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Regional social capital and the accumulation of physical capital by informal enterprises in India

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Abstract: This research examines the influence of regional social capital on the acquisition of physical capital by informal enterprises in India. The research analyses regional structural (bridging) social capital, regional relational (bonded) social capital, and regional cognitive social capital. We have employed data gathered over 15 years from three separate rounds of NSSO regarding informal enterprises in India. We utilised a pseudo-panel methodology developed by Deaton (1985) to examine the longitudinal impacts of regional social capital on the accumulation of physical capital, employing a robust standard error model with fixed effects. This is an innovative effort to measure regional social capital in Indian districts and its influence on informal enterprises. Our findings demonstrate that regional structural (bridging) social capital and regional cognitive social capital positively influence the formation of physical capital in informal enterprises. Nevertheless, regional relational (bonded) social capital hinders the creation of physical capital by informal enterprises.

Keywords: social capital; physical capital; informal sector; pseudo panel; fixed effect model; Indian enterprises; India.

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1 Introduction

The Indian informal sector, comprising around 85% of total firms, is the predominant employer in India (Kulshreshtha, 2011; Sahai et al., 2020). Micro, small, and medium scale businesses with little physical capital (PC) make up the majority of this sector. The informal sector functions as a supplementary system for the formal sector, catering to both domestic and international markets (Marjit and Kar, 2007). This phenomenon is distinctive to India, where the informal sector is the preferred option for entrepreneurs and constitutes an important portion of the economy. The informal sector globally is perceived as a problematic entity requiring governmental involvement, prompting numerous governments to pursue its formalisation. Despite its significance to the Indian economy, it has received minimal policy attention and is consistently denied access to economic capital (Badola and Mukherjee, 2021; Bates and Robb, 2016; Bhavani and Bhanumurthy, 2014; Bongini et al., 2021; Chhatoi, 2022, 2025; Garg et al., 2025; Giné, 2011; Seema et al., 2021). This raises an issue regarding the factors that stimulate the expansion of informal firms in India. This study seeks to examine alternative socio-economic theories that explain this phenomenon within the socio-cultural framework of Indian enterprises.

Economic capital is commonly characterised as a surplus value, transferable and tradeable, productive, capable of generating returns, storable, requiring maintenance, subject to depreciation over time, and able to change its form. Economic capital has been regarded as both a tangible and financial asset, as noted by von Böhm-Bawerk (1889), Clark (1899), Kuznets (1938), Marx (1867), Moulton (1935), Robinson (1953), Smith (1776) and Turgot (1770). Certain researchers have associated these attributes with human skills and knowledge in their definitions of concepts such as human capital and intellectual capital (Barro, 1991; Lucas, 1988; Swan, 1956; Veblen, 1908). Bourdieu (1986), Coleman (1988) and Putnam (1995) have delineated analogous attributes of social capital, comprising individual and community-level intangible assets such as trust, association, reciprocity, norms, and values. All three types of capital assist firms in generating profit and expanding.

Indian enterprises are typically influenced by the spiritual and philosophical principles established by its founders. These firms leverage social capital derived from bonding, collective action, mutuality, and social connections (Walker and Ghodasara, 2021). The financial performance of Indian enterprises is influenced by the entrepreneur's social connections, including relationships with family, friends, relatives, and other societal members and organisations (Agrawal and Padmanabhan, 2025; Ahmad, 2025; Bhatia and Srivastava, 2022; Kent and Singh, 2024). The entrepreneur's political connections also influence the performance of his venture (Dar and Mishra, 2020). Chamola et al. (2022) observed that social capital enhances members' trust in the organisation, resulting in increased cohesiveness in the workplace. Deshpande and Khanna (2021) discovered that women involved in self-help groups (SHG) benefit from their engagement. The social capital generated by such SHGs enhances the effectiveness

of female-owned firms and improves their access to credit. Nichols (2021) also discovered that women who have gotten assistance from SHGs cultivate greater faith in the institution. Such women can derive advantages from the collective social capital generated by these partnerships. Andriani et al. (2022) noted that group lending programs have aided numerous female entrepreneurs and enhanced repayment adherence. The social capital plays an important role in the performance of the Informal enterprises (Heysham and Elkadi, 2025; Mahato and Jha, 2024) and especially women led enterprises (Hassan et al., 2024; Malti and Kodge, 2024; Shahzad et al., 2025). Given the limitation of large-scale data on social capital we will be looking at the regional social capital (RSC) to understand its impact on small businesses. This can also help understand the impact of external environmental factors like social capital (Asaturyan and Kosals, 2024; Cao et al., 2025; Shiu et al., 2025) on the performance of small businesses.

There is a scarcity of research that examines factors beyond financial and economic capital in evaluating the performance of informal firms in India. This study seeks to examine the influence of RSC on the acquisition of PC by informal enterprises in India. We aim to examine the function of social capital in Indian informal enterprises, particularly whether it acts as a substitute for PC or aids in the creation of PC by these enterprises. This study seeks to enhance understanding of the operations of informal firms, specifically within the framework of Indian socio-cultural contexts. This research assesses the efficacy of governmental programs targeting the informal sector, specifically those pertaining to women-led firms, while also enhancing the literature on the informal sector and social capital. This study examines district-level data on PC of informal enterprises and social capital to analyse the relationship between these variables. We hypothesise that RSC can influence the accumulation of PC by informal enterprises. We utilised extensive primary data sourced from the National Sample Survey Organisation (NSSO) of India, the Census of India, the Election Commission of India, and banking data from the Reserve Bank of India. A pseudo panel of repeated cross-sectional data was utilised to conduct a fixed effect regression model with robust standard errors.

We examined three dimensions of social capital – structural (bridging), relational (bonding), and cognitive – to understand how RSC affects the accumulation of PC by informal enterprises. Our findings indicate that structural (bridging) and cognitive social capital have a positive effect on the accumulation of PC by informal enterprises. In contrast, relational (bonding) social capital exerts a negative influence on the same. The subsequent sections of the paper are organised as follows: Section 2 addresses the theory of social capital and outlines the hypotheses. Section 3 elaborates on the methodology and components of the empirical model. Section 4 presents the results and findings. Section 5 emphasises the robustness of the model. Section 6 discusses the limitations of the study, and Section 7 concludes the article.

2 Theoretical background and hypotheses development

2.1 Social capital theory

The development of the social capital theory provided us with an alternate view about the behaviour of the firm and growth of businesses especially micro and small businesses. Social capital has become increasingly prominent in economics, sociology, and various fields within the human sciences over recent decades. Scholars have defined social

capital in various ways. French sociologist Bourdieu (1986) significantly contributed to social capital theory. He equated social capital with other forms of capital, specifically economic and cultural capital. He posits that the value of social capital is rooted in the social networks, connections, and resources it encompasses. Social capital can be transformed into various other forms of capital, including PC. This argument relates to the theories of social embeddedness and social networks proposed by Granovetter (1973, 1985). Social capital originates from the robustness of an individual's or organisation's social networks and their relative standing within that network. Burt (1992) noted that gaps in social networks present opportunities for both individuals and organisations. They address these gaps through the competitive advantages provided by information. According to embeddedness theory, economic actions must be understood within the context of social structures and relationships, rather than in isolation. Coleman (1988) emphasised the significance of social capital in the development of human capital. Social capital is integrated within familial and social relationships. In contrast to PC, which possesses a tangible nature, social capital lacks tangibility. Its presence, while untouchable, is observable, akin to other forms of intangible capital such as human capital and intellectual capital. Putnam (1995, 1993) argued that the social structure of civic society, manifested through civic associations, generates value in the form of social networks, trust, and reciprocity. The value generated by civic societies constitutes the social capital for individuals and groups. This marks the inaugural treatment of social capital as a macro concept. In contrast to previous scholars who viewed social capital as belonging to individuals, families, communities, or organisations, Putnam conceptualised it as an aggregate variable. He posited that social capital is collectively possessed by individuals within the social network. There is no consensus among scholars regarding the definition of social capital. Due to the complexity of the social capital concept, Portes (2000) advised that analysts in this field exercise caution when defining social capital in both theoretical and empirical contexts. Several scholars argue that it is essential to restrict the scope of the concept of social capital for its definition. Dasgupta (2005) posited that social capital should be regarded solely as an interpersonal network and nothing beyond that. The quality of capital can be assessed based on the engagement of these networks. This perspective was supported by Durlauf and Fafchamps (2005). Critics have expressed concerns regarding the term 'capital' in the context of social capital. Arrow (2000) noted that social capital does not possess certain characteristics necessary to be classified as capital. Solow (2000) acknowledges the significance of the social capital concept but advises caution to other scholars regarding the use of the term 'capital', as he perceives it as indicative of behavioural patterns.

2.2 Social capital measurement

Lin (2001) developed a framework for the measurement of social capital. He concentrated on embedded resources and network locations. Nahapiet and Ghoshal (1998) categorise the various aspects of social capital into three clusters: structure, relational, and cognitive. The structural dimension encompasses elements such as social ties, networks, and associations. The relational dimension encompasses shared codes, language, and narrative. The cognitive dimension encompasses trust, norms, obligations, and identifications. The work of past scholars significantly influences these three dimensions. The structural dimension is shaped by Coleman's contributions, the relational dimension by Putnam's works, and the cognitive dimension by

cognitive-oriented criticism (Nordstrom and Steier, 2015). Putnam (1995) similarly discussed bridging and bonding social capital. He described connections within a family, organisation, or community as bonding social capital. When connections extend to other families, organisations, or communities, this is termed bridging social capital.

Structural or bridging social capital is predicated on the overarching trust present at the regional level. This phenomenon is primarily influenced by the weak ties present within the social network. Weak ties serve to link distinct groups (Granovetter, 1973). Individuals and organisations enhance structural or bridging social capital by addressing gaps in the network (Burt, 1992). At the regional level, organisations akin to Putnam's that do not engage in rent-seeking behaviour serve as sources of structural and bridging social capital. The value generated by structural or bridging social capital is collectively possessed by individuals. This form of value creation leads to resource exchange and product innovation (Tsai and Ghoshal, 1998). Relational or bonding social capital is founded on ascribed trust within organisations and communities. These are cohesive groups characterised by strong internal connections. The sharing of embedded resources establishes more robust criteria for inclusion (Granovetter, 1985). This often results in over-embeddedness, with resources acting as barriers to growth and progress (Fukuyama, 1995a; Uzzi, 2011). This phenomenon is typically observed in Olson-type organisations characterised as rent seekers (Olson, 1982). Critics of social capital concepts contend that while social capital generates value, it may also introduce rigidities within society that can hinder the advancement of individuals and organisations (Fukuyama, 1995a; Paldam, 2000). Cognitive social capital denotes the extent of values and norms within a specific region. This examines the collective perceptions, experiences, and actions of individuals as a unified entity. Bandura (1986), in his social cognitive theory, established the influence of education on collective cognition. Transformations in gender roles are shaping societal perceptions of social values and norms. While we have classified social capital into three categories, we acknowledge the challenges in establishing clear distinctions among these types (Belay and Wondimu, 2024). Numerous aspects of these dimensions exhibit overlap. Poder (2011) contended that while earlier researchers have portrayed social capital as a singular concept, it actually comprises a combination of diverse social constructs (Skreli et al., 2024).

2.3 Social capital and PC

Fukuyama (1995a, 1995b) noted that social capital is founded on trust among individuals, facilitating the development of economic organisation. He distinctly differentiated between general trust, established through weak bonds, and family and kinship trust, founded on strong bonds. He noted that nations characterised by high levels of general trust have experienced economic growth, attributed to their confidence in civic institutions and systems. In these countries, social capital has made a positive contribution to economic growth. Countries with strong family ties often cultivate a kinship culture, and in contexts of low educational attainment, individuals are inclined to trust primarily their family or kin members. This constitutes a barrier to economic growth. Knack and Keefer (1997) observed that general trust and cooperation among civil society members contribute to enhanced economic performance. Interpersonal trust facilitates access to credit in underdeveloped financial systems. It can establish a system to assist individuals lacking formal property rights and contract enforcement. Zak and Knack (2001) and Guiso et al. (2004) share the perspective that low overall trust within a

society diminishes its capacity to generate income. The significant social distance among agents, along with weak institutions and ineffective contract enforcement, adversely affects economic performance. Beugelsdijk and Van Schaik (2005) found that it is not trust at the regional level, but rather active membership in associations that contributes to improved economic performance.

Social capital fosters an environment that is favourable for entrepreneurship. It generates business opportunities for individuals with social connections. This leads to a rise in the number of individuals engaging in business activities (Amini Sedeh et al., 2021). Entrepreneurial families foster a general acceptance of business activities. This subsequently affects cognitive social capital, fostering a favourable environment for businesses (Benavides-Salazar et al., 2022). Participation in religious activities fosters social capital, which in turn enhances entrepreneurial endeavours. Small businesses gain advantages from the networks established within religious congregations (Deller et al., 2018). Research indicates that social tolerance enhances entrepreneurial activities and fosters business opportunities by lowering barriers to social communication (Crowley and Barlow, 2022). Social capital facilitates the enhancement of relationships between informal and formal firms, resulting in strengthened informal-formal connections (Koto, 2017). Internal social capital enhances trust among informal entrepreneurs, which is crucial for expanding business activities in the absence of formal support (Agrawal and Padmanabhan, 2025; Akintimehin et al., 2019; Olamide and Ogbechie, 2021). Social capital facilitates improved access to financial resources for entrepreneurs. Businesses have gained access to venture capital under more favourable conditions. They have gained advantages through knowledge exchange and collaboration (Shao and Sun, 2021). Dudley (2021) examined the capital structure of newly established firms, revealing that social capital has replaced personal commitments and guarantees. Dang et al. (2023) found that households in better-connected areas have improved access to informal finance compared to those in less-connected areas. They are more adequately prepared to manage adverse shocks. Social capital facilitates the business growth of women entrepreneurs (Brogan and Dooley, 2024; Malti and Kodge, 2024). Wang et al. (2019) demonstrated that female entrepreneurs possessing superior social capital tend to favour external financing for their enterprises. It is essential to recognise that social capital may not facilitate growth for all business types (Bag and Ray, 2023; Sahi, 2022). Neumeyer et al. (2019) demonstrated that social capital significantly influenced female entrepreneurs in the lifestyle and survival sectors, whereas it did not exhibit a similar effect for those in high-growth enterprises. The urban-rural divide was similarly noted by Sun et al. (2023). Research indicates that individuals with higher social capital in rural areas are more inclined to engage in entrepreneurial activities due to limited access to the job market. Individuals with higher social capital residing in urban areas tend to favour employment opportunities, as their social networks facilitate access to superior job prospects. Social capital and robust social ties may also negatively affect business growth. Tshabalala and Sidique (2020) observed that individuals with stronger social ties exhibited a lower propensity for diversification, as they tend to rely heavily on the information and assistance available within their internal networks. The literature indicates a relationship between social capital and PC. This study will examine the association across three dimensions of social capital at the regional level, guided by the following hypotheses.

- H1 Regional structural (bridging) social capital influences accumulation of PC by informal enterprises in India.
- H2 Regional relational (bonding) social capital influences accumulation of PC by informal enterprises in India.
- H3 Regional cognitive social capital influences accumulation of PC by informal enterprises in India.

3 Data and model

3.1 Data

This study empirically investigates the relationship between RSC and PC. This research employs informal firm-level data acquired from three different rounds of surveys administered by the NSSO. The 55th Round (1999–2000), the 67th Round (2010–2011), and the 73rd Round (2015–2016) of the NSSO were executed by a nationwide unit-level survey concentrating on Unincorporated Non-Agricultural Enterprises, with the exception of construction operations. This dataset constitutes the most comprehensive compilation of information regarding informal enterprises in India. Non-profit organisations have been omitted from the sample to mitigate their potential impact on the results. The literacy rate data is obtained from the Census of India for the years 2001 and 2011, and from the NSSO's 71st Round (2014–2015) concerning the India Social Consumption Education survey. The statistics on voter turnout is obtained from the Election Commission of India's database, which includes statistical records on numerous state assembly elections. Data concerning the branches of District Central Cooperative Banks is obtained from the district-level database managed by the National Federation of State Cooperative Banks Ltd. (NAFSCOB).

A robust standard error utilising a fixed effects model has been used to examine the data presented in the following section. Statistical analyses are carried out using Stata 15 software. Data is accessible for 643 districts in 2015–2016, 603 districts in 2010–2011, and 501 districts in 1999–2000 for the majority of variables. The study is limited to 364 districts due to the availability of cooperative banks data, which was accessible solely for certain districts in 21 major states.

3.2 Pseudo panel

The calculation of PC is based on data regarding fixed capital from informal enterprises. The availability of data presents a significant challenge for research on informal enterprises in India. A significant number of these firms are distributed across a wide geographical area of the country. The sole dataset accessible is the NSSO's multiple rounds of data concerning non-farm informal enterprises. Only three of these rounds – 55th (1999–2000), 67th (2010–2011), and 73rd (2015–2016) – encompass all categories of non-farm informal enterprises. Alternatively, certain rounds focus exclusively on informal manufacturing enterprises. Given that the focus is on capital accumulation, obtaining time series data from the enterprises is essential. The absence of time series data on these firms is due to the NSSO's practice of conducting cross-sectional surveys in each round, resulting in potentially different enterprises being surveyed each time. The

NSSO does not disclose the identities of enterprises. To address this challenge, we opted to create a pseudo panel of repeated cross-sectional datasets utilising the method proposed by Deaton (1985). This method is robust and yields results comparable to genuine panels (Kim and Kang, 2014; Verbeek and Nijman, 1992). Kesar (2024) and Posti and Maiti (2023) employed a comparable methodology to create a pseudo panel utilising the same rounds of NSSO surveys.

This method involved the creation of district-specific cohorts of enterprises. The district represents the smallest administrative unit in India, possessing significant socio-political relevance concerning demographics and development. Individual enterprise-level data have been aggregated into district-level data by calculating the mean for ordinal scale data and proportions for nominal data. Data on district-level social capital variables is extracted and computed from the relevant databases.

3.3 Variables

Our selection of variables for the calculation of RSC is majorly influenced by Rupasingha et al. (2006) and Nahapiet and Ghoshal (1998).

Table 1 Model variables

<i>Variables</i>	<i>Description</i>	<i>Data source</i>
Physical capital	District-level mean of total fixed assets owned by informal enterprises.	NSSO's 55th, 67th and 73rd rounds of survey on unincorporated enterprises.
Voter turnout	District-level voter turnout.	Election Commission of India
Enterprise registration	The district-level proportion of informal enterprises that are registered	NSSO's 55th, 67th and 73rd rounds of survey on unincorporated enterprises.
Cooperative banks	District-level cooperative bank branches.	National Federation of State Cooperative Banks Ltd. (NAFSCOB)
Access to credit	The district-level proportion of informal enterprises that have outstanding loan.	NSSO's 55th, 67th and 73rd rounds of survey on unincorporated enterprises.
Literacy rate	District-level literacy rate.	Census of India and NSSO's 71st round survey on the India Social Consumption Education
Female-owned enterprise	The district-level proportion of informal enterprises that are female-owned.	NSSO's 55th, 67th and 73rd rounds of survey on unincorporated enterprises.
Labour productivity	District-level mean of labour productivity of informal enterprises. Labour productivity is calculated by dividing GVA by the total number of workers.	NSSO's 55th, 67th and 73rd rounds of survey on unincorporated enterprises.
Own account enterprise	The district-level proportion of own account enterprises (OAE).	NSSO's 55th, 67th and 73rd rounds of survey on unincorporated enterprises.
Household enterprise	The district-level proportion of informal enterprises that operate from household premises	NSSO's 55th, 67th and 73rd rounds of survey on unincorporated enterprises.

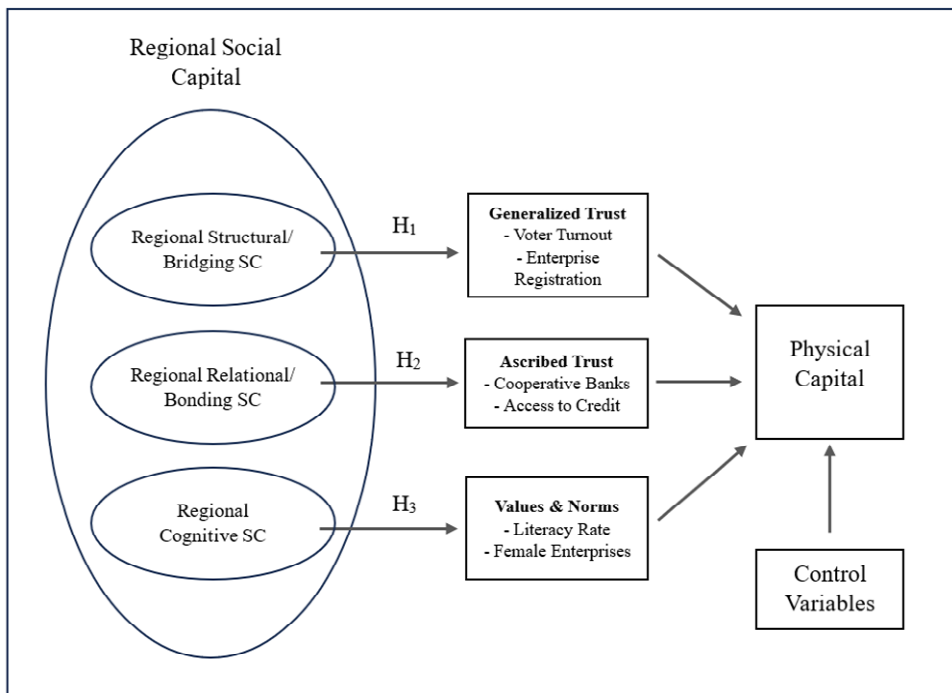
3.4 Model conceptualisation and details

The empirical model is based on the pseudo-panel data of repeated cross-sectional surveys. The model is as follows.

$$PC_{it} = \beta_0 + \beta_1 RSC_{it} + X_{it} + \varepsilon_{it}$$

Subscripts i and t denote district-level cohort and year respectively. The dependent variable PC is the district level mean fixed assets owned by informal enterprises in district i in the year t . The independent variable RSC is a vector of voter turnout, firm registration, cooperative banks, access to credit, literacy rate, and female enterprises. Regional structural/bridging social capital is represented by generalised trust. It is indicated by variables voter turnout, voting percentage and enterprise registration, the proportion of registered enterprises in district i in the year t . Regional structural/bridging social capital is represented by ascribed trust. It is indicated by variables cooperative banks, number of DCCBs and access to loan, the proportion of enterprises that have taken loan in district i in the year t . Cognitive social capital is represented by values and norms. It is indicated by variable literacy rate, and female enterprises, the proportion of female-owned enterprises in district i in the year t . X represents the vector of control variables that are firm characteristics at the district level. Labour productivity is a mean labour productivity, OAE is the proportion of OAEs, household enterprise is the proportion of enterprises that operate from the household premises in district i in the year t .

Figure 1 Conceptual framework of the model



3.5 *Diagnostic checks*

The Hausman test suggested a preference for the fixed effects model. The model has passed all diagnostic tests except one. The model demonstrates no endogeneity concerns, as indicated by a Hausman test p-value of 0.1295, above the significance level. A maximum VIF value of 4.57 indicates the absence of multicollinearity. The model demonstrates the absence of autocorrelation, as evidenced by a Wooldridge test p-value of 0.8683, which surpasses the significance level. The cross-sectional dependence test was unfeasible due to inadequate shared observations within the panel. The model demonstrated heteroskedasticity, evidenced by a Breusch-Pagan test p-value of 0.0010, which is below the significance threshold. We addressed the heteroskedasticity problem by utilising robust standard errors in the fixed effects model.

4 **Results and findings**

The findings explain the influence of RSC on the creation of PC by informal companies. This analysis of regional structural and bridging social capital highlights voter participation and the proportion of registered informal enterprises. In India, voting in elections is considered a crucial obligation. Politics affects almost every aspect of daily life and commercial operations. Rural India demonstrates consistently elevated voter participation compared to metropolitan areas. The difference in voter turnout between urban and rural regions highlights their dependence on the institutional framework. This also indicates the general confidence individuals have in institutions. Registering your firm with a governmental authority is the preliminary step in undertaking your enterprise with earnestness. Business activities are invariably dependent on bureaucratic approvals and permits. Registering a firm with a governmental agency signifies the general confidence that enterprises have in these organisations. Both variables positively impact the building of PC in informal companies. Bridging social capital strengthens relationships among varied groups. This serves as a lubricant that fosters business success in an environment defined by mutual trust and systemic confidence. Informal firms in India are heavily dependent on the existing level of societal trust, as numerous aspects of their operations are based on this trust. Areas with heightened structural and bridging capital have simultaneously shown greater PC accumulation in informal enterprises (Crowley and Barlow, 2022).

Regional relational social capital is measured by the quantity of district cooperative bank branches and the availability of credit. India has a significant history of cooperative movements. Different categories of cooperative societies, including producer cooperatives, credit cooperatives, labour cooperatives, and consumer cooperatives, operate at the regional level. These cooperative societies embody diverse groups united for shared goals. These organisations, characterised by Olson's framework, engage in rent-seeking activities aimed at enhancing the welfare of their members. Cooperative bank branches indicate the extent of activity of cooperative societies within a given region. Numerous cooperative societies conduct their banking operations through cooperative banks, attributed to the limited regulatory oversight of these institutions. Access to credit encompasses both formal and informal credit sources. In a bureaucratic system such as India, obtaining credit from a formal institution necessitates having connections within those institutions. Accessing formal credit can occur via corrupt

practices or through referrals. Individuals tend to leverage their political and community affiliations to gain recognition and circumvent financial obligations to intermediaries. Access to informal credit is similarly contingent upon social ties (Dang et al., 2023), particularly in the absence of assets to serve as collateral. Informal businesses typically favour obtaining funds from relatives or friends or leveraging these connections to access money lenders. SHGs predominantly led by women exhibit both of these characteristics. Individuals participate in such SHGs to obtain social and financial access. Both variables indicate the extent of regional relational or bonding social capital. Numerous scholars have observed that bonding social capital can undermine the common good by exacerbating disparities in social connectivity (Akintimehin et al., 2019; Beugelsdijk and Van Schaik, 2005; Fukuyama, 1995a; Shao and Sun, 2021). Our findings align with those of various scholars who have noted the detrimental effects of relational or bonding social capital. Regions characterised by elevated levels of relational or bonding social capital exhibit reduced PC accumulation among informal firms.

Table 2 Descriptive statistics

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. dev.</i>	<i>Min</i>	<i>Max</i>
Physical capital	1,063	10.45	1.11	7.20	12.34
Voter turnout	1,053	67.36	9.32	22.27	90.14
Registered enterprises	1,063	31.88	19.48	0.00	86.88
Log of cooperative banks	1,063	3.32	0.71	0.00	5.67
Access to credit	1,063	10.80	9.19	0.00	58.24
Literacy rate	1,062	64.15	12.94	27.38	94.01
Female enterprises	1,063	10.05	5.83	0.00	36.36
Log of labour productivity	1,063	10.74	1.11	8.40	13.05
Owned account enterprises	1,063	70.11	14.50	29.69	100.00
Household enterprises	1,063	34.05	11.96	2.00	68.90

Regional cognitive social capital is assessed by literacy rates and the proportion of female-owned businesses. The literacy rate in India has exhibited a steady enhancement. An elevated literacy rate promotes better access to knowledge and augments understanding. Indian society is distinguished by its prioritisation on values. Social values and conventions profoundly impact individuals' daily lives. Education fosters comprehension of these principles within a wider societal context. It has enabled the cessation of practices harmful to individuals and society at large. Similarly, the role of women in society is substantial. Indian regions are witnessing a rising proportion of women participating in the labour force and establishing their own businesses. The status and role of women in society indicate its degree of openness and acceptance. The informal sector in India functions as a principal channel for women to launch their enterprises owing to its comparative rapidity and simplicity of establishment. The two variables act as indicators of changes in regional cognitive social capital. Areas with high cognitive social capital have also shown greater PC accumulation by informal enterprises (Crowley and Barlow, 2022).

Control factors encompass district-level labour productivity of informal enterprises, a significant contributor to the generation of PC. The model results indicate that approximately 25% of the increase in productivity contributes to the accumulation of

fixed assets. The proportion of OAE reflects the quantity of enterprises operated by individual proprietors at the district level. The adverse effect of this proportion on district-level fixed asset creation highlights the constraints on the capacity for fixed asset development. The presence of enterprises based in household premises has positively influenced average capital accumulation at the district level. This may be attributed to reduced rental costs and the inclination to utilise personal and organisational savings for the accumulation of household assets.

Table 3 The empirical models results

<i>DV: Physical capital</i>			
<i>Independent variables</i>	<i>Model 1 OLS</i>	<i>Model 2 FE</i>	<i>Model 3 RSE</i>
Voter turnout	0.00731*** (0.00177)	0.00906*** (0.00310)	0.00906** (0.00361)
Registered enterprises	0.00711*** (0.00114)	0.0166*** (0.00188)	0.0166*** (0.00185)
Log of cooperative banks	0.0918*** (0.0242)	-0.141 (0.0961)	-0.141* (0.0779)
Access to credit	-0.0139*** (0.00191)	-0.00571** (0.00250)	-0.00571** (0.00222)
Literacy rate	-0.00357* (0.00187)	0.0150*** (0.00400)	0.0150*** (0.00419)
Female enterprises	-0.00337 (0.00321)	0.0114** (0.00508)	0.0114** (0.00523)
Log of labour productivity	0.574*** (0.0255)	0.256*** (0.0397)	0.256*** (0.0393)
Owned account enterprises	-0.0276*** (0.00217)	-0.0352*** (0.00262)	-0.0352*** (0.00264)
Household enterprises	0.0130*** (0.00141)	0.0211*** (0.00208)	0.0211*** (0.00235)
Constant	5.168*** (0.419)	7.756*** (0.573)	7.756*** (0.501)
Observations	1,052	1,052	1,052
R-squared	0.817	0.892	0.892
Number of State_District		364	364
Number of groups			

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

5 Robustness tests

The incorporation of fixed effects and robust standard errors strengthens the model's resilience. The fixed effect addresses unobserved, time-invariant variability among regional units, therefore reducing omitted variable bias. Robust standard errors improved

the model by addressing heteroskedasticity. It ensured more reliable inference despite the existence of non-constant error variances. The strength of our findings is seen in the stability of the coefficients for the main explanatory factors, which are statistically significant in all models. The R-squared rose from 0.817 in the OLS to 0.892 in the fixed effects models, so validating the robustness of our specification. These findings underscore the reliability of our estimates and affirm that the association between social capital and PC is independent of the model employed.

6 Limitations of the study

The task was formidable due to the limitations of data on informal enterprises and the availability of district-level data in India. A technique proposed by Deaton (1985) facilitated the construction of a district-level pseudo panel using data from repeated cross-sectional surveys. Efforts were made to collect and analyse district-level data on indicators such as literacy rate, voter turnout, and cooperative banks. Alternative variables may more accurately represent social capital. Due to data restrictions, this study was confined to the selected variables.

7 Conclusions

The study's findings demonstrate statistical significance for all three hypotheses. Regional structural and bridging social capital are crucial for the accumulation of PC by informal companies in a region. Informal enterprises depend on the general trust level within society for diverse requirements, including labour, suppliers, and consumer interactions. These enterprises function on a basis of trust owing to the inadequate legislative safeguards against malpractice. This regional structural and bridging social capital aids individuals and organisations in identifying network deficiencies, hence facilitating the formulation of business propositions (Burt, 1992; Patel and Wolfe, 2023; Shao and Sun, 2021; Weiss et al., 2019). Regional relational and bonding social capital serves as a unifying component. While it fosters greater connections and collaborative development within a particular organisation or group, it simultaneously encourages an insider-outsider mentality. This results in the proliferation of individuals within high-performing organisations, while reducing interactions among disparate organisations. At the aggregate level, it creates rigidities and restricts the dissemination of new information and ideas (Cordero and Lewis, 2024; Tshabalala and Sidique, 2020). Areas with high levels of relational or bonded capital limit access and opportunity for informal businesses. Regional relational and bonding social capital adversely affects the building of PC by informal companies. Regional cognitive social capital denotes the shared mentality of persons within a community. Areas with higher educational attainment and greater female economic participation show enhanced PC accumulation. An enhancement in educational attainment is enabling opportunities for informal firms via greater access to knowledge (Amini Sedeh et al., 2021). An increasing cohort of women entrepreneurs fosters greater social cohesion and enriches market insights through their profound comprehension of home requirements (Olamide and Ogbechie, 2021; Wang et al., 2019).

The study enhances the theory of the informal sector by elucidating its growth determinants. The study investigates an alternative methodology to traditional growth economic theories to better understand the expansion of informal enterprises in a country like India, characterised by a robust social and cultural framework. This study offers novel insights into the influence of social capital on the expansion of PC within informal enterprises. This study advances the literature on the informal sector and social capital by analysing their interaction across many characteristics of social capital. This study delineates critical domains for governmental policy formulation, encompassing the necessity to rectify deficiencies in institutional frameworks to bolster trust in the system, foster civic participation, reform and fortify the cooperative banking sector, refine the targeting of credit allocation, and invest in education and women's entrepreneurship. The forthcoming research program entails the creation of a RSC index that integrates supplementary variables reflecting the three elements of RSC.

Declarations

All authors declare that they have no conflicts of interest.

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