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Bank Access and Cultural Entropy across the Regions of India

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Abstract. Holding a bank account represents access to an important bank service for achieving the formal financial inclusion of an individual. At present, people living in different regions of India seem to experience different levels of access to this basic bank service and are therefore experiencing different levels of financial market exclusion. This paper studies to what extent social and cultural barriers hinder effective banking access across the regions of India. Normative caste-based exclusion can be modified by the rigidity of the local context in following inherited norms. This overall cultural rigidity of the context can be termed cultural openness. The Culture Based Development (CBD) approach to quantify cultural openness through the Cultural Entropy measure is employed here. Using data from the National Family Health Survey (NFHS) and National Sample Survey Organization (NSSO), I conduct a probit model estimation to test how Cultural Entropy (CE) modifies the caste discrimination effect in access to bank services. I find that there is strong evidence that regional Cultural Entropy modifies significantly the individual caste discrimination experience across the regions of the country.

Key words: bank services, regional accessibility, Culture Based Development, Cultural Entropy, India

1 Introduction

Having a formal bank account is still a major issue in most developing countries. In India, still people lack access to formal bank account even though India has demonstrated substantial progress in financial inclusion, with account ownership rising from 77.5% in 2021 to 89% in 2024 (DRG 2025). A persistent challenge is the high proportion of inactive accounts (16%), which remains considerably above the global average of 6%. Opening a bank account is important but using it is more important. However, most alarming is the fact that the improvement in bank access is not equitably distributed across space and different regions remain left behind in terms of bank access in comparison to others that manage more successfully to integrate their incumbent population.

Generally, the individual differences in access to bank services have been well studied. The reasons for poor access relate to factors such as distrust towards the formal institutions, gender-based mobility constraints, and low financial literacy, which all contribute to self-exclusion and limited bank account use. These factors reinforce reliance on informal financial networks (money lenders and shop keepers) despite high levels of account

ownership. The Government of India has launched many schemes and programmes (such as Jan Dhan Yojana, MUDRA, etc.) that aim to correct this self-exclusion behaviour.

There is however another aspect of the exclusion from bank services, and this is the discrimination by society and the system towards individuals from certain social groups. Numerous studies document the role of discrimination based on caste, religion, gender, race and other socio-economic variables in determining the access to bank accounts at the household level (Kumar, Venkatachalam 2019, Ghosh, Vinod 2017, Govindapuram et al. 2023).

However, none of the above can answer the question why the same social groups experience more discrimination in some regions of India and are less discriminated and better included in others. To address this gap, the present study hypothesizes that local cultural context affects financial inclusion by influencing how strongly individuals adhere to inherited social norms versus their openness to change. This regional cultural openness is hypothesized to moderate the effect of caste discrimination and thus results in unequal levels of financial system exclusion across the regions of India.

To operationalise this hypothesis, the paper employs the Culture Based Development (CBD) paradigm (Tubadji 2025a), and specifically its notion of Cultural Entropy (CE) (Tubadji 2025b). According to CBD, the local cultural openness can be understood in terms of wiring of the brain of the local population through the means of local aesthetic experience of either inherited (cultural heritage) nature, or experiences and participation including ideas and attitudes shaped contemporaneously by the society (i.e. what CBD terms living culture). CBD measures the overall open-mindedness of the local milieu as a balance between the level of exposures to cultural heritage (CH) and level of exposures to living culture (LC) experiences by the population. If both CH and LC are evenly present as experience locally, the locality will not exert cultural bias, and the choice locally will be rational. However, an imbalance in the proportion between CH and LC will generate cultural bias among the different social groups locally. A greater imbalance between CH and LC is associated with a higher likelihood of cultural discrimination across social groups. The balance between CH and LC is quantified using the Shannon Entropy Index for unrelated variety between CH and LC as components of the local cultural capital i.e. the power of the local cultural milieu to bias choice on the regional level. Hence, I will test whether the Cultural Entropy across the regions of India modifies the average individual effects of class discrimination towards castes, thus creating inequitable financial inclusion across the regions of India.

The rest of the paper is structured as follows. Section 2 presents my literature review of financial access in India and the role of caste and local culture from a CBD perspective. Section 3 discusses my data. Section 4 offers my estimation strategy. Section 5 presents the results and Section 6 concludes.

2 Literature Review

This section is divided into three main sub-topics. It starts with an overview of the literature on access to bank services in India, continues with an overview of the literature on caste-based discrimination in the country, and finishes with the Cultural Based Development (CBD) paradigm. This helps to distinguish between the caste norms and the local cultural variation across the regions of India that modifies the stickiness (i.e. severity) with which the caste discrimination affects the individual users of the bank services.

2.1 Access to Bank Services in India

Inclusive economic development is one of the major objectives of the Indian government. After the independence in 1947 it started with the Five-year plans, nationalization of banks and other private sector entities, which clearly shows the efforts of the government towards inclusion and Sustainable Development Goals (SDGs).

Access and usage of banking is an important public good, that enables all aspects of finance such as savings, credit, payments, insurance and risk management. It has a significant impact on reducing poverty and inequality and advances inclusive growth (Demirgüç-Kunt, Klapper 2013). India experienced a steep progress in financial inclusion,

but the barriers remain the same such as geography, economic status, caste, religion, gender, and digital divide (Sarma, Pais 2011, Govindapuram et al. 2023).

India's financial inclusion journey has evolved through several phases: bank nationalization in 1969, the expansion of rural branch networks (between 1970s to 1990s), the introduction of self-help groups (SHGs) and microfinance (2000s), Aadhaar-enabled direct benefit transfers (2010s), and the recent digital infrastructure revolution enabled by India Stack, UPI, and Jan Dhan Yojana (IMF 2021). Although account ownership has increased dramatically, especially after PMJDY (Pradhan Mantri Jan Dhan Yojana), account usage, quality of services, and consumer trust remain uneven across states, gender groups, and rural-urban boundaries (RBI 2020, Data For India 2023).

Access to banking in India has expanded through nationalisation-driven bank branch growth that reduced rural poverty (Burgess, Pande 2005), though liberalisation later slowed progress, sustaining exclusion (Sarma, Pais 2011). Microfinance and SHG-Bank Linkage models improved outreach but remained uneven and limited in transformative impact (Harper 2002).

Digital public infrastructure has significantly reshaped financial access in India, with Aadhaar reducing documentation barriers and enabling low-cost, paperless KYC processes. Together, Aadhaar, e-KYC, Jan Dhan accounts, and UPI created an interoperable digital architecture which has expanded access and reduced transaction costs for underserved populations (Mehta 2021). Aadhaar-enabled Payment Systems further extended last-mile service delivery through business correspondents, while UPI's rapid scaling beyond card and wallet transactions reflected widespread adoption of low-cost digital payments (NPCI 2022). However, digital divides persist due to gaps in smartphone ownership, gendered access to technology, and uneven digital literacy, limiting effective participation among women, elderly users, and rural households (Roy, Singh 2025).

Socio-economic factors remain strong predictors of financial inclusion. Income, education, and social identity shape account ownership and usage (Demirgüç-Kunt, Klapper 2013). Gender constraints, caste-based discrimination, and rural infrastructural deficits continue to restrict engagement with formal banking services (Jayachandran 2021, Thorat 2010, Sarma, Pais 2011, Govindapuram et al. 2023).

Supply-side constraints significantly shape the extent and quality of financial service delivery in India. High operational costs make rural branches financially unviable for many commercial banks, particularly in sparsely populated or low-income regions (RBI 2020). This has historically limited branch expansion despite substantial demand for formal financial services. The Business Correspondent (BC) model, introduced to enhance last-mile outreach at lower cost, has delivered mixed results. While it has improved access in remote areas, many BC agents face challenges such as low and irregular commissions, inadequate training, liquidity shortages, and operational risks associated with connectivity issues or fraud (Kochhar 2020). Product design also remains a structural weakness. Standardised savings and credit products are poorly suited to the irregular cash flows of low-income households, whose financial needs centre on frequent small deposits, emergency loans, and informal savings mechanisms (Collins et al. 2009). Weak consumer protection frameworks and inadequate grievance redressal systems further reduce trust in formal financial institutions, a concern exacerbated by rising cyber-fraud in digital transactions, particularly among digitally inexperienced populations (RBI 2020).

Policy interventions have been critical in shaping India's financial inclusion trajectory. The Pradhan Mantri Jan Dhan Yojana (PMJDY), launched in 2014, led to one of the fastest expansions of account ownership globally, increasing coverage from about 53 percent to over 80 percent of adults within a few years (World Bank 2020). However, studies highlight that a considerable share of these accounts remains inactive or maintains zero balances, raising questions about sustained usage and the depth of inclusion achieved (RBI 2020). The integration of Jan Dhan accounts with Aadhaar and mobile phones (the JAM trinity) substantially strengthened the implementation of Direct Benefit Transfers (DBT). This system streamlined welfare delivery, reduced leakages, and increased account activity, particularly among low-income households (Chattopadhyay, Roy 2021). Financial literacy initiatives by the Reserve Bank of India and public agencies aim to improve financial knowledge, responsible usage, and digital awareness. Yet their

effectiveness varies considerably across regions, gender, and socio-economic groups (Aggarwal et al. 2022). Regulatory innovations such as licensing Small Finance Banks and Payments Banks and promoting fintech-bank collaborations have diversified the financial ecosystem and expanded the provision of technology-driven solutions for underserved populations (Shah 2022).

Overall, the literature indicates that India has made substantial progress in expanding access to banking and financial services, particularly through digital infrastructure and state-led interventions. However, persistent gaps in usage, quality of service delivery, and equitable access remain. Scholars broadly agree that the central challenge has shifted from simply opening accounts to achieving meaningful financial inclusion that enhances financial resilience, economic participation, and long-term welfare for all citizens.

2.2 Caste Discrimination in India

Caste discrimination in India has been extensively studied (e.g. Thorat, Attewell 2007, Fuller 1996, Jodhka 2015) across the social sciences, with scholars repeatedly emphasizing that caste remains one of the most enduring and influential structures shaping social, economic, and political life. Early social sciences work positioned caste as a rigid hierarchy rooted in ideas of purity, pollution, and hereditary occupation (Dumont 1970). Although modernization, urbanization, and constitutional safeguards were expected to undermine caste boundaries, researchers argue that caste has shown remarkable resilience and adaptability, continuing to influence life chances in both rural and urban contexts (Fuller 1996, Jodhka 2015). The literature consistently demonstrates that caste persists not only as a cultural identity but also as a structural determinant of inequality.

One of the most widely documented domains of caste discrimination is economic participation. Empirical work shows that caste influences access to jobs, wages, and economic mobility. Using audit experiments, Thorat, Attewell (2007) provided compelling evidence that job applicants with Dalit-identifying (lower caste) names received significantly fewer callbacks than upper-caste applicants with identical qualifications. Labour market studies build on these findings to demonstrate that wage gaps between Dalits and upper castes persist even after accounting for education, experience, and location, suggesting that the disparities largely reflect discrimination rather than productivity differences (Madheswaran, Attewell 2007). Earlier research had already highlighted occupational segregation, with Dalits being concentrated in manual, low-wage, and stigmatized forms of labour (Banerjee, Knight 1985). The persistence of landlessness and unequal asset ownership further reinforces caste hierarchies. Rawal (2008) notes that Dalits remain disproportionately represented among landless households, and this structural deprivation limits their bargaining power and economic autonomy.

Education, often conceptualized as a route to mobility, is similarly shaped by caste-based barriers. Research on primary and secondary schooling, documents subtle and overt forms of discrimination, including biased teacher attitudes, segregation within classrooms, bullying, and lowered expectations for Dalit students (Nambissan 2010). Scholars find that such experiences affect learning outcomes, self-confidence, and school retention. In higher education, discrimination becomes more institutionalized. Sukumar (2013) observes that Dalit students in universities often face micro-aggressions, stereotyping, and social exclusion, undermining their academic performance and mental well-being. Although affirmative action policies have improved access to professional education and government employment, their impact is constrained by the persistence of prejudice and by the fact that many spaces of elite education remain dominated by upper castes (Deshpande, Yadav 2006).

Beyond economic and educational spaces, caste continues to shape everyday social interactions, neighbourhood patterns, and access to public goods. Ethnographic studies reveal that many villages still exhibit clear spatial segregation, with Dalits living in separate hamlets and facing restrictions on access to wells, temples, and common spaces (Shah et al. 2006). Urban spaces, long viewed as more anonymous and egalitarian, also show caste-based residential patterns. Sidhwani (2015) finds that informal rental markets often discriminate against Dalits, reinforcing patterns of exclusion that resemble rural marginalization. Everyday discrimination also manifests in social practices such as refusal

to share food, reluctance to enter Dalit households, or denial of services by barbers, priests, and other service providers (Thorat, Newman 2012). While such practices may appear subtle, they reflect deep-rooted prejudices that shape social hierarchies.

Violence remains an extreme but persistent expression of caste inequality. The literature documents that crimes against Scheduled Castes often arise in contexts where Dalits challenge traditional hierarchies, such as attempts to access common land, inter-caste marriage, or assertion of political rights (Jangam 2021). Scholars argue that the threat or use of violence functions as a mechanism to reinforce caste dominance and discourage upward mobility (Vithayathil, Singh 2012). Despite legal safeguards such as the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, implementation gaps and local power structures often limit justice for victims (Kapur 2020). Research shows that police response to caste-based violence is frequently inadequate, reflecting systemic bias and bureaucratic inertia.

The political sphere illustrates both the transformation and continuity of caste. Democratic participation has created new opportunities for lower-caste groups to mobilize and secure representation. Jaffrelot (2003) argues that the rise of Dalit and backward-caste political movements have altered India's political landscape, enabling marginalized groups to assert their rights and gain visibility. However, scholars caution that symbolic political representation does not always translate into substantive empowerment, especially in rural areas where upper-caste elites continue to dominate local governance (Pai 2002). Even where Dalits hold elected positions, social pressure and economic dependence can constrain their autonomy.

Recent literature expands the study of caste into modern and digital domains. With the proliferation of technology, caste identities have acquired new forms of expression. Studies on matrimonial websites show that caste remains a central criterion in marriage selection, demonstrating the continued relevance of endogamy (Banaji 2018). Social media has also become a space where caste prejudice is reproduced through trolling, abuse, and hate speech targeted at Dalits and other marginalized groups (Paik 2022). Online platforms, often thought to be democratizing spaces, thus also reflect offline hierarchies. Scholars argue that digital environments magnify certain caste biases because anonymity emboldens discriminatory behaviour that might be restrained in face-to-face settings.

Across this wide body of literature, a consistent theme emerges. Although India has enacted constitutional protections, progressive legislation, and affirmative action policies, caste discrimination continues to shape opportunities, interactions, and institutional outcomes. The nature of discrimination has evolved, shifting from overt exclusion to more subtle, indirect, or institutionalized forms, but its effects remain profound. Caste operates not only as a social identity but as a system of economic and political power. Researchers increasingly highlight the need to analyse caste as a dynamic, context-dependent force that interacts with class, gender, region, and emerging technologies. The growing recognition that caste persists even in spaces assumed to be modern and meritocratic, such as universities, corporate workplaces, and digital platforms, which suggests that it remains a durable form of inequality requiring multidimensional interventions.

2.3 Culture Based Development (CBD): Cultural Entropy

The concept of culture-based development (CBD) has emerged as a distinctive analytical framework that foregrounds the role of culture, its norms, values, symbolic systems, and inherited social structures, in shaping economic choices and regional development trajectories. Classical development theories tended to privilege capital accumulation, technological progress, and institutional design while treating culture as peripheral. However, contemporary scholarship argues that culture acts as a foundational determinant of economic behaviour and institutional performance, thereby shaping long-term development patterns (North 1990, Sen 1999). Culture influences the aspirations, preferences, and constraints faced by individuals and communities, and these, in turn, guide processes of social cooperation, resource allocation, and innovation. Thus, culture does not merely accompany development; it actively structures it.

Throsby (2001) was among the first to conceptualise cultural capital as an asset with both economic and intrinsic value. His framework highlights that cultural practices,

artistic traditions, and shared meanings contribute to human well-being and economic productivity in ways that are not fully captured by market transactions. This view aligns with the influential theory of cultural capital by Bourdieu (1986) which identifies cultural knowledge, competencies, and socialized behaviours as critical resources that shape educational attainment, labour-market opportunities, and social mobility. Combined, these perspectives shift the analysis of development from material resources alone to the distribution and reproduction of cultural resources across social groups.

Building on this foundation, Tubadji (2013, 2015) formalised the Culture-Based Development (CBD) model, which posits that culture functions as a contextual "background factor" influencing economic choices. The CBD model emphasizes that cultural biases, shaped by history, collective memory, social norms, and identity, play an important role in influencing individual behaviour, innovation, institutional efficiency, and regional economic development. In this framework, Tubadji (2013, 2015) distinguishes between"cultural bias", which affects social preferences, and "cultural capital", which reflects a community's capacity to generate economic value. According to this model, regions characterized by supportive cultural norms, such as trust, learning orientation, openness, and cooperation, tend to experience higher levels of social cohesion, better governance, and stronger economic performance. Conversely, regions marked by exclusionary cultural norms, rigid hierarchies, or discriminatory practices often face persistent underdevelopment despite their economic potential.

The CBD paradigm developed by Tubadji offers a robust theoretical and empirical framework for understanding the role of culture in shaping socio-economic outcomes (Tubadji 2012, 2013, 2025a). Unlike conventional approaches that treat culture as a residual factor or approximate it through narrow indicators such as religion, language, or ethnicity, CBD reconceptualises culture as a foundational element of socio-economic organisation. In this framework, culture is understood as a proto-institution: a locally embedded system of shared attitudes that shapes how individuals and communities assign value, form preferences, and interpret choices. Rather than directly constraining behaviour, culture operates as a cognitive and behavioural code that precedes formal institutions and structures the valuation processes underlying all socio-economic decisions (Tubadji 2021).

To operationalise this cultural valuation system empirically, CBD identifies two fundamental and exhaustive components of cultural capital: Cultural Heritage (CH) and Living Culture (LC) (Tubadji 2021, 2025a). Cultural Heritage represents inherited, identity-preserving attitudes that are transmitted across generations. These attitudes reflect deeply rooted symbolic meanings, norms, and traditions that provide continuity and stability within a locality. Living Culture, by contrast, captures contemporaneously formed and adaptive attitudes that emerge through ongoing cultural participation, aesthetic engagement, and social interaction. LC reflects the dynamic aspect of culture, responding to changing economic, social, and institutional environments. Together, CH and LC capture culture's dual role as both a mechanism of persistence and a source of adaptation, avoiding the under-specification that arises when culture is measured through isolated or arbitrarily selected indicators. Building on this dual structure, CBD introduces the concept of Cultural Entropy (CE), defined as the balance between Cultural Heritage and Living Culture (Tubadji 2025a,b). Cultural Entropy does not measure the quantity of culture but its internal configuration. It indicates whether a local cultural system is dominated by preservation-oriented attitudes, adaptation-oriented attitudes, or maintains a balanced combination of both. CE captures the degree of openness, coherence, and flexibility within a cultural system and predicts the direction and strength of behavioural bias at the local level. Empirical evidence suggests that CE often provides a more stable and interpretable predictor of socio-economic outcomes than CH or LC considered independently, particularly in contexts requiring cooperation, institutional adoption, or innovation (Tubadji 2013). A key empirical strength of the CBD framework lies in its approach to cultural measurement. Rather than relying on normative assumptions about which cultural traits are relevant, CBD constructs CH and LC using a broad set of cultural participation and behavioural indicators, aggregated through dimensionality-reduction techniques such as principal component analysis (PCA)

(Tubadji 2021). This value-neutral methodology minimises both under-measurement and over-interpretation, addressing two persistent challenges in empirical cultural research: the reduction of culture to simplistic proxies and the conflation of cultural effects with socio-economic characteristics.

CBD has been applied across diverse empirical settings, including regional economic performance, innovation, migration, and institutional quality (Tubadji 2013, Tubadji, Nijkamp 2015). These studies demonstrate that culture, when rigorously operationalised, exerts an independent and systematic influence on behavioural and spatial outcomes. This makes CBD particularly relevant for analysing ecological public goods and collective action problems, where outcomes depend on shared norms, cooperation, and long-term commitment.

In the Indian context, where cultural diversity is extensive and cannot be adequately captured through single dimensions such as caste or religion, the CBD framework provides a uniquely comprehensive approach to measuring cultural milieu (Tubadji et al. 2024). By capturing both inherited and adaptive cultural attitudes and summarising their balance through cultural entropy, CBD enables a systematic analysis of how local cultural capital shapes access to formal credit across regions in India.

Empirical literature reinforces these claims. Putnam's comparative study of Italian regions (Putnam 1993) demonstrated that social capital rooted in shared cultural norms of trust and reciprocity strongly predicts institutional performance and developmental success. Similar findings have been observed across diverse settings, where cultural contexts shape the effectiveness of local governance, collective action, and public-goods provision. In the Indian context, prevailing cultural structures, especially caste hierarchies, gender norms, and localised community identities, have been shown to influence educational outcomes, economic aspirations, labour-market participation, and entrepreneurship (Deshpande 2011, Basu 2017). These patterns illustrate that cultural norms can both empower communities and entrench disadvantage, depending on their nature and historical evolution.

CBD literature also highlights the economic potential embedded in cultural assets. Throsby (2010) and UNESCO (2013) argue that cultural heritage, creative industries, and traditional knowledge systems can serve as drivers of local development by generating employment, promoting tourism, and fostering innovation rooted in local identity. Cities that have invested in cultural clusters, heritage conservation, and creative economies often observe positive spillover effects on urban regeneration and social cohesion. However, critical scholarship warns that the commodification of culture must be approached with caution. Without inclusive governance, cultural-economy policies may lead to gentrification, exploitation of indigenous communities, or the reinforcement of existing hierarchies (Harvey 2001).

Taken together, the literature on culture-based development challenges the notion that development is culturally neutral. Instead, it reveals that cultural contexts shape preferences, institutions, and opportunities, influencing both micro-level decision-making and macro-level developmental trajectories. The CBD approach integrates cultural analysis with economic modelling, offering a multidimensional explanation of why regions with similar economic endowments can experience divergent growth paths. As globalisation and digitalisation reshape social identities and cultural interactions, culture-based development frameworks provide valuable analytical tools for understanding how deep-rooted beliefs and evolving cultural dynamics interact with economic transformations.

I have chosen to employ the CBD paradigm in my research, due to its comprehensive definition and measurement of local cultural as a factor for behaviour and choice. Namely, I choose to employ CBD in order to account more comprehensively for the cultural milieu effect beyond the particular caste effect that the literature already knows about. This can reveal a more complete picture about the cultural bias on the access to financial services in the regions of India.

3 Data

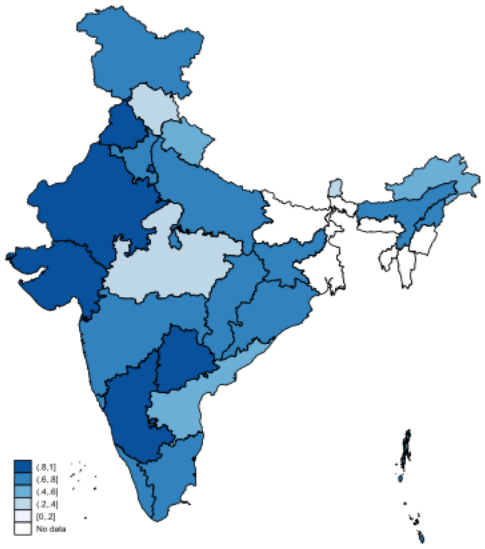
To operationalise my model, I use a rich dataset of about 630,000 individuals. The data is obtained from two main data sources: (i) the National Sample Survey Organisation (NSSO) 71st round on the Survey on Literacy and Culture of India 2014, used to operationalise regional Cultural Entropy and (ii) the National Family Health Survey (NFHS) 5th round (2019-21), used to obtain the information on bank access, demographic controls and among them the caste belonging of the individual. Both data sets are sample surveys of the Government of India, and are publicly available.

The main outcome variable is the access to bank account. In the NFHS Survey, respondents are asked *do you have a bank account?* The variable is a binary in nature (yes or no). This justifies the use of a probit estimator for testing our hypothesis. The 0-1 coding of the outcome provides clear identification of who has access and who does not have access, i.e. is excluded from access to basic bank services.

The main explanatory variables reflect differences in the local cultural milieu, particularly the persistence of caste norms and the extent to which they continue to shape social interactions and behaviour. From the Survey on Literacy and Culture of India (NSSO - 2014), I utilize 18 variables capturing diverse forms of cultural participation and practices related to inherited cultural traditions. These include activities such as reading books, attending musical events, undertaking travel motivated by religious beliefs, and listening to religion-related mass media programmes. These variables are employed to construct composite indicators – factor variables – that represent the local cultural context,commonly referred to as the cultural milieu. In the framework of Culture-Based Development (CBD), the local cultural milieu is studied as a source of cultural bias on individual choices. The power of the milieu to create this bias is termed local cultural milieu. The magnitude of this power is defined as a product of the composition of cultural capital, specifically by the level of its two components: cultural heritage (CH; inherited local attitudes) and living culture (LC; currently shaped cultural attitudes). The degree of stickiness, flexibility to change of the local milieu is termed Cultural Entropy as measured in terms of the balance between the level of CH and LC locally. CBD calculates the balance between CH and LC employing the Shannon Entropy index of unrelated variety between CH and LC in the composition of the local milieu. The Cultural Entropy (CE) index can vary between 0 and 1, these being the only mathematically possible extremes for Shannon entropy for two classes. When CE is close to 0, the local cultural milieu exudes very little source of bias on local choices and the latter are optimal and rational locally or at least do not vary across space in the degree of their cultural bias in the country that follows the same formal laws. Hence, through principal component factor analysis I obtain the CH and LC for the regions of India and use them to calculate the CE for the regions of India (see Appendix A for the details). This CE will be my main explanatory variable. I will interact it with the individual caste, expecting that the caste-discrimination experienced by the individual will be moderated by the stickiness to tradition that the local cultural milieu exudes. The higher the Cultural Entropy, the lower the experienced discrimination due to the caste is expected to be, in line with the CBD paradigm theory and preceding research.

I have plotted these main dependent and independent variables on two maps. Figure 1 shows Cultural entropy across Indian states, while Figure 2 shows the banking access across Indian states. Both figures show significant inter-state heterogeneity and highlight the spatial variation in social-cultural diversity and financial penetration across India. Figure 1 shows that North-eastern states and large urban states have larger CE. It may be because of the more linguistic, ethnic and migrant populations. Further, Western and Southern states shows that there is a higher diversity probably due to opportunities in urban areas and the internal migration. Figure 2 shows that formal financial services are not equally distributes across Indian states. South and Western states have higher banking access as compared to other areas, it may be due the better educational levels and the stronger government policies. North-Eastern and some eastern states have low access, may be because of the geographic and institutional challenges.

Control Variables come from the NFHS. They include wealth of the individuals, num-



Source: DataMeet (State Boundary shapefiles); NFHS and NSSO data
Notes: authors' calculations

Figure 1: Cultural Entropy across Indian States

ber of children in the family, age of the household head, gender of the household head, location and the year of interview. More details on the descriptive statistics for each variable can be seen in Appendix B.

4 Estimation Strategy

My testable working hypothesis can be stated as follows:

> *H01*: The regional Cultural Entropy modifies the degree of caste discrimination experienced by an individual in terms of access to banking services in India.

To test this hypothesis I have to implement two steps. The first regards quantifying comprehensively the regional context using the CBD paradigm. The second comprises of testing the hypothesis. The estimation strategy for each step is detailed below.

First, I obtain the Cultural Entropy index according to the CBD paradigm procedures. All eighteen mono-dimensional variables available from the dataset are used in a principal component factor analysis. Thus, I obtain the two components of the local cultural capital: Cultural Heritage (CH) and Living Culture (LC). I use their sum and the percentage that each represents in the sum to calculate the Shannon Entropy index that gives the Cultural Entropy, as defined by CBD (see Tubadji 2025a).

Second, I use the following Probit model (Equation 1) to test my working hypothesis *H01*:

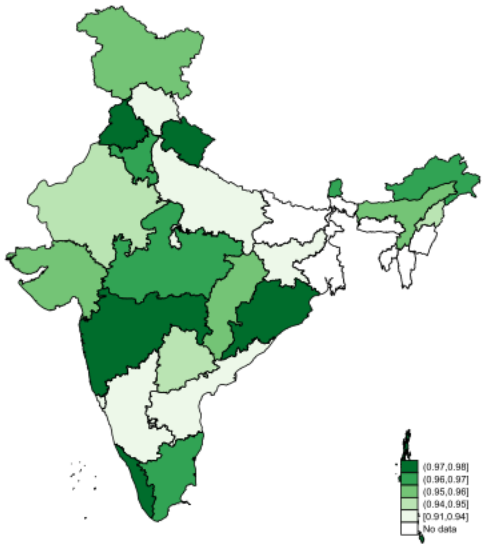
$$\text{Access\_Bank} = f(\text{Caste}, \text{Cultural Entropy}, \text{Caste*Cultural Entropy}, Z, \varepsilon) \quad (1)$$

The components of the above stated model (Equation 1) are defined as follows:

Access_Bank – having a bank account (yes/no, 0 or 1)

Caste – caste of the individual

Cultural Entropy – the openness (i.e. stickiness) of the regional cultural context, expressed as the balance between CH and LC, calculated using a Shannon Entropy index, according to the CBD methodology (Tubadji 2025a,b).



Source: DataMeet (State Boundary shapefiles); NFHS and NSSO data
Notes: authors' calculations

Figure 2: Banking Access across Indian States

$\boldsymbol{Z}$ – a battery of individual and household control variables

ε – error term

The main test for hypothesis *H01* here consists in investigating whether the interaction between individual caste and regional Cultural Entropy is statistically significant. The direction of the effect is a matter of the particular case.

5 Results

Using the Probit model, I estimated step wise results. Before obtaining the parametric main results, I can clearly see in Table 1 that there are different strength and direction of the basic correlation between the individual castes and the Cultural Entropy of the regions. Also, the bank access is weakly and negatively associated with Cultural Entropy and wealth follows the same pattern but with higher magnitude. Apparently, I can expect to find that places that are more open and equitable as a local cultural milieu (having higher Cultural Entropy) end up concentrating poorer population which consequently has lower access to financial services due to one's economic exclusion.

Table 1: Correlation Coefficients

	Cultural Entropy	bank_acc	wealth index	caste_1	caste_2	caste_3	location
Cultural Entropy	1						
bank_acc	-0.0145	1					
wealth index	-0.0689	0.0705	1				
caste_1	0.0943	-0.0355	-0.2717	1			
caste_2	-0.0288	0.0224	0.0641	-0.401	1		
caste_3	-0.0404	0.0151	0.2701	-0.2568	-0.4053	1	
location	0.0149	0.0127	-0.477	0.133	-0.0308	-0.1204	1

Source: Authors calculations using NFHS and NSSO data

At a next step, I can proceed with the actual parametric hypothesis testing; in particular whether the caste discrimination in bank access is moderated by the local cultural openness (i.e., the cohesiveness and inclusivity-propensity of the local cultural milieu). To test this hypothesis, I use a probit model that clearly distinguishes and identifies exclusion by not having a bank account. The variable is 0-1 coded in the survey, hence

it is also statistically appropriate to use a probit model in this instance. The results are presented in Table 2.

Table 2: Caste Discrimination for Bank Services Access, moderated by Regional Cultural Entropy – Probit model estimations

Variables	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
Cultural Entropy	-0.0911***	-0.149***	-0.0646***	-0.120***
	(0.0104)	(0.0216)	(0.0107)	(0.0225)
caste_1	-0.105***	-0.231***	-0.0564***	-0.140***
	(0.00853)	(0.0232)	(0.00866)	(0.0240)
caste_2	0.0951***	0.0852***	0.0565***	0.0300
	(0.00786)	(0.0200)	(0.00803)	(0.0207)
caste_3	0.0973***	0.0435*	-0.00415	-0.0593**
	(0.00908)	(0.0231)	(0.00955)	(0.0241)
wealth_index			0.157***	0.157***
			(0.00277)	(0.00277)
No_child			0.0179***	0.0179***
			(0.00394)	(0.00394)
Age_hh			0.00134***	0.00135***
			(0.000222)	(0.000222)
Sex_hh			-0.114***	-0.114***
			(0.00721)	(0.00721)
2.location			0.321***	0.320***
			(0.00786)	(0.00786)
2020.year_interview			0.0154**	0.0115*
			(0.00682)	(0.00692)
2021.year_interview			0.143***	0.138***
			(0.00754)	(0.00765)
inter_ce_caste_1		0.179***		0.120***
		(0.0312)		(0.0324)
inter_ce_caste_2		0.0149		0.0395
		(0.0275)		(0.0286)
inter_ce_caste_3		0.0815**		0.0829**
		(0.0323)		(0.0337)
Constant	1.749***	1.788***	1.129***	1.168***
	(0.00921)	(0.0157)	(0.0205)	(0.0245)
Observations	603,348	603,348	603,348	603,348

Source: Authors calculations using NFHS and NSSO data
Notes: Dependent Variable = Having access to Bank account, Independent variables include: Cultural Entropy, Caste 1= STs (Schedule Tribes), Caste 2 = SCs (Schedule Castes) and Caste 3 = OBCs (Other Backward Classes) and General caste category is the base category. wealth_index = Wealth Index of the Individuals (which measures the income across the individuals). No_child = Number of Children in the family. Age_hh = Age of the Household head. Sex_hh = Gender of the Household Head, it may male or female. Location is Urban or Rural. NFHS Survey Interviews – 2019, 2020 and 2021, 2019 is the base category. I considered this Year of the interviews to check whether COVID-19 pandemic have some influence on the selected variable. Further, I have done interaction between the Cultural Entropy (CE) with the all the Caste categories step wise. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2 gives the estimation of probit results for four alternative specifications. Specification 1 tests for the presence of association between individual caste, regional Cultural Entropy and the bank access of the individual. Specification 2 adds the main interaction between caste and CE, which is the core of hypothesis *H01*. Specification 3 adds a battery of controls to what is tested in Specification 1. Specification 4 adds the same battery of controls to what is tested in Specification 2. Thus, Specification 4 is my most rigorous test of *H01* in the presence of all available controls.

There is negative and significant relationship between the cultural factors and the bank access in all the model specifications. Caste 1, that is Scheduled Tribe (ST) caste have lower access to bank account as compared to the Scheduled caste (SCs) and other castes. (Caste 2 and Caste 3). The wealth of the individual is positively impacting bank access, as higher wealth will lead to more bank access, in turn more financial inclusion. This result is clearly expected and indicated that the model performs adequately. Number of children in the family, age of the head of the households and the location are positively

and significantly influencing bank access. This might be due to the correlation between wealth and decision to have a family and what size this family can afford to be in terms of number of kids.

The main test of *H01* is contained in the statistical significance of the interaction terms in Specification 2 & 3 in Table 2. Statistically speaking, both CE, caste and their interaction are statistically significant with and without additional controls. This means that the statistical significance of the interaction is indeed very powerful. *H01* cannot be rejected based on my data and estimation strategy.

The economic meaning of these results is that regional cultural context has a comprehensive characteristic as a milieu that moderates the level to which the inherited social norms affect individuals. This is a core claim and expectation of the CBD market for values (see Tubadji 2025a). It seems that this expected relationship is present across the regions of India. There is a comprehensive local characteristic of the cultural milieu that moderates the inherited social norms and the discrimination that different cultural clubs will experience locally.

6 Conclusion

This study aims to employ the CBD paradigm in order to explain the regional inequality in access to bank services among the regions of India. We know that there is caste discrimination, but castes are present everywhere across the territory of the country and some localities experience worse inclusion than others. This effect is not entirely compositional – in terms of having segregation in castes per regions. Hence, it is very relevant to hypothesize that the different cultural milieux in the regions of India contribute to different degrees of caste discrimination which results in different average levels of exclusion from the banking services.

The study uses a big dataset, with over 600,000 observations regarding the banking services and augments this data with high quality survey data about local cultural participation across the regions of India. The latter allows for implementing the CBD over-identification of culture and measure most precisely the aggregate cultural milieu in every region.

The results clearly demonstrate that individual level caste discrimination is moderated by the overall regional cultural entropy of the region. This is a highly encouraging insight because it opens an avenue for intervention in the unwanted inequality in financial integration. By rebalancing the cultural participation of the lagging behind regions, the necessary cultural milieu can be ensured that will decrease the regional cultural bias and allow these regions to catch up in financial integration of all their social groups.

The strong statistical significance of the interaction between caste and regional Cultural Entropy suggest that the above policy advice is likely to be reliable. Further CBD-employing research, confirming the role of aesthetic education for moderating local inequality in discrimination and financial integration is therefore highly relevant and needed.

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A Appendix: Obtaining the CBD Cultural Entropy Measure

The 18 variables used in this study are drawn from the NSSO - Survey on Literacy and Culture (2014) and capture diverse forms of cultural participation and inherited cultural norms. These include membership in clubs and cultural groups, engagement with reading books, viewing television programs, radio, cinema, and video shows, as well as attendance at dramas, dance performances, musical programs, and religious programs. Participation in sports and games, magic shows, puppet shows, museum or exhibition visits, educational and recreational activities, and religiously motivated travel are also included. Collectively, these variables provide a comprehensive measure of individual and household involvement in cultural activities, serving as indicators to construct factor variables that reflect the local cultural milieu or cultural capital.

A principal component factor analysis is implemented with these 18 variables. This identifies a CH and LC factor variable as elements of the local cultural capital. The rotated loadings of the variables in factors are presented in Table A.1.

Figure A.1 shows the Scree plot of eigenvalues after factor loading, which means a decline in eigenvalues after the fourth factor, indicating that four factors are sufficient to represent the underlying data structure and variation.

Table A.1 shows a significant Bartlett's test and a KMO value of 0.642 suggest adequate intercorrelation among variables and support the use of factor analysis.

Table A.2 clearly indicate that six factors have eigenvalues greater than one and together explain approximately 45.2% of the total variance in the data.

Table A.3 shows the contribution of each variable to the extracted latent factors, highlighting the underlying dimensions captured by the factor analysis.

Table A.1: Bartlett's Test of Sphericity and Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy

Bartlett test of sphericity H0: variables are not intercorrelated	Kaiser-Meyer-Olkin Measure of Sampling Adequacy
p-value = 0.000 Chi-square = 5.78e+05 Degrees of freedom = 153	KMO = 0.642

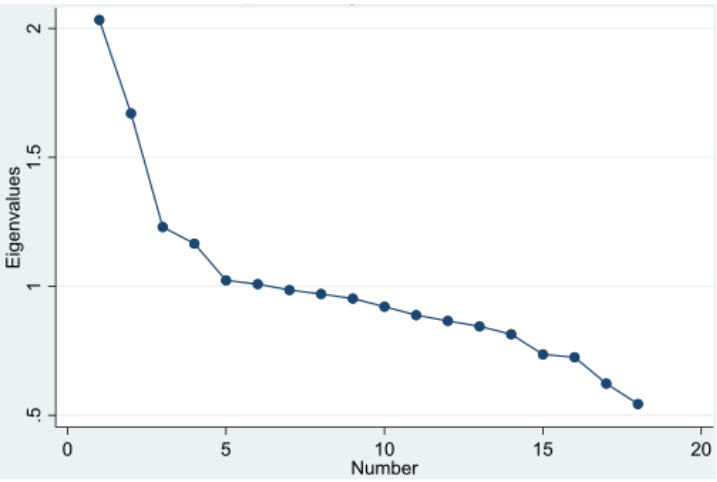

Figure A.1: Scree plot of eigenvalues after factor

Table A.2: Eigenvalues and Variance Explained by Retained Factors

Factor	Variance	Difference	Proportion	Cumulative
LC_Performance	1.89637	0.45321	0.1054	0.1054
LC_Telecast	1.44317	0.09933	0.0802	0.1855
SC	1.34384	0.09556	0.0747	0.2602
CH_relig	1.24828	0.10098	0.0693	0.3295
LC_shows	1.1473	0.09608	0.0637	0.3933
Sports	1.05122	.	0.0584	0.4517

Notes: LR test: independent vs. saturated: $\text{chi}^2(153) = 5.8\text{e}{+05}$ Prob>chi2 = 0.0000

Table A.3: Factor Loadings and Uniqueness of Variables from Factor Analysis

Variable	LC_Performance	LC_Telecast	SC	CH_relig	LC_shows	Sports	Uniqueness
Club	0.2327	0.0971	0.205	0.6209	0.0218	-0.1772	0.4771
Cultural Group	0.2505	-0.0006	0.1878	0.6071	-0.107	-0.1292	0.5052
Reading Groups	0.2214	0.6818	-0.0926	-0.0452	0.2207	0.0749	0.4212
Radio/Tape recorder	0.1798	0.6008	-0.4467	0.0768	-0.0448	0.1124	0.3866
TV Programmes	0.2096	0.5265	0.4972	-0.2549	0.0694	-0.0338	0.3608
Cinema	0.1953	0.3266	-0.4014	0.176	-0.3318	0.2019	0.5123
Video Show	0.2394	0.2874	0.1932	-0.124	0.5085	0.0779	0.5427
Drama	0.4196	-0.1139	-0.0325	0.1152	-0.0705	0.0429	0.7899
Dance	0.5445	-0.1991	-0.1016	-0.1365	-0.0024	-0.0696	0.6301
Recreation/Musical	0.2953	-0.0735	0.0485	0.1363	0.2024	0.2729	0.7711
Religious Programmes	-0.0391	-0.3786	0.0143	0.197	0.5258	0.2761	0.4634
Sports & Games	0.1174	0.13	0.1846	0.1724	0.1844	-0.3116	0.7744
Circus/Magic show	0.5618	-0.2217	-0.115	-0.2662	0.0338	-0.0628	0.5461
Puppet/ other show	0.6341	-0.2377	-0.1188	-0.1726	0.0033	-0.1128	0.4847
Museum/Exhibition	0.5653	-0.1777	-0.0346	-0.0556	-0.0554	-0.0308	0.6405
Educational	0.2253	-0.0315	0.0474	0.1712	-0.1291	0.1287	0.8834
Recreational	0.1623	0.0769	0.6047	-0.1915	-0.4411	0.0435	0.3689
Religious	0.0781	-0.0789	0.2331	0.0577	-0.1226	0.7769	0.3114

Source: Authors collation based on the NSSO data
Note: Using 18 cultural variables from the NSSO (2014), I conducted a factor analysis and extracted six underlying factors. Each factor was labelled based on its constituent variables, as indicated by the factor loadings. These factor scores were then aggregated at the regional level to generate a cultural profile for each region. The resulting regional summaries provide a quantitative description of the local cultural context in which individuals observed in the NFHS dataset are embedded.

B How is the Cultural Entropy calculated?

Cultural Entropy is calculated according to Tubadji (2025a). To quantify the local cultural environment, this study adopts the Culture-Based Development (CBD) framework, which conceptualizes culture as a complex entity composed of two core components: Living Culture (LC) and Cultural Heritage (CH). CBD argues that any local cultural system can be understood through the balance between these two elements, where LC captures every day, contemporary cultural practices, and CH reflects historically rooted or traditional cultural expressions.

To operationalize this balance, CBD defines cultural entropy (CE) as a measure of the variability between LC and CH within the cultural capital of a locality. This measure is derived by adapting the Shannon Entropy formula (Shannon 1948):

$$CE = H(p_i) = -\sum_i p_i \log(p_i) \tag{2}$$

where:

i denotes the cultural class, which in this framework comprises two categories: LC and CH.

p_i represents the probability that a cultural activity in a given locality falls into category i.

H denotes the Shannon Entropy, interpreted here as the variability of the cultural capital composition.

A higher CE value indicates a more even balance between LC and CH, suggesting a diverse and dynamic cultural environment. Conversely, a lower CE value reflects the dominance of one cultural component, signalling a more homogeneous cultural landscape. Although Shannon Entropy can theoretically range from 0 to infinity, with two classes it is effectively bounded by the distribution of LC and CH probabilities.

To construct these probabilities empirically, I use 18 cultural participation variables from the NSSO (2014) survey, representing a wide spectrum of cultural activities such as reading, watching cultural programs, attending performances, sports, religious travel, museum visits, and other cultural engagements.

A factor analysis (FA) is conducted on these 18 variables, producing six underlying factor dimensions, each labelled according to its dominant cultural characteristics based on factor loadings. These factor scores are then aggregated at the regional level, generating quantitative summaries that capture regional cultural profiles.

Next, these regional cultural scores are mapped onto the two CBD cultural classes (LC and CH), allowing the computation of probability distributions p_i for each region. These distributions are used to calculate cultural entropy (CE) for each region.

Finally, the regional CE scores are merged with the National Family Health Survey (NFHS) dataset. Each individual in the NFHS is thus situated within a quantified description of their local cultural context. This enables analysis of whether and how variations in local cultural entropy influence household behaviours, social outcomes, or developmental indicators captured in the NFHS.

Table B.1: Summary Statistics for the Main Variables in the Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
bank_acc	6,34,731	0.956353	0.204308	0	1
CE	6,34,868	0.661338	0.280253	0.000779	1
caste_1	6,03,491	0.202606	0.401942	0	1
caste_2	6,03,491	0.387608	0.487205	0	1
caste_3	6,03,491	0.206013	0.40444	0	1
inter_ce_c~1	6,03,478	0.144648	0.309233	0	1
inter_ce_c~2	6,03,478	0.25228	0.364477	0	1
inter_ce_c~3	6,03,478	0.131579	0.28752	0	1
wealth_index	6,34,881	2.814297	1.39628	1	5
no_child	6,34,881	0.435746	0.757291	0	11
age_hh	6,34,881	49.62948	14.11599	12	98
sex_hh	6,34,881	1.172283	0.377693	1	3
location					
urban	6,34,881	0.251591	0.433927	0	1
rural	6,34,881	0.74841	0.433927	0	1
year_inter~w					
2019	6,34,881	0.476655	0.499455	0	1
2020	6,34,881	0.279197	0.448605	0	1
2021	6,34,881	0.244148	0.429581	0	1

Source: Authors collation based on the NFHS and NSSO data
Notes: Dependent Variable = Having access to Bank account, Independent variables includes: Cuntural Entropy, Caste 1= STs (Schedule Tribes), Caste 2 = SCs (Schedule Castes) and Caste 3 = OBCs (Other Backward Classes) and General cate category is the base category. wealth_index = Wealth Index of the Indivuals (which measures the income across the individuals). No_child = Number of Children in the family. Age_hh = Age of the Household head. Sex_hh = Gender of the Household Head, it may male or female. Location is Urban or Rural. NFHS Survey Interviews – 2019, 2020 and 2021, 2019 is the base category.