62,754

Notes: Standard errors in parentheses.
***p < 0.01, **p < 0.05 and *p < 0.1.

Table 5 The quantile regression model robustness test with method of moments quantile regression (MMQR) (2010–2011)

Variables	*q1*	*q2*	*q3*	*q4*	*q5*	*q6*	*q7*	*q8*	*q9*
Loan	0.577***	0.666***	0.732***	0.799***	0.863***	0.941***	1.022***	1.128***	1.286***
	(0.0306)	(0.0277)	(0.0267)	(0.0268)	(0.0280)	(0.0306)	(0.0344)	(0.0405)	(0.0510)
Registration	0.632***	0.608***	0.591***	0.573***	0.556***	0.535***	0.514***	0.486***	0.444***
	(0.0226)	(0.0205)	(0.0197)	(0.0198)	(0.0207)	(0.0226)	(0.0254)	(0.0299)	(0.0377)
Govt. assistance	–0.121*	–0.0685	–0.0298	0.00941	0.0468	0.0924	0.140*	0.201**	0.294**
	(0.0716)	(0.0648)	(0.0625)	(0.0627)	(0.0654)	(0.0715)	(0.0804)	(0.0946)	(0.119)
Computer	1.509***	1.511***	1.512***	1.514***	1.515***	1.516***	1.518***	1.520***	1.523***
	(0.0521)	(0.0472)	(0.0455)	(0.0457)	(0.0476)	(0.0521)	(0.0585)	(0.0689)	(0.0869)
Internet	0.485***	0.501***	0.513***	0.525***	0.537***	0.551***	0.566***	0.585***	0.614***
	(0.0690)	(0.0625)	(0.0602)	(0.0604)	(0.0630)	(0.0689)	(0.0774)	(0.0911)	(0.115)
Female owner	–0.621***	–0.484***	–0.382***	–0.278***	–0.180***	–0.0595	0.0653	0.228***	0.472***
	(0.0405)	(0.0366)	(0.0354)	(0.0355)	(0.0370)	(0.0404)	(0.0455)	(0.0535)	(0.0675)
Social group	–0.0868***	–0.0751***	–0.0664***	–0.0575***	–0.0491**	–0.0389*	–0.0283	–0.0144	0.00638
	(0.0211)	(0.0191)	(0.0184)	(0.0185)	(0.0193)	(0.0211)	(0.0237)	(0.0279)	(0.0352)
Hired workers	1.036***	1.041***	1.045***	1.049***	1.053***	1.058***	1.063***	1.069***	1.079***
	(0.0222)	(0.0201)	(0.0194)	(0.0194)	(0.0203)	(0.0222)	(0.0249)	(0.0293)	(0.0370)
State development	0.439***	0.488***	0.525***	0.562***	0.597***	0.640***	0.685***	0.743***	0.830***
	(0.0215)	(0.0194)	(0.0187)	(0.0188)	(0.0196)	(0.0214)	(0.0241)	(0.0284)	(0.0358)
Constant	4.464***	5.068***	5.517***	5.972***	6.405***	6.934***	7.483***	8.196***	9.269***
	(0.0263)	(0.0224)	(0.0225)	(0.0226)	(0.0232)	(0.0248)	(0.0290)	(0.0344)	(0.0420)
Observations	46,967	46,967	46,967	46,967	46,967	46,967	46,967	46,967	46,967

Notes: Standard errors in parentheses.
***p < 0.01, **p < 0.05 and *p < 0.1.

Table 6 The quantile regression model robustness test with MMQR (2015–2016)

Variables	*q1*	*q2*	*q3*	*q4*	*q5*	*q6*	*q7*	*q8*	*q9*
Loan	0.370***	0.452***	0.514***	0.574***	0.631***	0.691***	0.767***	0.853***	0.987***
	(0.0223)	(0.0200)	(0.0191)	(0.0190)	(0.0197)	(0.0212)	(0.0238)	(0.0277)	(0.0346)
Registration	0.604***	0.575***	0.552***	0.531***	0.510***	0.488***	0.461***	0.430***	0.381***
	(0.0186)	(0.0167)	(0.0159)	(0.0159)	(0.0165)	(0.0177)	(0.0199)	(0.0231)	(0.0289)
Govt. assistance	0.0196	0.0882	0.141**	0.191***	0.240***	0.290***	0.354***	0.427***	0.540***
	(0.0707)	(0.0634)	(0.0605)	(0.0603)	(0.0625)	(0.0671)	(0.0755)	(0.0877)	(0.110)
Computer	0.893***	0.912***	0.926***	0.940***	0.953***	0.967***	0.985***	1.005***	1.036***
	(0.0423)	(0.0379)	(0.0361)	(0.0360)	(0.0374)	(0.0401)	(0.0451)	(0.0524)	(0.0656)
Internet	0.464***	0.485***	0.502***	0.518***	0.534***	0.549***	0.570***	0.593***	0.628***
	(0.0460)	(0.0413)	(0.0394)	(0.0393)	(0.0407)	(0.0437)	(0.0491)	(0.0570)	(0.0714)
Female owner	–0.716***	–0.611***	–0.530***	–0.453***	–0.378***	–0.301***	–0.204***	–0.0920**	0.0806*
	(0.0310)	(0.0278)	(0.0265)	(0.0264)	(0.0274)	(0.0294)	(0.0331)	(0.0384)	(0.0481)
Social group	–0.0953***	–0.0764***	–0.0618***	–0.0479***	–0.0345**	–0.0206	–0.00303	0.0171	0.0482*
	(0.0171)	(0.0153)	(0.0146)	(0.0146)	(0.0151)	(0.0162)	(0.0183)	(0.0212)	(0.0266)
Hired workers	1.004***	1.011***	1.017***	1.022***	1.028***	1.033***	1.040***	1.047***	1.059***
	(0.0182)	(0.0163)	(0.0156)	(0.0155)	(0.0161)	(0.0173)	(0.0194)	(0.0225)	(0.0282)
State development	0.0622***	0.103***	0.134***	0.163***	0.192***	0.221***	0.259***	0.302***	0.368***
	(0.0176)	(0.0158)	(0.0151)	(0.0150)	(0.0156)	(0.0167)	(0.0188)	(0.0218)	(0.0273)
Constant	5.273***	5.839***	6.276***	6.691***	7.093***	7.508***	8.035***	8.636***	9.568***
	(0.0207)	(0.0191)	(0.0183)	(0.0184)	(0.0193)	(0.0206)	(0.0233)	(0.0271)	(0.0336)
Observations	62,754	62,754	62,754	62,754	62,754	62,754	62,754	62,754	62,754

Notes: Standard errors in parentheses.
***p < 0.01, **p < 0.05 and *p < 0.1.

Table 7 The quantile regression model robustness test with additional independent variables (2010–2011)

Variables	*q1*	*q2*	*q3*	*q4*	*q5*	*q6*	*q7*	*q8*	*q9*
Loan	0.446***	0.542***	0.650***	0.688***	0.721***	0.799***	0.856***	0.876***	0.981***
	(0.0315)	(0.0332)	(0.0296)	(0.0288)	(0.0289)	(0.0303)	(0.0347)	(0.0333)	(0.0436)
Registration	0.584***	0.690***	0.754***	0.780***	0.821***	0.810***	0.856***	0.853***	0.808***
	(0.0256)	(0.0269)	(0.0240)	(0.0233)	(0.0234)	(0.0246)	(0.0281)	(0.0269)	(0.0353)
Govt. assistance	–0.0793	–0.0183	0.149**	0.169***	0.134**	0.278***	0.348***	0.449***	0.381***
	(0.0699)	(0.0736)	(0.0656)	(0.0638)	(0.0639)	(0.0672)	(0.0769)	(0.0736)	(0.0964)
Computer	1.410***	1.332***	1.387***	1.352***	1.383***	1.369***	1.284***	1.323***	1.401***
	(0.0582)	(0.0613)	(0.0547)	(0.0531)	(0.0533)	(0.0560)	(0.0641)	(0.0614)	(0.0804)
Internet	0.332***	0.419***	0.415***	0.468***	0.405***	0.364***	0.386***	0.582***	0.702***
	(0.0756)	(0.0797)	(0.0711)	(0.0690)	(0.0692)	(0.0727)	(0.0832)	(0.0797)	(0.104)
Female owner	–0.682***	–0.629***	–0.545***	–0.514***	–0.426***	–0.346***	–0.231***	–0.142***	–0.151***
	(0.0391)	(0.0411)	(0.0367)	(0.0357)	(0.0358)	(0.0376)	(0.0430)	(0.0412)	(0.0539)
Social group	–0.0793***	–0.0953***	–0.129***	–0.104***	–0.0955***	–0.0953***	–0.0606**	–0.0635**	–0.115***
	(0.0236)	(0.0248)	(0.0222)	(0.0215)	(0.0216)	(0.0227)	(0.0259)	(0.0249)	(0.0326)
Hired workers	0.951***	0.981***	1.002***	1.003***	1.012***	1.008***	1.041***	1.099***	1.206***
	(0.0250)	(0.0263)	(0.0235)	(0.0228)	(0.0229)	(0.0241)	(0.0275)	(0.0264)	(0.0345)
State development	0.337***	0.408***	0.449***	0.467***	0.453***	0.447***	0.405***	0.336***	0.298***
	(0.0248)	(0.0262)	(0.0233)	(0.0227)	(0.0227)	(0.0239)	(0.0273)	(0.0262)	(0.0343)
Sub–contracting	–0.560***	–0.557***	–0.530***	–0.494***	–0.374***	–0.262***	–0.208***	–0.180**	–0.144
	(0.0665)	(0.0700)	(0.0625)	(0.0607)	(0.0609)	(0.0639)	(0.0732)	(0.0701)	(0.0918)
Growth – stagnant	0.257***	0.226***	0.220***	0.266***	0.307***	0.336***	0.325***	0.336***	0.395***
	(0.0283)	(0.0298)	(0.0266)	(0.0259)	(0.0259)	(0.0272)	(0.0312)	(0.0299)	(0.0391)
Growth – contracting	–0.0242	–0.123**	–0.0961**	–0.112***	–0.0672	–0.0263	–0.0118	0	0.0944
	(0.0473)	(0.0498)	(0.0444)	(0.0431)	(0.0433)	(0.0454)	(0.0520)	(0.0498)	(0.0652)
Growth – new firm	1.019***	1.430***	1.854***	2.131***	2.387***	2.565***	2.734***	2.819***	2.864***
	(0.0299)	(0.0315)	(0.0281)	(0.0273)	(0.0274)	(0.0287)	(0.0329)	(0.0315)	(0.0413)
Constant	4.347***	4.880***	5.236***	5.578***	5.924***	6.310***	6.745***	7.328***	8.122***
	(0.0326)	(0.0343)	(0.0306)	(0.0298)	(0.0298)	(0.0313)	(0.0359)	(0.0344)	(0.0450)
Observations	46,967	46,967	46,967	46,967	46,967	46,967	46,967	46,967	46,967

Notes: Standard errors in parentheses.
***p < 0.01, **p < 0.05 and *p < 0.1.

Table 8 The quantile regression model robustness test with additional independent variables (2015–2016)

Variables	*q1*	*q2*	*q3*	*q4*	*q5*	*q6*	*q7*	*q8*	*q9*
Loan	0.357***	0.421***	0.470***	0.484***	0.511***	0.549***	0.600***	0.683***	0.778***
	(0.0238)	(0.0243)	(0.0239)	(0.0235)	(0.0208)	(0.0226)	(0.0232)	(0.0263)	(0.0330)
Registration	0.572***	0.565***	0.602***	0.612***	0.600***	0.622***	0.655***	0.636***	0.647***
	(0.0215)	(0.0220)	(0.0216)	(0.0212)	(0.0188)	(0.0204)	(0.0210)	(0.0237)	(0.0298)
Govt. assistance	0.0498	0.0692	0.182***	0.248***	0.401***	0.377***	0.481***	0.544***	0.541***
	(0.0691)	(0.0706)	(0.0694)	(0.0682)	(0.0605)	(0.0655)	(0.0673)	(0.0762)	(0.0957)
Computer	0.754***	0.855***	0.866***	0.893***	0.869***	0.831***	0.818***	0.763***	0.831***
	(0.0478)	(0.0489)	(0.0480)	(0.0472)	(0.0419)	(0.0454)	(0.0466)	(0.0528)	(0.0663)
Internet	0.437***	0.435***	0.520***	0.508***	0.546***	0.550***	0.560***	0.644***	0.852***
	(0.0516)	(0.0527)	(0.0518)	(0.0510)	(0.0452)	(0.0489)	(0.0503)	(0.0569)	(0.0715)
Female owner	–0.608***	–0.620***	–0.652***	–0.605***	–0.589***	–0.541***	–0.441***	–0.377***	–0.336***
	(0.0317)	(0.0324)	(0.0319)	(0.0313)	(0.0278)	(0.0301)	(0.0309)	(0.0350)	(0.0439)
Social group	–0.105***	–0.0958***	–0.0816***	–0.0819***	–0.0892***	–0.0878***	–0.0873***	–0.103***	–0.0762***
	(0.0196)	(0.0200)	(0.0196)	(0.0193)	(0.0171)	(0.0185)	(0.0190)	(0.0216)	(0.0271)
Hired workers	0.932***	1.019***	1.007***	1.003***	0.983***	1.004***	1.023***	1.047***	1.094***
	(0.0210)	(0.0215)	(0.0211)	(0.0208)	(0.0184)	(0.0199)	(0.0205)	(0.0232)	(0.0291)
State development	0.118***	0.150***	0.141***	0.174***	0.127***	0.143***	0.0927***	0.103***	0.115***
	(0.0207)	(0.0212)	(0.0208)	(0.0205)	(0.0181)	(0.0196)	(0.0202)	(0.0228)	(0.0287)
Sub–contracting	–0.645***	–0.574***	–0.511***	–0.484***	–0.470***	–0.384***	–0.292***	–0.229***	–0.236***
	(0.0419)	(0.0428)	(0.0421)	(0.0414)	(0.0367)	(0.0397)	(0.0408)	(0.0462)	(0.0580)
Growth – stagnant	0.223***	0.271***	0.223***	0.264***	0.231***	0.280***	0.273***	0.282***	0.279***
	(0.0227)	(0.0232)	(0.0228)	(0.0224)	(0.0198)	(0.0215)	(0.0221)	(0.0250)	(0.0314)
Growth – contracting	–0.251***	–0.255***	–0.223***	–0.207***	–0.150***	–0.111***	–0.0565*	–0.00563	0.0717
	(0.0345)	(0.0352)	(0.0347)	(0.0341)	(0.0302)	(0.0327)	(0.0336)	(0.0381)	(0.0478)
Growth – new firm	0.876***	1.313***	1.650***	1.994***	2.207***	2.382***	2.471***	2.519***	2.495***
	(0.0259)	(0.0264)	(0.0260)	(0.0256)	(0.0227)	(0.0245)	(0.0252)	(0.0286)	(0.0358)
Constant	5.181***	5.649***	6.073***	6.423***	6.858***	7.178***	7.601***	8.115***	8.784***
	(0.0274)	(0.0280)	(0.0275)	(0.0271)	(0.0240)	(0.0260)	(0.0267)	(0.0302)	(0.0380)
Observations	60,081	60,081	60,081	60,081	60,081	60,081	60,081	60,081	60,081

Notes: Standard errors in parentheses.
***p < 0.01, **p < 0.05 and *p < 0.1.

The fifth factor pertains to access through social identities. Indian women encounter distinct social challenges. They must contend with several challenges and surmount various hurdles to operate their firm and achieve success. The model demonstrates that female-led enterprises encounter challenges in CA relative to male-led enterprises. The correlation is predominantly unfavourable, as evidenced by data over seven quantiles. The top two quantiles exhibit a little positive trend, suggesting that women-owned enterprises with greater capital effectively capitalise on available chances and advantages. A multitude of studies have noted analogous observations. Ghosh and Mitra (2020) noted that women-owned enterprises lack expansion plans, functioning primarily for survival. Maurya and Mohanty (2019) observed that the Indian banking system fails to address the specific demands of female entrepreneurs in the country. Sasidharan and Raj (2014) assert that female-owned enterprises exhibit superior resilience compared to male-owned enterprises. Like female enterprises, businesses operated by individuals from scheduled tribes and scheduled castes encounter numerous hurdles in their operations. Garg et al. (2024) noted that enhanced access to finance has resulted in a rise in the number of women entrepreneurs, coinciding with higher banking penetration in Indian districts. Wani and Khanday (2024) have noted that financial inclusion offers equitable opportunity for all women and fosters gender parity. Data from 2010–2011 and 2015–2016 indicate that enterprises owned by individuals from socially disadvantaged communities have accumulated less capital than those held by individuals from the general category. Maurya and Mohanty (2021) noted that entrepreneurs from marginalised communities encounter difficulties in obtaining loans. Badigannavar et al. (2020) noted that enterprises held by individuals from socially disadvantaged communities have performed comparatively better recently due to political clientelism. They contend that the performance of enterprises run by individuals from socially disadvantaged communities demonstrates the tenacity of entrepreneurs despite the social challenges they encounter.

The sixth component pertains to the regional development and geographic positioning of the enterprise. Data indicate that informal enterprises in less and least developed regions have underperformed compared to those in comparatively developed regions. Informal enterprises in more developed regions possess superior access to capital and possibilities (Casey et al., 2022).

6 Robustness checks

To validate the robustness of the quantile regression findings, two supplementary models were estimated. Initially, we utilised the MMQR method, which addresses distributional heterogeneity and results in smoothed quantile estimates. We re-estimated the model by incorporating additional independent variables, including subcontracting status and enterprise growth orientation, to assess the sensitivity of the core relationships. The MMQR estimates largely corroborate the primary findings of quantile regression, maintaining the direction, magnitude, and significance of essential variables such as access to credit, registration, digital infrastructure and hired labour. The extended model incorporating additional instrumental variables produced consistent results. The introduction of new variables resulted in minor adjustments to the magnitude of certain coefficients, especially regarding government assistance and female ownership; however,

the overall patterns remained consistent. The robustness checks confirm that the primary conclusions of the study remain unaffected by different estimation methods or omitted variable bias resulting from restricted model specification.

Table 9 Summary of hypotheses

Hypothesis		*Empirical evidence*
H1	Access to credit has a significant impact on the accumulation of physical capital by informal enterprises.	Supported
H2	Access to institutions has a significant impact on the accumulation of physical capital by informal enterprises.	Supported
H3	Access to technology has a significant impact on the accumulation of physical capital by informal enterprises.	Supported
H4	Access to the workforce has a significant impact on the accumulation of physical capital by informal enterprises.	Supported
H5	Access via social identity has a significant impact on the accumulation of physical capital by informal enterprises.	Supported
H6	Access to regional development has a significant impact on the accumulation of physical capital by informal enterprises.	Supported

7 Conclusions

The purpose of our study was to examine the impact of social and economic access given to informal enterprises in India on their success. In the context of SDG 8, which focusses on inclusive and sustainable economic growth and decent work for all, our findings provide essential insights into the performance and growth of informal companies in India. The results of our study indicate that access to credit, technology, and labour favourably affects CA among all categories of enterprises. Nonetheless, the advantages are inequitably allocated, as organisations with greater capital typically derive more benefit from these factors. This signifies the concentration of advantages among comparatively larger informal enterprises. This issue must be addressed to fulfil the objectives of SDG 8. Institutional access has enhanced from 2010–2011 to 2015–2016, highlighting the improved implementation of government initiatives. This alteration in policy execution represents a favourable advancement towards inclusive growth. The adoption of technology is undoubtedly the primary catalyst enabling informal enterprises to access diverse economic resources and critical information. Leveraging this technological access can facilitate inclusive and sustainable economic growth for numerous small enterprises in India.

The enduring disparities rooted in gender and social identity require targeted and sustained intervention. While there is slight enhancement in this situation for enterprises with comparatively greater capital, it is imperative that these concerns be addressed across all levels of firms for India to attain inclusive and sustainable growth and decent employment for all. The regional development has enabled the equitable distribution of benefits across all levels of enterprises by cultivating a regional business ecosystem and governance. The ongoing initiative to enhance infrastructure across all regions will undoubtedly produce improved outcomes in the future. In conclusion, we emphasise that India's economic outlook has shifted towards enhanced productivity and accessibility.

Nonetheless, numerous disparities in fair access to economic and social resources across various societal segments require rectification through targeted and differentiated policies. Enhancing credit and technological access for the lower quantiles, augmenting institutional coverage, ensuring equitable regional development, and addressing barriers related to gender and social background will assist India in fulfilling its obligations towards SDG 8 of inclusive sustainable economic growth.

Declarations

All authors declare that they have no conflicts of interest.

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