DISSERTATION ON

Finance, Efficiency, and Sustainable Development:

A Structural and Behavioural Analysis of Indian States (2015–2024)

MA ECONOMICS (2023–25)

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Declaration

This is to certify that, I, a student of MA (Economics - Specialization in Trade and Finance) [MA(ECO):2023-25] , Indian Institute of Foreign Trade, New Delhi, have submitted this research project **"Finance, Efficiency, and Sustainable Development: A Structural and Behavioural Analysis of Indian States (2015–2024)"** to IIFT in partial fulfillment of the requirements for the MA(ECO) degree. This is an original work. It is neither copied (partially/fully) from any other scholastic work nor it is submitted to any other institution for any degree or diploma. I remain fully responsible for any error and plagiarism.

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Project Guide Certification

This is to inform that ABDUR RAUF SYED , a student of IIFT MA(ECO):2023-25, has completed research project on the topic **"Finance, Efficiency, and Sustainable Development: A Structural and Behavioural Analysis of Indian States (2015–2024)"** under my guidance.

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ABSTRACT

This dissertation investigates the differential effectiveness of public and private finance in driving sustainable development outcomes across Indian states. Even with increasing public expenditure and mandatory Corporate Social Responsibility (CSR) under the Companies Act, development on key Sustainable Development Goal (SDG) indicators remains uneven. Based on panel data of 30 Indian states (FY 2015–2023), the study evaluates the performance of sectoral public expenditure and CSR spending on nine SDG goals aligned indicators.

In addition to fixed-effects regression, the research suggests a latent conversion efficiency coefficient (ϕ_s) to identify the structural ability of each state to translate investment into development benefits. A return gap measure is then used to quantify behavioural deviation from structural expectations such that a typology of states into Punching Above Weight, Underperformers, Reformers, and Structural Traps can be identified.

An interaction model also checks if CSR is more effective in structurally weak states. Results indicate that CSR has greater marginal effect in structurally weaker. Results highlight that development is not a question of spending, but of capacity, behaviour, and institutional alignment. This study offers a framework to quantify development finance effectiveness, with implications for fiscal federalism, CSR policy, and targeted interventions at the state level.

Contents

Chapter 1

Introduction

India's development trajectory demonstrates a persistent paradox. Despite huge public expenditure on social sectors, infrastructure, and poverty reduction over the past two decades, there are huge variations in development gains between states. Such a gap between investment and developmental achievement is particularly stark in the context of the institutionalisation of private financial mechanisms—most directly demonstrated by the imposition of mandatory Corporate Social Responsibility (CSR) spending as prescribed under the Companies Act of 2013. Combined, both public and private financial resources have now expanded significantly, especially in alignment with the Sustainable Development Goals (SDGs). Yet, between states, the same investment levels continue to produce vastly different results.

The prevailing policy assumption, influenced by the classical growth models like Harrod-Domar and Solow (Solow, 1956), is that there exists a generally proportional relationship between growth and investment. However, this assumption has increasingly come under the lens of empirical studies. Research has found that the marginal returns of public spending are subject to institutional quality, governance capability, and the efficiency of the bureaucracy (Rajkumar and Swaroop, 2008; Easterly, 2001). In the Indian context, Dreze and Sen (2013) point out that states receiving comparable budgetary allocations show drastically different social outcomes—implying differences in administrative ability, accountability processes, and the level of citizen participation.

At the same time, the emergence of CSR as a development tool has added a new layer of financial obligation beyond conventional state channels. Though CSR is regularly touted for its flexibility, innovativeness, and proximity to local requirements (Porter and Kramer, 2011), there are lingering concerns about its targeting effectiveness, systemic alignment, and sustainability (Ghosh and Pattnaik, 2020; Kapoor and Debroy, 2019). Most estimates are still firm-level reporting or anecdotal case studies, creating a void in

our knowledge regarding CSR's macro-level developmental impact—especially regarding state capacity.

This dissertation contends that the seeming disjuncture between development outcomes and investment finance is not so much a matter of scale, but one of conversion efficiency—the intrinsic, context-specific ability to convert resources into outcomes. It is this structural factor, and not financial scale per se, that largely determines success or failure of development endeavours.

To systematically examine this issue, the study offers a tripartite analytical structure. First, it empirically estimates the effect of disaggregated finance variables, both public expenditure(revenue and capital) and CSR expenditure on nine SDG aligned indicators using fixed effect panel regressions. Second, it estimates a latent development conversion efficiency coefficient (ϕ_s) for each state, defined as the marginal developmental return per unit of financial input—a Sharpe ratio analogue used in financial modelling (Andrews et al., 2013). Third, it builds a return gap measure that tests the behavioural disequilibrium between expected and observed consequences. It is a proxy for over- or under-performance relative to structural capacity. The study also examines the interaction between CSR intensity and ϕ_s, testing whether CSR plays a compensatory role in structurally weak states.

Employing a 30-state Indian panel dataset from 2015-2024, this paper analyses a series of indicators which map to the Sustainable Development Goals (SDGs), such as infant mortality rates, sanitation coverage, ghigher education enrolment, stunting prevalence, renewable energy capacity, and access to infrastructure. Fixed-effects panel regression and latent modelling is applied to the analysis, complemented by typological classification of the states based on structural efficiency and behavioural performance.

This approach adds to the literature both methodologically and substantively. Methodologically, it synthesises econometric modelling with structural and behavioural diagnostics, and thus provides a more sophisticated reading of the effectiveness of development finance. Substantively, it provides a behaviourally-informed and context-sensitive approach to the assessment of intergovernmental development strategies that goes beyond the expenditure-based paradigm prevailing in the literature. In this endeavour, the research not only aims to examine the magnitude of spending but also examine the effectiveness of the use of resources and the circumstances under which they facilitate significant progress.

It hypothesises that developmental results are determined to an equal degree by state capacity, responsiveness of implementation, and fiscal cohesion, along with the total amount of money spent. By emphasising the contributions of conversion efficiency and behavioural change, this dissertation aims to reframe the debate on fiscal federalism,

corporate social responsibility, and development policy in India in an analytic framework that is better informed and tested empirically.

Research Objectives

The overall aim of this dissertation is to critically explore the connections between development outcomes and financial investment in Indian states, combining econometric sophistication with structural and behavioral understanding. More specifically, it tries to solve the following research objectives:

1. **To estimate the relative contribution of public and private finance to state-level development outcomes.** We estimate the impact of sector-specific public spending and CSR expenditure on a list of SDG-matched targets, including infant mortality, sanitation, higher education enrollment, and renewable energy capacity, via fixed-effects panel regression models.

2. **To build a structural efficiency measure (ϕ_s) which captures each state's inherent ability to transform investment into outcomes.** This coefficient estimate from normalized return-output relationships enables us to compare states not only by performance, but by their development conversion efficiency.

3. **To obtain a measure referred to as 'return gap' that measures behavioral deviation from structural norms as expected.** The return gap captures the deviation between actual outcomes and those implied by ϕ_s, whether a state is performing better or worse than its underlying ability to perform.

4. **To test the role of Corporate Social Responsibility (CSR) in assisting low-efficiency states to escape from developmental stagnation.** Based on an interaction model, we test whether private finance (that is, CSR spending) has a compensatory function in those areas with inadequate public service delivery systems or institutional constraints.

5. **To develop a typology of Indian states based on their structure effectiveness and variation in returns.** This typology—covering Reformers, Structural Traps, Punching Above Weight, and Underperformers—is a high-level view that is more suited to policy-making than the old spending-based typologies.

Chapter 2

Literature Review

2.1 The Evolving Relationship between Finance and Development

The traditional view of development finance is premised on the idea that increased investment means commensurate progress in human and economic development. From the Harrod-Domar growth model to Solow's neoclassical growth model, capital accumulation has been viewed as the determining factor for growth (Solow, 1956). Policy makers interpreted this to mean a spending paradigm: the more you spent, the more you progressed.

However, empirical evidence has more and more questioned this hypothesis. Cross-country studies (Easterly, 2001; Rajkumar and Swaroop, 2008) show that marginal returns to public expenditure are very responsive to institutional quality. In the Indian experience, Dreze and Sen (2013) noted that equal levels of spending across states were found to have very dissimilar human development trajectories, indicating the role of deeper determinants like governance, quality of administration, and civil society engagement.

Recent research has sought to distinguish between different mechanisms through which financial inputs have an impact. Banerjee, Duflo, and Glennerster (2008) emphasised the importance of targeting, implementation, and context in measuring the impact of policies. This has therefore led to a shift in focus from aggregate expenditures to micro-level implementation, and input-based measures to output- and outcome-based evaluations.

2.2 Institutional Capacity and Structural Efficiency

While conflicts over development have traditionally cantered on the amount of financial investment, an increasing body of literature highlights the importance of efficient deployment of resources. This focus on structural efficiency highlights the primacy of institutional capacity, absorptive capacity, and systemic bottlenecks in shaping developmental outcomes.

Grindle (1997) and Fukuyama (2004) are of the view that "state capacity"—i.e., the ability of institutions to deliver on the ground—is at least as important as the policies themselves. Translated to development finance, this would be that two countries with the same resources would be able to perform differently based on variations in bureaucratic ability, delivery mechanisms of public services, or local accountability.

In India, heterogeneity in implementing capacity is long established. Pritchett and Woolcock (2004) emphasise research identifying that low-capacity settings are characterised by "isomorphic mimicry"—policy designs that are sound on paper but ineffective in practice because they lack effective institutions. Aiyar and Beasley (2006) use case studies of Indian states to demonstrate that frontline and administrative capacity, not expenditure, is important to translate finance into effective delivery of services.

Recent empirical work has tried to quantify existing efficiency gaps. Anand et al. (2016) offer state-level public service delivery measures to gauge "the efficacy with which" states are performing in terms of outcome relative to resources. However, there is limited research that explicitly conceptualises structural conversion efficiency as a latent coefficient in a longitudinal framework—leaving a theoretical and methodological gap that this dissertation seeks to fill by estimating ϕ_s.

2.3 Behavioural Heterogeneity and Outcome Divergence

Even when structural conditions and financial inputs are similar, development outcomes can vary significantly. This persistent gap between capacity and performance has prompted scholars to focus on behavioural heterogeneity—differences in institutional responsiveness, administrative culture, leadership, and local political dynamics that shape the real-world effectiveness of development interventions.

The phrase "implementation elasticity" (Pritchett, 2013) conveys the idea that identical policies can yield extremely different consequences depending on how they are imple-

mented. Building on this school of thought, Dasgupta and Kapur (2020) illustrate how decentralised governance structures in India create enormous variations in the implementation of programs despite the existence of nationally standardised programs.

In empirical development economics, that has meant increasing interest in measuring performance, not only in absolute but relative terms to expectations or structural norms. For instance, Lanjouw and Murgai (2012) rank states not only on performance in poverty reduction but on their capacity to translate growth into inclusiveness. Likewise, Rajan and Shah (2008) suggest ranking states on departures from projected social performance from economic fundamentals.

This dissertation builds on this behavioural approach by estimating a "return gap" between realised gains in composite development scores and those predicted on the basis of structural conversion efficiency (ϕ_s). Those countries that regularly outperform or underperform projected performance are then classified using a behavioural typology, thus giving a more nuanced and context-sensitive basis for assessment.

2.4   CSR and Private Finance in Development

In the last decades, the role of private finance in development has grown significantly, especially where the public systems have had capacity limitations. Corporate Social Responsibility (CSR) has, in particular, become an official instrument for directing private investments towards public goals. In the case of India, the Companies Act of 2013 led to the imposition of a requirement on big companies to invest in CSR, establishing a new institutional setup for analysing its contribution to development.

The literature on CSR development remains divided. On the one hand, it is argued by researchers that CSR can complement the state, particularly in areas like health, education, and infrastructure, where creative, locally-driven initiatives could outperform inflexible bureaucratic programs (Porter and Kramer, 2011). CSR is largely celebrated for its potential to meet local needs, experiment with new concepts, and leverage corporate efficiency in executing projects (Sharma and Vredenburg, 1998).

On the other hand, several criticisms point to CSR's fragmented targeting, accountability gaps, and poor coordination with systemic development needs. Kapoor and Debroy (2019) note that CSR investments are clustered in already well-developed regions or in the headquarter states of firms, rather than where the majority of needs are concentrated. Similarly, empirical evaluations (Ghosh and Pattnaik, 2020) provide uneven proof of CSR developmental influence, largely in soft areas like nutrition, gender equality, or basic education.

In India, although CSR is conceptually aligned with SDGs, its impact is under-explored at a state-level level. Current research is largely project-level impact assessments or firm-level disclosures. This dissertation contributes to the literature by modelling CSR as direct input as well as interacting with structural capacity (ϕ_s), to find out whether CSR is more impactful in low-capacity environments where public institutions may be weaker but where the marginal value of private finance is higher.

2.5 Synthesis and Research Gap

The literature discussed in this chapter indicates a definite paradigm shift away from input-based paradigms towards more advanced models focusing on structural capability, behavioural differences, and institutional flexibility. With studies having mushroomed to examine the impact of public spending and, to a lesser degree, corporate social responsibility on developmental performance, much is still to be measured in terms of the interplay between structural efficiency and private finance over time in accounting for interstate differentials.

This dissertation fills the gap identified by proposing a fresh analysis framework that combines panel regression with latent efficiency estimation (ϕ_s), a return gap, and behavioural state typologies. It also explores the possibility of harnessing the power of corporate social responsibility (CSR) to counteract institutional vulnerabilities by understanding its interaction with ϕ_s. Along the way, the research makes theoretical and empirical contributions to the interdisciplinary fields of development economics, public finance, and governance studies, with specific focus on the federal Indian context.

Chapter 3

Methodology

3.1 Data and Variables

Given variable reporting for frequency, coverage, and granularity across official sources, the hybrid imputation strategy used weighed statistical formality with domain logic to ensure temporal continuity in use and cross-state conformity in the panel. Missing values were handled in a multi-stage procedure adapted to the nature of each indicator.

Where an indicator was measured at intervals (e.g., NFHS-based data for sanitation and stunting for 2015-16 and 2019-21), linear or spline interpolation was used to impute the intermediate years, whereas the forward extrapolation was done based on state-specific estimates of annual growth rates derived from historical trends for indicator beyond observed years.

For Infant Mortality rate (IMR), a declination of percentage was calculated between IMR values in any given year and then the median estimated to project forward values for 2021-23. A certain limit was kept, which would not make IMR negative, neither low in unrealistically high-performing states.

For GER (Gross Erollment Ratio in higher education) assessment of projected values for missing values of GER for the year 2022-2023 was made based on estimates of past median growth rates, where the missing years were interpolated, and prospective increases were applied conservatively.

Tabel 3.1 summarises the imputation method applied for all the nine development indicators.

Table 3.1: Imputation and Projection Methods for Key Development Indicators (2015–2024)

Indicator	Data Years Available	Imputation / Projection Method
Infant Mortality Rate (IMR)	2015–2020	Linear interpolation for missing intermediate years; median growth projection for 2021–2023 based on historical decline rates
Gross Enrolment Ratio (GER, Higher Education)	2015–2021	Median growth-based forward projection for 2022–2023; no backward fill needed
Renewable Energy Installed Capacity	FY2015–16 to FY2023–24	No imputation needed; full annual data from MNRE
Sanitation Coverage (%)	2015, 2020 (NFHS)	Spline interpolation between NFHS-4 and NFHS-5 for 2016–2019; smoothed forward projection for 2021–2023 using blended trend from Swachh Bharat reports
Stunting (% under 5)	2015, 2020, POSHAN (2022–24)	Rule-based interpolation for 2016–2019; forward-fill + POSHAN-based trend for 2022–2023
Girls' Toilets (Secondary Schools)	2015, 2017, 2021, 2023	Linear interpolation for missing years (2016, 2018–2020, 2022) using UDISE trends
Unemployment Rate	2015–16 (Labour Survey), 2017–2023 (PLFS)	Forward-fill for 2016–2017 gap; smoothing with moving average for discontinuity correction
Worker Population Ratio (WPR)	2017–2023 (PLFS)	Backward projection to 2015–2016 using linear trend
Habitation Connectivity (% covered)	FY2015–FY2023	Fully available from PMGSY; no imputation required

The key independent variables include disaggregated public finance data on sectoral expenditures—such as health, education, rural development, and sanitation—as well as private finance indicators, primarily Corporate Social Responsibility (CSR) spending by both public sector and private sector enterprises. All financial variables were normalised by state-level Gross State Domestic Product (GSDP) or per capita income(in case of CSR) to allow comparability across regions. For financial indicators such as CSR spend-

ing, missing values in the latest year (2023) were imputed using a hybrid prediction model based on state-wise historical trends, median change, and national year-on-year shifts, ensuring logical continuity without arbitrary assumptions.

We excluded all Union Territories except Delhi and corrected formatting inconsistencies such as leading whitespace or duplicated entries. All monetary values were inflation-adjusted to 2023 prices using the GDP deflator with 2011–12 as the base year. The final panel was structured to include 30 states over 9 years (2015–2024), ensuring a consistent and analysable dataset for the regression and modelling stages.

Composite Score Construction and Final Imputation

After processing individual indicators, we transformed inverse-direction indicators (e.g., IMR, stunting, unemployment) by multiplying them by -1 to maintain directional consistency in the composite score. We handled residual missing values using K-Nearest Neighbors (KNN) Imputation, with k = 5, leveraging multivariate similarity across states and years.

Composite Development Score was constructed via Ridge Regression, where the indicator matrix was mapped to a normalised anchor score (average of gsdp per capita and NITI AYOG SDG index). This allowed the model to learn optimised indicator weights and reduce overfitting

3.2 Panel Regression Framework

To evaluate the relationship between financial inputs and development outcomes, we estimate a series of fixed-effects panel regression models. These models are designed to capture the within-state variation over time, controlling for time-invariant heterogeneity across states. Each development outcome is modelled independently to reflect sector-specific sensitivities to public and private financial flows.

Models were estimated using `PanelOLS` from the `linearmodels` Python package, with entity fixed effects and clustered standard errors at the state level. The regression equation took the form:

$$y_{it} = \alpha_i + \sum_k \beta_k X_{kit} + \sum_m \gamma_m Z_{mit} + \varepsilon_{it} \tag{3.1}$$

where X_{kit} are financial predictors (public expenditure), Z_{mit} are control variables, and

α_i captures state-specific fixed effects.

A log of the final number of observations used in each model was maintained, and specifications were adjusted to ensure model feasibility without compromising statistical validity.

Table 3.2: Summary of Key Variables Used in the Analysis

Variable	Description
Dependent Variables	
Composite Development Score	Index constructed from normalized SDG-aligned indicators
Infant Mortality Rate (IMR)	Deaths per 1,000 live births (SRS)
Gross Enrolment Ratio (GER)	Higher education enrolment rate (AISHE)
Sanitation Coverage	Percent of population using improved sanitation (NFHS)
Stunting	Percent of under-5 children who are stunted (NFHS)
Renewable Energy Capacity	Installed renewable energy capacity in MW (MNRE)
Unemployment Rate	Unemployment rate based on PLFS
Workforce Participation Rate (WPR)	Proportion of working-age population employed (PLFS)
Habitation Connectivity	Share of rural habitations connected by all-weather roads (PMGSY)
Girls' Toilet Access	Share of schools with separate usable girls' toilets (UDISE)
Key Independent Variables	
Public Expenditure	Sector-wise Actual/Budget Estimate (AE/BE) expenditure in health, education, sanitation, infrastructure
CSR (PSU / Non-PSU)	Corporate Social Responsibility spending by public and private firms (INR crore)
PPP / Green Bonds (optional)	Private participation via long-term finance instruments (included selectively)
Control Variables	
Per Capita Income (GPC)	Annual state-level income in constant prices (INR)
Female Labour Force Participation (FLFPR)	Labour force participation rate of women (PLFS)
Population Density	Number of persons per square kilometer (Census projections)
Inflation (CPI)	Consumer Price Index, base year 2012 = 100

3.3 Latent Conversion Efficiency

Although fixed-effects panel regression provides valuable information on the average marginal effect of financial variables on development outcomes, it is restrictive in its capacity to capture deeper structural or institutional inefficiencies that can differ across states. The explanatory power of such models, albeit statistically significant in a small number of instances, tended to remain limited. Specifically, the same fiscal inputs were seen to provide widely varying developmental returns across states even after adjusting for observable attributes such as income, inflation, or labor participation.

This implies the existence of latent variables—like state capacity, institutional quality, or administrative efficiency—that affect the degree to which a state can efficiently convert financial inputs into actual developmental advancement. These missing variables create possible endogeneity issues and unobserved heterogeneity that conventional regression cannot effectively handle, particularly without good instruments or exogenous shocks.

To meet this shortcoming, we build a state-specific latent efficiency parameter, the latent conversion efficiency coefficient (ϕ_s), which reflects the marginal rate at which a state translates financial investment into development outcomes. Instead of assuming a uniform slope for all states, we permit this coefficient to vary, acknowledging that equivalent levels of expenditure can have different effects based on underlying systemic attributes.

The coefficient ϕ_s is estimated by first calculating the change in composite development score over one year ($\Delta D_{s,t}$), and then regressing it on an investment score ($I_{s,t}$) made up of normalized public and private finance inflows. The model is specified as:

$$\Delta D_{s,t} = \phi_s \cdot I_{s,t} + \varepsilon_{s,t} \tag{3.2}$$

Here, $\Delta D_{s,t}$ is the first-difference of the composite development score of state s at time t, $I_{s,t}$ is the respective total investment input (normalized by GSDP), and $\varepsilon_{s,t}$ is the error term. Estimation of this equation for each state individually enables us to recover a state-specific slope coefficient ϕ_s for each one of them, which can be viewed as a latent development conversion capacity.

We incorporate both public and private financial contributions in alll major development areas — health, education, sanitation, infrastructure, environment etc. and For each of the already normalised major financial variables $F_{k,s,t}$, The investment score is then calculated as:

$$I_{s,t} = \sum_{k=1} F_{k,s,t} \tag{3.3}$$

This methodology is conceptually borrowing from financial portfolio theory, wherein the return-risk ratio of an asset indicates its efficiency. In this instance, ϕ_s is a comparable measure: an increased value of ϕ_s suggests that a state can elicit higher development returns out of the same unit of investment. On the other hand, low ϕ_s suggests structural frictions, institutional resistance, or systemic inefficiencies that fail to convert resources into impact.

Financial Analogy: ϕ_s as a Return-to-Risk Ratio

Latent coefficient ϕ_s has a similar conceptual meaning as Sharpe Ratio in portfolio theory, which signifies excess return relative to one unit of risk incurred on a given asset. Finance employs this measure as a benchmark to assess whether an asset performs risk exposure efficiency into returns or not. The same interpretation goes with ϕ_s here in that we see this as a test of how a state transforms finance investment into returns from development.

Technically, the Sharpe Ratio is the following:

$$\text{Sharpe Ratio} = \frac{E[R - R_f]}{\sigma} \tag{3.4}$$

where $E[R]$ is the expected return, R_f is the risk-free rate, and σ is the standard deviation of returns (or the risk). The principle is to measure marginal return in relation to uncertainty.

Converting this to the development context, we are less interested in volatility per se, but rather in the ability of a state to transform inputs $(I_{s,t})$ into returns $(\Delta D_{s,t})$. The Sharpe Ratio analogue becomes the slope of the development production function:

$$\phi_s = \frac{\Delta D_{s,t}}{I_{s,t}} \tag{3.5}$$

This ratio captures the degree to which each unit of normalized financial input is "productive" over time, averaged out. A greater ϕ_s means small investments return great developmental change — just as a greater Sharpe Ratio means that a portfolio has a more efficient risk-return profile.

This analogy is not metaphorical. In each instance, the ratio separates performance from a constraint: in finance, risk; here, systemic friction or conversion inefficiency. Therefore, ϕ_s captures not only observed development, but the unobservable structural ease or difficulty with which a state mobilizes financial capital for impact.

The financial framing also makes this model more interpretable. Similar to portfolio optimization, where two assets with comparable returns can be very different in efficiency based on different risk, two states with comparable development outcomes can be running under very different conversion dynamics. It is exactly this hidden asymmetry that the ϕ_s framework is intended to reveal.

3.4 Behavioural Typology of States

After we have estimated the Latent Conversion Coefficient (ϕ_s) for every state, we compare it with the actual development performance of the state in order to categorise its behavioural path. This allows us to transcend structural capacity and determine whether a state is performing above or below what its internal efficiency would lead us to expect.

For every state-year, we take the difference between the actual development return $(\Delta D_{s,t})$ and the predicted return from the state's ϕ_s and investment level:

$$\text{ReturnGap}_{s,t} = \Delta D_{s,t} - \widehat{\Delta D}_{s,t} = \Delta D_{s,t} - \phi_s \cdot I_{s,t} \tag{3.6}$$

This gap is a signal of behavior: states with positive return gaps are doing better than their latent capacity (ϕ_s) would suggest, while negative gaps indicate performing worse than potential.

From this combined measurement of latent capability (ϕ_s) and actual performance (return gap), we establish a four-quadrant behavioral typology:

1. **Punching Above Weight:** High ϕ_s and consistently positive or near-zero return gap These are states that combine strong institutional capacity with effective on-ground delivery. Even when not dramatically exceeding expectations in every year, their consistent over performance or alignment between potential and outcomes marks them as reliably effective states. They are strong candidates for fiscal autonomy, scale-up pilots, or delegated innovation platforms.

2. **Underperformers:** Moderate to high ϕ_s, but with frequent negative return gaps (≥ 5 years). These are states with latent potential but recurring inefficiency in converting finance into outcomes. The revised framework highlights them as chronically inconsistent performers, potentially suffering from institutional bottlenecks, local political economy constraints, or administrative drift.

3. **Reformers:** Low ϕ_s, but with frequent positive return gaps and positive average behaviour scores These states are constrained structurally but consistently punch above their weight in performance.

4. **Structural Traps:** Low ϕ_s, negative behaviour score, and 5 years of trap-like behaviour These are no longer defined merely by their momentary inefficiency but by long-run structural stagnation and behavioural inertia.

   This typology enables us to transcend a binary "high vs. low performance" narrative. It allows us to note that these two states with comparable outcomes may fundamentally diverge with regard to the underlying system that generated them.

3.5 Robustness Check[1]

To ensure the structural soundness of the latent conversion efficiency model (ϕ_s) and behavioral typology framework, a robustness check was designed based on

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[1]This section was added in response to comments received during the dissertation viva panel, to strengthen the model's validation.

fiscal performance. The rationale was to assess whether the observed efficiency and behavioral patterns were simply driven by the fiscal discipline of states, or whether they reflected deeper institutional and systemic dynamics.

Identification of Fiscally Prudent States: States were classified as fiscally prudent if their average Gross Fiscal Deficit (as a percentage of GSDP) between FY 2015 and 2023 was among the lowest ten in the country. This subset included a mix of industrially developed and developing states, ensuring diversity within the "prudent" group.

Analytical Strategy: Two key analyses were performed:

(a) Comparison of ϕ_s distributions between prudent and other states using box plots and error-bar plots (means with standard deviation).

(b) Examination of the spread of dominant behavioral types across fiscal groups to detect clustering or distortion.

This methodological check confirms that the model's insights are not artifacts of fiscal imbalance and that behavioral development typologies hold across different fiscal contexts.

Chapter 4

Results and Analysis

This section reports the empirical results of the study in three steps. First, we assess the marginal contribution of public and private finance to development outcomes by using panel regression methods. Second, we estimate and the Latent Conversion Coefficient (ϕ_s) for every state, and type states as behavioural categories according to their relative performance. Lastly, we examine if targeted private finance, especially Corporate Social Responsibility (CSR) expenditure, contributes meaningfully to structurally weak states breaking free from development inertia.

The objective of this analysis is two-pronged: to ascertain statistically significant trends ,if any, in financial performance, and to discover less superficial structural or behavioural forces which are not necessarily quantifiable using conventional regression models alone.

4.1 Impact of Public Finance on Sustainable Development Outcomes

Table 4.1 presents the fixed-effects regression findings for nine SDG-aligned development outcomes, using sector-specific public expenditure variables. Standard errors are clustered at the state level.

Table 4.1: Key Findings: Public Finance and Development Outcomes

Outcome	Significant Predictors	Effect Direction	R^2 (Within)
IMR (Infant Mortality)	RevExp Health	Negative	0.49
Higher Ed GER	RevExp Edu	Positive	0.27
Sanitation Coverage	CapExp Urban, FLFPR	Positive	0.46
RE Capacity	RevExp Env	Positive	0.32
Stunting	None	–	0.06
Usable Toilets (Girls)	None	–	0.05
WPR	FLFPR	Strong Positive	0.22
Unemployment	FLFPR (–), weak CSR	Weak	0.15
Habitation Connectivity	None	–	0.17

The fixed-effects regressions indicate that sector-specific public finance indicators like health and education spending have statistically significant impacts on development outcomes such as infant mortality and GER. The model for IMR explains a moderate portion of the within-state variation, with an R^2 of 0.49, indicating a reasonably strong structural link. In education, revenue expenditure on higher education is positively associated with Gross Enrolment Ratio (GER) for the 18–23 age group. However, the explanatory power is limited ($R^2 = 0.27$), implying that while spending matters, other structural or social factors likely mediate educational attainment. Similarly, in the sanitation domain, capital expenditure in urban development and female labor force participation rate (FLFPR) jointly show a significant positive effect on sanitation coverage, with a relatively strong model fit ($R^2 = 0.46$).

Other results, however, — stunting, usable girls toilets in schools, and unemployment — yield weak or inconsistent evidence. In a few instances, expenditure variables were not significant, or had the wrong directions.

While public finance exhibits varying effects on development outcomes, it is significant to know if the same or different patterns result from private funding tools such as CSR. The following section tests this by running the same fixed-effects model on disaggregated CSR data.

4.2 Impact of Private Finance (CSR) on Sustainable Development Outcomes

We then investigate the impact of sectoral CSR spending—separated by PSU and non-PSU sources—on the same development indicators. All CSR variables are nor-

malized by state GSDP and estimated with fixed-effects panel models with clustered standard errors.

Table 4.2: Fixed Effects Regression Summary: CSR and Development Outcomes

Outcome	Significant CSR Predictor(s)	Effect Direction	R^2 (Within)
Infant Mortality (IMR)	CSR Health (non-PSU)	Strong Negative	0.47
GER (Higher Education)	CSR Edu (PSU)	Strong Negative	0.37
RE Capacity	CSR Env (non-PSU)	Weak Negative	0.21
Stunting	CSR Hunger (PSU/non-PSU)	No significant effect	0.10
Sanitation Coverage	CSR Infra-Sanitation	Mixed/Weak	0.35
Toilets (Girls)	CSR Edu (PSU)	Weak Positive	0.04
Worker Pop. Ratio (WPR)	–	No significant effect	0.17
Unemployment	–	No significant effect	0.15
Habitation Connectivity	CSR Infra-Sanitation (PSU/non-PSU)	Strong Positive	0.18

The panel regressions based on CSR data are mixed and generally uncertain in their outcomes. Sectoral CSR, especially in the health and education sectors, seems to have an effect on some of the outcomes but with far from consistent patterns. The only strong finding is that non-PSU CSR in health is inversely related to infant mortality, implying that less rigid, decentralized private resources are more likely to be aligned with local priorities in the provision of health services.

While fixed-effects regression specifications provide rich information on directional sectoral financial input effects on development results, their explanatory scope is limited. The observed statistical significance does not imply that changes in public or private finance directly cause improvements (or deteriorations) in development indicators. Several methodological and empirical limitations prevent us from making strong causal claims. Some indicators are weak or unassociated with public or private finance. This leaves open the possibility that standard regression specifications might not be adequate to capture the full richness of development dynamics, particularly when there are structural bottlenecks, institutional lags, or unobserved heterogeneity.

First, the analysis is based on observational panel data, not experimental or quasi-experimental designs. In such settings, omitted variable bias is a persistent concern. There may be unobserved state-level characteristics—such as governance quality,

institutional capacity, civil society engagement, or political stability—that simultaneously affect both financial investments and development outcomes. Without explicitly controlling for these latent confounders, the estimated coefficients may capture spurious correlations rather than true causal effects.

Second, reverse causality is a plausible concern. For instance, states that are already improving in health or education outcomes may attract more public investment or CSR funding, rather than the investment being the driver of progress. This would bias the direction of inference. Fixed effects models help mitigate some of this by accounting for time-invariant heterogeneity, but they do not resolve dynamic feedback loops or anticipation effects.

Third, endogeneity of financial allocations remains a challenge. Budgetary decisions are not exogenous—they are often shaped by political economy considerations, lobbying pressures, or targeted schemes for underperforming states. This can create a selection bias wherein states that receive more funds are systematically different from those that do not, undermining the assumption of independence between regressors and the error term.

Moreover, CSR spending is not randomly assigned. It is often concentrated in states where firms have operations or profit centers, and may reflect private sector priorities rather than public development needs. This weakens the ability to draw clean inferences about its effectiveness, especially in sectors where CSR spending is low or inconsistent.

To meet these challenges, we propose a different modeling approach that relocates the emphasis from input-output causality to conversion efficiency. In particular, we add a latent state-specific coefficient ϕ_s, one that explains the marginal rate of return to finance investment in development outcomes. This structural parameter is then estimated through panel trajectories of composite development scores and finance flows, allowing us to see which states are best (and worst) at converting finance into concrete advance.

4.3 Development Efficiency Frontier

A composite investment score was first constructed by aggregating key public and private finance variables across sectors such as health, education, sanitation, agriculture, and renewable energy. This included both sectoral public expenditure (revenue and capital) and Corporate Social Responsibility (CSR) spending across thematic domains. For each state, the development return was regressed on the investment score using ordinary least squares (OLS). The resulting slope coefficient

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from this state-wise regression was interpreted as the latent conversion efficiency coefficient (ϕ_s), representing the structural ability of that state to translate financial inputs into observable improvements in development indicators. Subsequently, a predicted return was computed for each observation.

The return gap was calculated as the difference between the observed and predicted return. A positive return gap indicates a behavioural surplus (over-performance relative to structural efficiency), while a negative gap indicates underperformance. This deviation from expected structural efficiency was then used to classify states into four behavioural typologies

Table 4.3: Sample of State-wise Development Efficiency and Behavioral Typology

State	Year	Composite Score	Dev Return	Investment Score	Gap	ϕ	Behavior Type
Chhatisgarh	2023	0.423	0.040	0.129	0.004	0.278	Punching Above Weight
Gujarat	2016	0.372	0.028	0.027	0.006	0.784	Punching Above Weight
Jammu & Kashmir	2020	0.419	0.003	0.117	-0.008	0.094	Underperformer
Jharkhand	2016	0.158	0.022	0.082	-0.017	0.481	Underperformer
Madhya Pradesh	2023	0.440	0.055	0.070	0.009	0.663	Punching Above Weight
Maharashtra	2023	0.560	0.022	0.048	-0.002	0.515	Underperformer
Meghalaya	2016	0.236	-0.033	0.121	-0.043	0.084	Underperformer
Sikkim	2021	0.678	-0.007	0.074	-0.031	0.318	Underperformer
Telangana	2019	0.463	0.029	0.035	-0.005	0.961	Underperformer
Uttarakhand	2019	0.453	0.056	0.058	0.019	0.624	Punching Above Weight

Key Observations from State-wise Behavioral Typology

The final classification of 30 Indian states across a four-quadrant behavioural typology – Punching Above Weight, Reformers, Underperformers, and Structural Traps – shown in Figure 4.1 yields a few noteworthy patterns.

States such as *Andhra Pradesh, Telangana, Karnataka, Kerala, and Gujarat* are categorised as Punching Above Weight, combining relatively high conversion efficiency (ϕ_s) with consistent or above-expected development returns. These states tend to exhibit alignment between structural capacity and financial utilisation.

A second cluster of states, including *Mizoram, Nagaland, Arunachal Pradesh, and Meghalaya*, emerge as Reformers. Despite low ϕ_s, these states have demonstrated positive return gaps and behavior scores, indicating performance above structural expectations in several observed years.
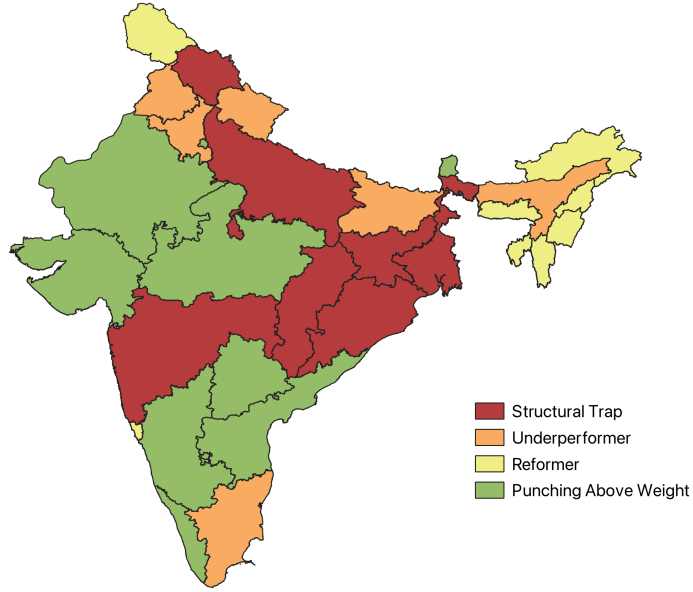
Behavorial Typology of Indian States

Figure 4.1: Behavioral Typology of Indian States (2015–2024), classified by latent conversion efficiency (ϕ_s) and return gap performance.

Underperformers—such as *Bihar, Tamil Nadu, Punjab, and Haryana*—show reasonable ϕ_s but persistent shortfalls in realized returns. Meanwhile, states like *Chhattisgarh, Jharkhand, Maharashtra, and Uttar Pradesh* fall under Structural Traps, characterized by long-term behavioral inefficiency and poor return profiles despite financial input.

Table 4.4: Sample of States and Their Dominant Development Behaviour Type*

State	Dominant Behaviour Type
Andhra Pradesh	Punching Above Weight
Haryana	Underperformer
Himachal Pradesh	Underperformer
Karnataka	Punching Above Weight
Maharashtra	Structural Trap
Meghalaya	Reformer
Sikkim	Punching Above Weight
Tamil Nadu	Underperformer
Uttar Pradesh	Structural Trap
Uttrakhand	Underperformer

It is important to note that these classifications are based on observed data patterns across 2015–2024 and reflect median values and typology frequencies. The model does not capture unobserved heterogeneity, governance transitions, or policy shocks. While the classifications are useful for comparative diagnostics, they should not be interpreted as fixed rankings or prescriptions. Further qualitative and institutional analysis would be necessary to interpret the underlying causes of performance.

Having identified latent conversion efficiencies (ϕ_s) and behavioural type across states, we now explore whether CSR can serve as a strategic tool for bridging structural limitations. To do this, we construct an interaction model between CSR and ϕ_s.

4.4 CSR and Conversion Efficiency: Regression-Based Evidence

To test whether CSR is more effective in states with weak structural capacity, we estimate an interaction model between the latent conversion coefficient (ϕ_s) and CSR intensity. Specifically, we regress annual changes in the composite development score $\Delta D_{s,t}$ on total investment $I_{s,t}$, , CSR intensity, and their interaction:

$$\Delta D_{s,t} = \alpha + \beta_1 I_{s,t} + \beta_2 \phi_s + \beta_3 \text{CSR}_{s,t} + \beta_4(\phi_s \cdot \text{CSR}_{s,t}) + \varepsilon_{s,t} \qquad (4.1)$$

Here, $\text{CSR}_{s,t}$ is the normalized CSR expenditure (as a share of GSDP) in state s and year t. The coefficient β_4 captures the key hypothesis: whether CSR has

diminishing returns in structurally strong states, and conversely, whether it helps compensate in structurally weaker state.

The pooled OLS model, adjusted for robust standard errors, finds a positive and statistically significant association between total investment and development return (coefficient = 0.1787, $p = 0.012$), and a similar effect for ϕ_s (coefficient = 0.0452, $p < 0.001$). However, the main effect of CSR and its interaction with ϕ_s were not significant in the pooled model, potentially due to unobserved state-level differences.

A fixed-effects panel model with clustered standard errors provides clearer insight. The main effect of CSR is positive and statistically significant (coefficient = 12.690, $p < 0.001$), while the interaction term $\phi_s \times$ CSR is strongly negative and significant (coefficient = –103.50, p < 0.001). This suggests that CSR contributes more to development returns in structurally weaker states and becomes less effective as institutional efficiency increases. The R-squared within (0.1036) and robust F-statistic ($p < 0.0001$) indicate moderate explanatory power.

Table 4.5: Comparison of OLS and Fixed-Effects Panel Regression Results

Variable	OLS Coef.	OLS P-Value	PanelOLS Coef.	PanelOLS P-Value
Intercept	-0.0058	0.5654	0.0153	0.3149
Investment Score	0.1787	0.0116	0.2574	0.2344
ϕ (Conversion Efficiency)	0.0452	0.0001	—	—
CSR Total	-0.1791	0.9650	12.6900	0.0000
$\phi \times$ CSR Interaction	-9.4392	0.7354	-103.5000	0.0000

In substance, this means that CSR works better in low-ϕ_s settings — where public systems are weaker but CSR outlays are more flexible, decentralised, and attuned to ground realities. This is in favour of the theory that CSR might work best not as an add-on to strong systems, but as a compensatory mechanism within structurally disadvantaged contexts.

Although the interaction model supports the developmental function of CSR in weak states, a pertinent question lingers: Are our results, particularly the ϕ_s coefficients and typology of behaviour, merely capturing states' financial prudence and not actual conversion efficiency? To establish this, we perform a fiscal deficit-based robustness check, contrasting fiscally responsible states against the rest to check the structural validity and independence of our model.

4.5 Robustness Check: Fiscal Prudence and Model Validity[2]

To assess the robustness of our latent conversion efficiency coefficient (ϕ_s) and behavioral typology, we conducted a sub-sample analysis based on fiscal performance. Specifically, states were classified as "Top Fiscally Prudent" based on their average gross fiscal deficit (as a percentage of GSDP) between FY 2015–2023. These states were then compared with the rest on two key dimensions: conversion efficiency and typological diversity.

Conversion Efficiency by Fiscal Group

The average ϕ_s for the top fiscally prudent states was found to be **0.494**, compared to **0.449** for all states. As shown in Figure 4.2, the fiscally prudent group exhibits a slightly higher median ϕ_s and a narrower interquartile range, indicating greater consistency in converting investment into development outcomes.
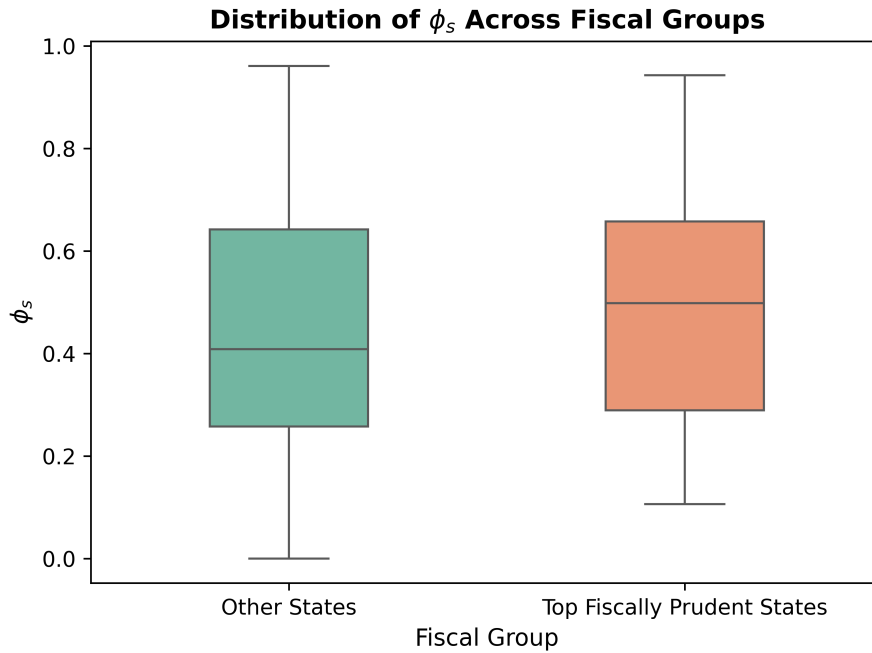

Figure 4.2: Boxplot of ϕ_s (Conversion Efficiency) by Fiscal Prudence Group

This pattern suggests that while fiscal discipline may contribute to higher efficiency, it is not the sole determinant. The latent coefficient ϕ_s appears methodologically robust and not driven by poor fiscal management states.

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[2]This section was added in response to comments received during the dissertation viva panel, to strengthen the model's validation.

Behavioral Typology Spread

Figure 4.3 shows the behavioral typology distribution across fiscally prudent and other states. Crucially, prudent states appear in all four behavioral categories—*Punching Above Weight*, *Underperformers*, *Reformers*, and *Structural Traps*. This indicates that fiscal performance does not predetermine behavioral performance.
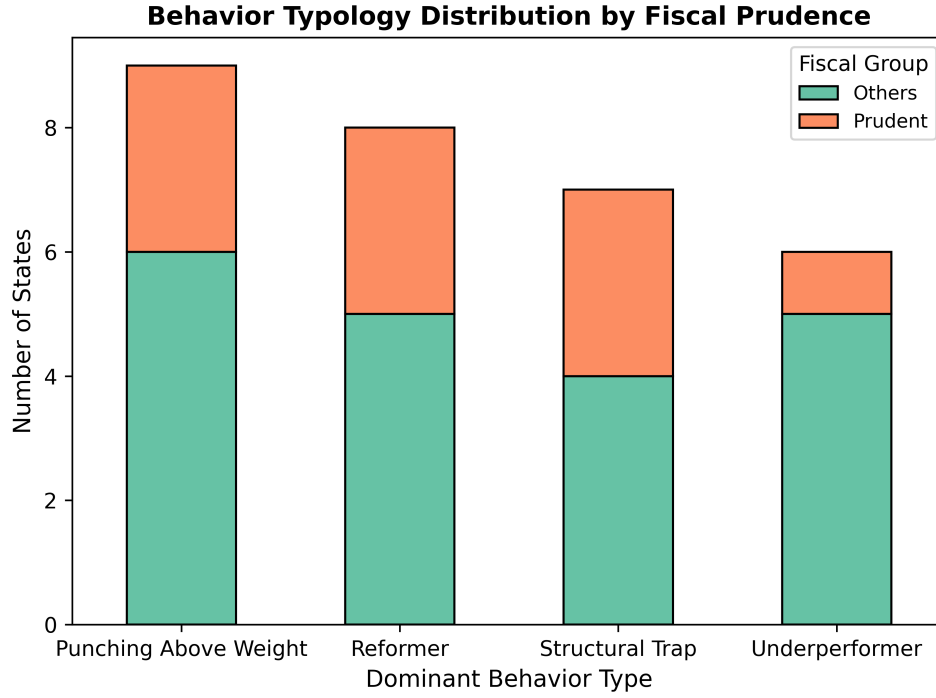

Figure 4.3: Behavioral Typology Distribution Across Fiscal Prudence Groups

Conclusion

Together, these findings affirm the structural and behavioral validity of our model. The ϕ_s metric remains statistically consistent across fiscal contexts, and the behavioral typology is preserved regardless of budget discipline. This strengthens the case that development effectiveness is shaped not merely by how much is spent or saved, but by how effectively resources are converted into meaningful outcomes.

Summary

This chapter outlined a multi-layered empirical analysis to explore the link between development finance and sustainable development outcomes at the Indian state level. Fixed-effects regressions showed that public and private finance variables both exert statistically significant but uneven impacts on SDG-aligned indicators,

showing the shortcoming of input-based approaches. To deal with this, a latent conversion efficiency coefficient (ϕ_s) was also estimated for every state, showing profound structural variations in how well states convert resources into outcomes. Subsequently, using this as a foundation, a behavioural typology was constructed from return gaps to place states into Reformers, Structural Traps, Underperformers, and Punching Above Weight. A model of interaction went on to illustrate that CSR expenditure is more efficiently applied in structurally weaker states, with implications for a strategic rather than symbolic role for private funding. In order to test these results, a robustness check was undertaken where conversion efficiency and behaviour were compared between financially prudent and less prudent states. Cumulatively, these results meet the central research goals and provide the platform for the policy implications investigated in the following chapter.

Chapter 5

Discussion and Policy Implications

This chapter translates the empirical findings into a wider framework of institutional capacity, behavioral heterogeneity, and financial effectiveness in the Indian development landscape. It considers what the findings say—not only about the mechanics of public and private finance—but about the underlying structural and behavioral forces that determine development trajectories across states.

While standard regressions reinforced that financial inputs are somewhat significant, their impacts were uneven and usually weaker than predicted. Adding a latent structural efficiency parameter (ϕ_s) unveiled lingering interstate gaps in the capacity to translate investment into outcomes. Additionally, the return gap framework illustrated that certain states systematically over- or under-achieve in comparison to their structural capacity.

Lastly, by estimating the interaction between CSR and ϕ_s, we had suggestive evidence that CSR can be more effective in low-capacity states—where decentralised, flexible funds can substitute for poor public systems to some extent.

These findings lead to three significant implications: one institutional, one behavioural, and one financial.

Beyond Spending: Rethinking Finance-Led Development

Our findings suggest that financial inputs—public or private—are not development guarantees. States with high per-capita investment (e.g., Maharashtra, Gujarat) did not always outperform, while others with lower structural capacity (e.g., Sikkim, Tripura) demonstrated surprising dynamism.

This requires a movement away from input-based appraisals to performance-based indicators involving structural effectiveness and behavioural sensitivity. Merely

boosting budgetary spends or CSR obligations might not trigger proportionate changes unless parallel strengths are injected into institutional delivery frameworks.

Policy mechanisms should therefore comprise indicators such as ϕ_s in state-level diagnostics, so governments can direct system-level reforms as well as fiscal provisioning.

Tailoring Strategy to Behavioural Typologies

The typology framework (Underperformers, Reformers, Structural Traps, Punching Above Weight) offers a behavioural perspective on reading development dynamics. Rather than applying a unitary assumption that all states are administratively equal entities, policy design should recognise such variant trajectories.

For example:

- **Reformer states** deserve targeted support and flexibility, as they are proving capable of high returns despite constraints.

- **Underperformers** require institutional audit and re-alignment of incentives to convert capacity into results.

- **Structural Traps** need deep structural interventions—across governance, service delivery, and state capacity—not just additional funding.

This typology can inform differentiated federalism, where support and reform are tailored to behavioral performance, not just fiscal needs.

Validating Model Independence from Fiscal Metrics

The robustness check confirms that our latent conversion efficiency measure (ϕ_s) and behavioral typology are not merely functions of fiscal discipline. Fiscally prudent states do not uniformly exhibit high efficiency or belong to a single behavioral group. This reinforces the model's structural and behavioral validity—affirming that it captures developmental effectiveness in terms of systemic capacity and institutional responsiveness, not just financial rectitude. Consequently, fiscal policy should be accompanied by systemic diagnostics, as financial prudence alone does not guarantee effective delivery or developmental dynamism.

CSR as a Strategic Complement, Not Substitute

The interaction model indicates that CSR's effect is greatest in low-ϕ environments. This contradicts conventional wisdom, where CSR is regarded as marginal or sym-

bolic in poor regions. Our results suggest that CSR can assume a compensatory role—most importantly, in such outcomes as connectivity of habitation and local health services—when strategically integrated. This opportunity remains untapped in most states due to poor coordination, accountability, or goal clarity. Policymakers must:

- Encourage CSR targeting toward structurally weak but reform-oriented states

- Link CSR to outcome-based monitoring and co-financing models

- Promote public–private co-design of interventions in underperforming sectors

CSR needs to be reimagined not as excess charity, but as adaptive capital in an asymmetric capacity system.

The main takeaway is this: money by itself doesn't build states. The money-progress dynamic is brokered by structure, strategy, and stewardship. A clearer, fact-based grasp of the dynamic—based on country-specific data and behavior realism—can open up wiser, more location-specific development planning in India.

Limitations

Although the models used in analysis in this work provide useful results, they suffer from a few limitations. In the first instance, the dataset—albeit large—is derived mainly from government surveys and administrative records with mixed frequency, coverage, and consistency across states. A number of outcome indicators were imputed and may thus generate bias even when validated carefully.

Second, the estimation of ϕ_s relies on time-invariant conversion efficiency between states, which could ignore policy changes or other shocks. Likewise, the interaction model, though indicative, cannot completely estimate causality between CSR and performance because of omitted variable bias and reverse causality concerns.

Lastly, the composite development score, as multifaceted as it is, cannot possibly encapsulate the qualitative and context-dependent nature of well-being and governance. These caveats should inform careful interpretation of findings and spur additional research employing richer, more detailed data.

While the dissertation offers a novel lens for comparative diagnostics, the model is observational and not causal; it does not claim that spending causes outcomes.

Chapter 6

Conclusion and Future Research

This dissertation attempted to explore a deceptively straightforward question: does money produce development? With a mix of fixed-effects panel regressions, latent efficiency modeling, and behavioral typologies, we discovered that the response is yes and no. Financial inputs count—but their impacts are determined in essence by structural capacity, behavioral implementation, and contextual appropriateness.

This strategy permitted us to discover not only which states are spending more or less, but which states are *punching above their weight*, which states are not meeting their potential, and which are reforming stealthily despite structural limitations. It also provided an opportunity to reframe CSR as not a corporate afterthought, but a strategic, context-sensitive addition to public development work.

There are a number of directions that this work might go in the future. First, subsequent research might use more detailed sub-state data—district-level or block-level panel datasets—to examine whether the same structural and behavioral dynamics apply at the state level. Second, experimental or quasi-experimental designs might be used to isolate the causal effect of CSR and public finance institutions under controlled environments. Finally, incorporating political economy controls—e.g., electoral incentives, bureaucratic turnover, or local governance quality—might add depth to the behavioral typology framework set out here.

Finally, it is not the goal of the dissertation to supplant fiscal modelling with behavioural heuristics, but to marry them—such that finance is no longer measured merely in terms of crores expended, but in terms of capacity unleashed and lives changed.

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Our AI writing assessment is designed to help educators identify text that might be prepared by a generative AI tool. Our AI writing assessment may not always be accurate (it may misidentify writing that is likely AI generated as AI generated and AI paraphrased or likely AI generated and AI paraphrased writing as only AI generated) so it should not be used as the sole basis for adverse actions against a student. It takes further scrutiny and human judgment in conjunction with an organization's application of its specific academic policies to determine whether any academic misconduct has occurred.

Frequently Asked Questions

How should I interpret Turnitin's AI writing percentage and false positives?
The percentage shown in the AI writing report is the amount of qualifying text within the submission that Turnitin's AI writing detection model determines was either likely AI-generated text from a large-language model or likely AI-generated text that was likely revised using an AI-paraphrase tool or word spinner.

False positives (incorrectly flagging human-written text as AI-generated) are a possibility in AI models.

AI detection scores under 20%, which we do not surface in new reports, have a higher likelihood of false positives. To reduce the likelihood of misinterpretation, no score or highlights are attributed and are indicated with an asterisk in the report (*%).

The AI writing percentage should not be the sole basis to determine whether misconduct has occurred. The reviewer/instructor should use the percentage as a means to start a formative conversation with their student and/or use it to examine the submitted assignment in accordance with their school's policies.

What does 'qualifying text' mean?
Our model only processes qualifying text in the form of long-form writing. Long-form writing means individual sentences contained in paragraphs that make up a longer piece of written work, such as an essay, a dissertation, or an article, etc. Qualifying text that has been determined to be likely AI-generated will be highlighted in cyan in the submission, and likely AI-generated and then likely AI-paraphrased will be highlighted purple.

Non-qualifying text, such as bullet points, annotated bibliographies, etc., will not be processed and can create disparity between the submission highlights and the percentage shown.