Ecole Doctorale des Sciences Economiques, Juridiques, Politiques et de gestion
Centre d'Etudes et de Recherche sur le Développement International (CERDI)

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Assessing local public policies in India: gender budgeting and federalism in focus

Thèse Nouveau Régime
Présentée et soutenue publiquement le 20/05/2026
pour l'obtention du titre de Docteur en Sciences Economiques

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Acknowledgements

Alors que j'écris ces lignes, je me remémore mon arrivée à Clermont-Ferrand en 2016, jeune étudiant encore loin d'imaginer le chemin que j'allais parcourir. Je ne savais pas encore tout ce que ces années allaient m'apporter : les apprentissages, les rencontres, les doutes, les remises en question, mais aussi les accomplissements, les amitiés durables et cette thèse qui marque aujourd'hui l'aboutissement d'un long cycle. Je remercie Dieu de m'avoir permis d'arriver là.

La réalisation d'une thèse de doctorat est souvent assimilée à un marathon. L'essentiel n'étant pas d'aller le plus vite possible, mais de garder un rythme constant tout en mettant à l'épreuve ses propres connaissances. J'ai pu expérimenter ceci tout au long de ces années à la fois difficiles éprouvantes mais tout aussi excitantes et enthousiasmantes. Pour arriver au bout de ce chemin j'ai dû compter sur moi bien sûr, mais aussi sur plusieurs personnes.

Je tiens à exprimer ma profonde gratitude à mes directeurs de thèse, Émilie CALDEIRA et Bertrand LAPORTE. Vous avez été les premiers à me faire confiance, en me donnant la chance d'entamer ce travail doctoral. Depuis cette opportunité initiale, vous n'avez cessé de m'accompagner avec rigueur, bienveillance et patience. Merci pour le temps que vous m'avez consacré, pour vos conseils, vos remarques, et pour toutes les occasions de progression que vous m'avez offertes. Votre encadrement a été exigeant mais toujours juste, et je mesure pleinement tout ce que je vous dois. C'est un privilège d'avoir pu cheminer sous votre direction.

Mes remerciements vont également aux membres du comité de thèse, Gregoire Rota-Graziosi, Michael Keen, Francesca Marchetta, Pierre-Guillaume Meon et Anabela Santos et Martial FOUCAULT. Je vous remerci d'avoir accepté de faire partie du jury de cette thèse. Cette thèse n'aurait pas été possible sans les enseignements reçus de la part de l'ensemble du corps enseignant de l'Université, Claudio Araujo, Samuel Guérineau, Grégoire Rota-Graziosi, Ekrame Boubtane, Francesca Marchetta, Sonia Schwartz, Jean-François Brun, Pascale Motel-Combes, Marie-Françoise Renard, Florent Bresson, Catherine Araujo, et tout particulièrement Marie-Eliette Dury. Un

grand merci aussi à toute l'équipe administrative Hassen, Chantal, Johan, Flora, Sandra, Christelle, Estelle, Marie. Je remercie aussi tous mes collègues de la direction B.7 du Joint Research Center Andrea, Anabela, Filippo, Pietro, Ilias, Tryfonas, Catarina, Nicholas et Stefano pour leurs conseils et soutien pendant ces mois à Séville.

Cette thèse a aussi été le fruit des échanges avec mes collègues doctorants, parmi lesquels Adama, Vincent, Asbath, Aime, Jule, Arouna, Lompo, Ulrich, Baowe, Dorian, Francois, Ilass, Daouda, Yannick, Mariz, Anouck, Lucie, Noura. Merci aussi a tous mes amis d'Abidjan, Clermont, Séville et d'ailleurs.

Enfin, last but not least cette these est le resultat du travail de plusieurs personnes qui n'en n'ont pas idée. Je parle de ma famille de Cote d'Ivoire, Sokona, Aminata, Amssatou, Amadou, Alain, Flany, Anta (repose en paix) ; mais aussi ici, Cécile, Sylvie, Valérie, Marie-Louise, Claudette, Babeth, Nathalie, Cédric, Philippe, Olivier, Dom, David et Alex (titi). Il reste à cela une personne sans qui rien de tout cela n'aurait pas été possible. Celle qui m'a toujours accompagné et soutenu, celle que j'ai rencontrée au début d'un cours dans l'amphi A1 et qui depuis n'a plus quitter mon cœur, cette thèse est aussi ton succès Louison.

Résumé

Cette thèse se décompose en deux parties, chacune d'elles contenant deux sous-parties. Au total cette thèse contient donc quatre articles à l'intersection du fédéralisme, du genre, des conflits et des politiques budgétaires, le tout dans le contexte indien. La première partie (Chapitres 2 et 3) se focalise sur les effets du fédéralisme sur les conflits et les inégalités de genre. La seconde partie (Chapitres 4 et 5) elle porte sur les effets de la mise en place des budget sensibles au genre à la fois sur les dépenses publiques, mais aussi sur leur efficacité.

Le chapitre 1 constitue une introduction générale présentant le contexte indien, le fédéralisme, le concept de budget sensible au genre ainsi que les motivations de cette thèse. Il synthétise aussi les principaux résultats des chapitres suivants ainsi que leurs contributions.

Le chapitre 2 analyse les liens entre fédéralisme (à travers l'autonomie fiscale) et l'intensité des conflits en Inde. Le fédéralisme en renforçant le pouvoir de décision des échelons locaux peut aussi accentuer les conflits entre autorités nationales et locales. En combinant plusieurs sources de données et en traitant l'endogénéité avec une *variable instrumentale*, ce chapitre compare les effets du fédéralisme sur différents types de conflits. Les types de conflits considérés étant d'abord ceux liés à la gestion des ressources naturelles, puis ceux ayant pour objectif la sécession, et enfin ceux se rapportant à une demande de scission interne. Les résultats montrent que si elle réduit l'intensité des deux premiers types de conflits, elle peut accentuer l'intensité des conflits de la dernière catégorie. Ce chapitre met aussi en lumière des effets de voisinage et d'interactions spatiales. Une hausse de l'intensité des conflits sécessionnistes ou réclamant une scission dans un état entraine une baisse chez ses voisins immédiats.

Le chapitre 3 porte lui sur les liens entre fédéralisme et inégalités de genre et utilise la même méthodologie que le chapitre précédant. Le fédéralisme en demandant aux pouvoirs locaux de ne compter que sur eux tend à renforcer les inégalités inter et intrarégionales. La question du genre n'échappe pas non plus à cette hausse des inégalités. Le fédéralisme en renforçant le pouvoir de décision des autorités locales

expose les femmes à des politiques publiques plus conservatrices, et ne prenant pas en compte leurs spécificités.

Les chapitres 4 et 5 portent eux sur les solutions à cet état de fait. Les budgets sensibles au genre (GRB) visent à intégrer les contraintes propres aux femmes dans la formulation des politiques budgétaires et publiques. Il est devenu un outil populaire pour répondre aux inégalités de genre, mais qu'en est-il de son efficacité et de ses effets sur les dépenses publiques ? Ces deux chapitres essaient d'apporter une réponse à ces questions afin de savoir s'il s'agit d'une politique efficace ou d'un « gadget politique ». Pour y répondre ces chapitres combinent des méthodes de *matching*, combinées à des outils d'évaluation d'impact (*doubles différences* et *d'équilibre de l'entropie*). Les résultats montrent que les états ayant adoptés le GRB consacrent une part plus importante de leurs dépenses aux secteurs clés pour réduire les inégalités de genre. Ces états sont aussi plus efficaces dans leur utilisation des fonds publiques lies au secteur de la sante. Au niveau microéconomique, les femmes vivantes dans ces états (en comparaison aux autres) semblent moins enclines à tolérer les violences domestiques, et on plus de chance d'être propriétaires de leurs maisons ou d'actifs économiques. Elles bénéficient ont aussi plus de chance d'être prise en charge par les assurances santé fournies par les gouvernements locaux. Tous ces effets (macroéconomiques et microéconomiques) semblent s'expliquer par une plus grande crédibilité des gouvernements locaux et par une sensibilisation plus grande des femmes dans les états concernés.

Summary

This thesis is divided into two parts, each containing two sub-sections. In total, this thesis contains four articles at the intersection of federalism, gender, conflict, and fiscal policy, all in the Indian context. The first part (Chapters 2 and 3) focuses on the effects of federalism on conflict and gender inequality. The second part (Chapters 4 and 5) examines the effects of gender-responsive budgeting on both public spending and its effectiveness.

Chapter 1 provides a general introduction presenting the Indian context, federalism, the concept of gender-responsive budgeting, and the motivations behind this thesis. It also summarizes the main findings of the following chapters and their contributions.

Chapter 2 analyzes the links between federalism (through fiscal autonomy) and the intensity of conflicts in India. By strengthening the decision-making power of local authorities, federalism can also exacerbate conflicts between national and local authorities. By combining several data sources and treating endogeneity with an instrumental variable, this chapter compares the effects of federalism on different types of conflicts. The types of conflicts considered are first those related to natural resource management, then those aimed at secession, and finally those related to demands for internal division. The results show that while federalism reduces the intensity of the first two types of conflicts, it can exacerbate the intensity of conflicts in the latter category. This chapter also highlights the effects of proximity and spatial interactions. An increase in the intensity of secessionist conflicts or demands for division in one state leads to a decrease in its immediate neighbors.

Chapter 3 focuses on the links between federalism and gender inequalities and uses the same methodology as the previous chapter. By requiring local authorities to rely solely on themselves, federalism tends to reinforce inter- and intra-regional inequalities. The issue of gender is also affected by this increase in inequality. By strengthening the decision-making power of local authorities, federalism exposes women to more conservative public policies that do not take their specific needs into account.

Chapters 4 and 5 focus on solutions to this situation. Gender-responsive budgeting (GRB) aims to integrate the specific constraints faced by women into the formulation of budgetary and public policies. It has become a popular tool for addressing gender inequalities, but what about its effectiveness and impact on public spending? These two chapters attempt to answer these questions to determine whether it is an effective policy or a "political gimmick." To answer these questions, these chapters combine matching methods with impact assessment tools (double differences and entropy balance). The results show that states that have adopted GBA devote a larger share of their spending to key sectors for reducing gender inequality. These states are also more efficient in their use of public funds related to the health sector. At the microeconomic level, women living in these states (compared to others) seem less inclined to tolerate domestic violence and are more likely to own their homes or economic assets. They are also more likely to be covered by health insurance provided by local governments. All these effects (macroeconomic and microeconomic) seem to be explained by the greater credibility of local governments and greater awareness among women in the states concerned.

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Chapter 1

General Introduction

Federalism refers to a political system in which authority is constitutionally divided between central and subnational governments, each with significant autonomy in specific domains. This structure enables diverse regions within a country to exercise self-rule while remaining part of a unified state. Federal systems vary widely, from classical federations like the United States and Germany to asymmetric or quasi-federal arrangements such as those in India or Spain.

Federalism is currently practiced in over 25 countries[1], collectively encompassing around 40% of the world's population.

Federalism as a distinctive political framework, profoundly shape economic, societal and political outcomes. Its design and implementation through distribution of power and resources across multiple level of governance can either exacerbate or mitigate disparities within or between regions. So, it can influence everything from fiscal policies to social cohesion (Anderson (2015)). Concurrently, the global landscape is witnessing a troubling rising of gender inequality. This can be observed through persistent wage gaps, unequal access to opportunities and the failure to take women into account in the formulation of public policies. In response, governments and international organizations have introduced a range of corrective measures aimed at redressing these imbalances.

Yet, these two critical phenomena (federalism and gender inequality) often appear evolve in parallel. Indeed, little scholars have paid attention to their potential intersections. The interplay between federal structures and gender dynamics remains underexplored even though decentralized governance can either amplify or alleviate

[1] https://www.forumfed.org/federal-countries/

gender disparities depending on its design. This gap in analysis where federalism and gender are rarely considered in tandem underscores the necessity of this research. By examining how federal frameworks affect conflicts interact with gender policies and outcomes, this thesis seeks to bridge these disparate fields. By doing this, it offers insights into how institutional design can be leveraged to reduce conflicts and to foster more equitable society.

To rigorously assess these interactions, it is essential to anchor the analysis in a single and coherent framework. India presents itself as an ideal case study for this research. As a federal country, India embodies as a vast and highly heterogeneous landscape with a rich tapestry of culture languages and ethnic groups (Panda and Gupta (2004) and Diwakar (2024)). This diversity, however, is not without challenges. The country grapples with frequent ethnic conflicts and ongoing geopolitical tensions with Pakistan and China. These factors contribute to a complex governance environment, where the distribution of resources and power is continually tested. The next graph (figure 1.1 for example summarizes the average number of deaths due to conflict by Indian states over the period (1991-2020). It shows the concentration of death in specific states and highlights the significant heterogeneity in the intensity of conflicts.

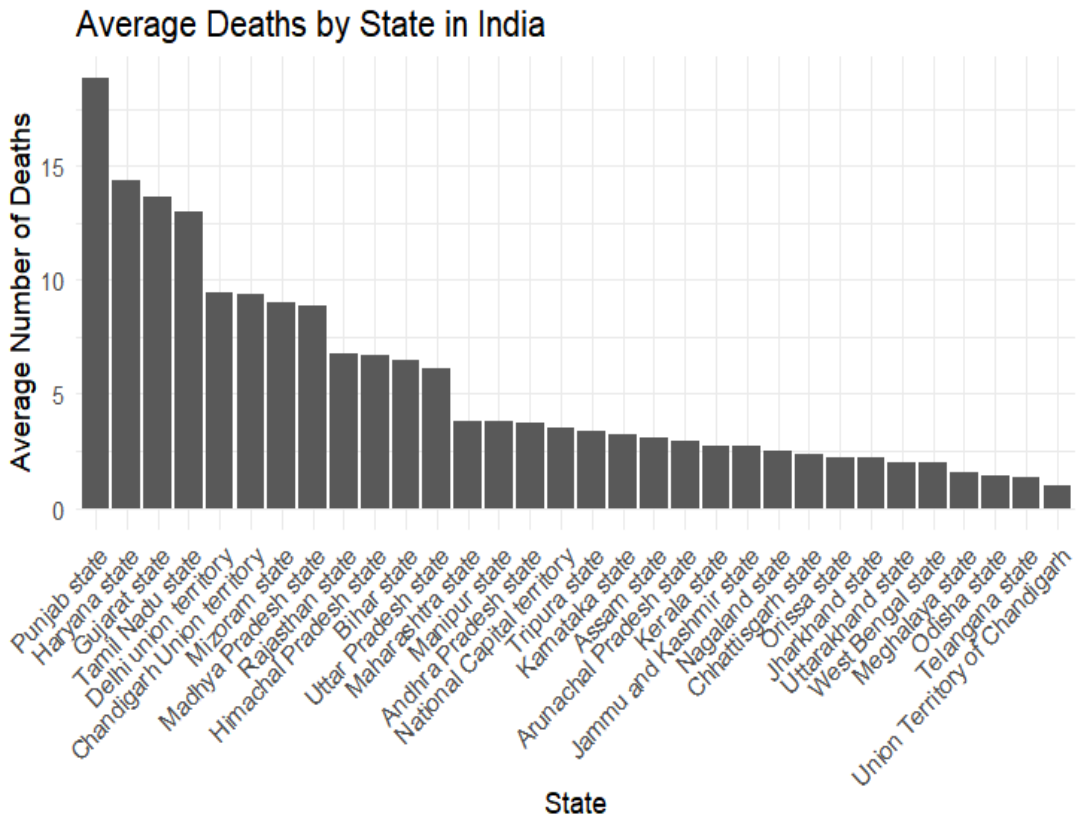

Figure 1.1: Average deaths due to conflicts by state in India

Beyond conflicts issues, India is also marked by persistent and pronounced gender inequality (DGE (2023)). Disparities in education, economic participation and access to resources remain a significant barrier to achieving gender equity. These inequalities are deeply embedded in societal norms and institutional practices, making India a critical context for examining the relationship between federalism and gender dynamics.

By focusing on India, this research seeks to uncover empirical evidence on the relationship between federal governance, conflict intensity and gender outcomes. The insights drawn from this study are not only pertinent for India, but also for other emerging and developing countries facing similar challenges. Through this analysis, the thesis aims to identify mechanism that can foster more inclusive policies and reduce domestic conflict intensity. Ultimately this thesis wants to contribute to the broader discussion on governance, inequality and social justice.

While there is a substantial body of literature exploring the relationship between federalism and conflicts, the findings remain inconclusive. On one hand, by accommodating regional demands and granting political voice to minorities, federalism can reduce grievances and mitigate the risk of violent conflict. On the other hand, when poorly designed or unevenly implemented, it may entrench divisions, foster regional inequalities, or even incentivize secessionist movements. The effects of federalism on peace and stability are thus conditional and require careful empirical scrutiny (Suberu (2009); Roeder (2013); Martinez-Vazquez et al. (2017); (Mansoob Murshed et al. (2009); Davies et al. (2023); Aya (2024)) and Madiès et al. (2018)). Despite this debate, one dimension remains overlooked. Indeed, how federalism can affect gender inequality.

Federal systems do not only shape distribution of political power, but allocation of economic (and social) resources and public services delivery (Oates (2005); Caldeira et al. (2012); Agrawal et al. (2024); Galasso and Ravallion (2005) and Bargain et al. (2025)). It's already well known that federalism can increase inequality between and within regions (Kelly and Witko (2012) and Grumbach and Michener (2022)). Federalism can also affect dynamic of conflicts by intensifying or alleviating them. Based on these various observations, it seems pertinent to ask how federalism can affect gender inequalities, especially since women are particularly affected by issues of inequality. Indeed, in emerging and developing economies women often face systemic barriers that limit their access to economic opportunities, education and political participation. However, the existing literature did not explicitly assess the effect of federalism on gender inequality.

To address gender inequality policymakers have increasingly turned to gender budgeting (Rubin and Bartle (2023); Jung (2022) and Martínez Guzmán (2024)). It is

a fiscal approach that integrated gender perspectives into budgetary processes. Despite its good intentions the effectiveness of gender budgeting remains understudied (Stotsky and Zaman (2016)). That raises important questions on how gender budgeting adoption shape fiscal policy at local level. Are the effects visible? Is this just a publicity stunt? What about the results for women? The next graphs summarize the gender budgeting framework (figure 1.2) and its adoption by Indian states (figure 1.3).

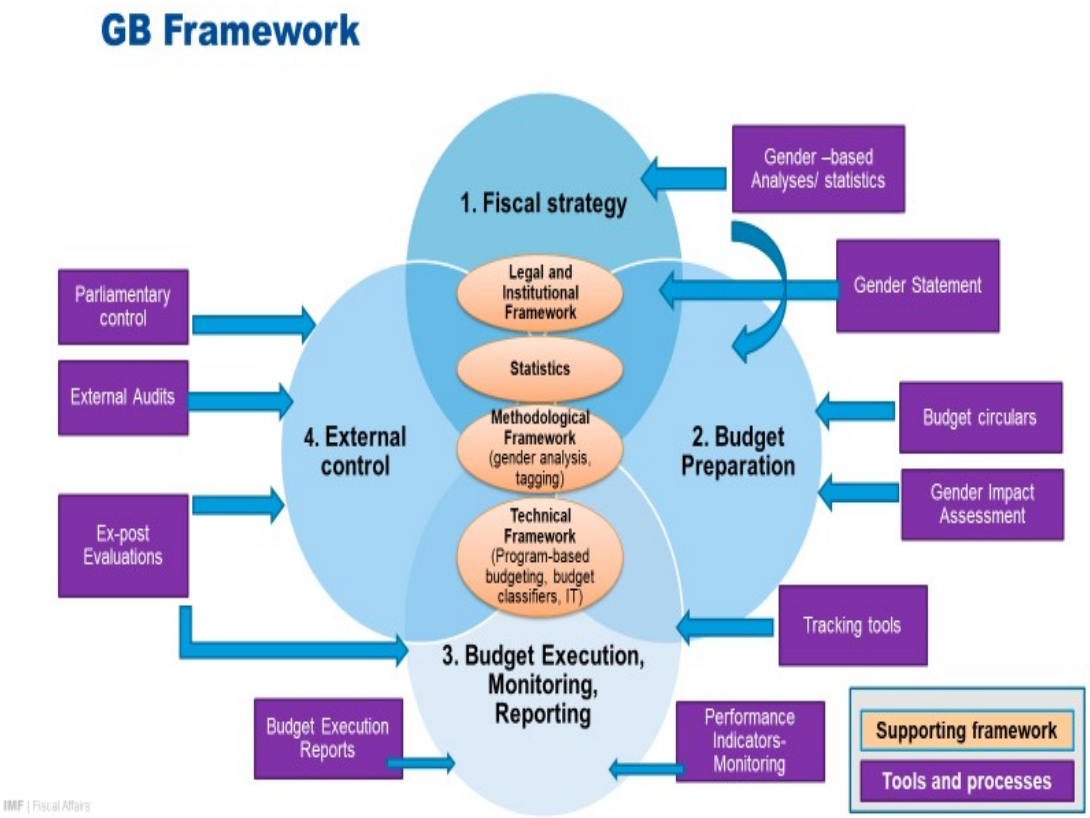

Figure 1.2: Gender Budgeting framework (Source: IMF PFM Blog)

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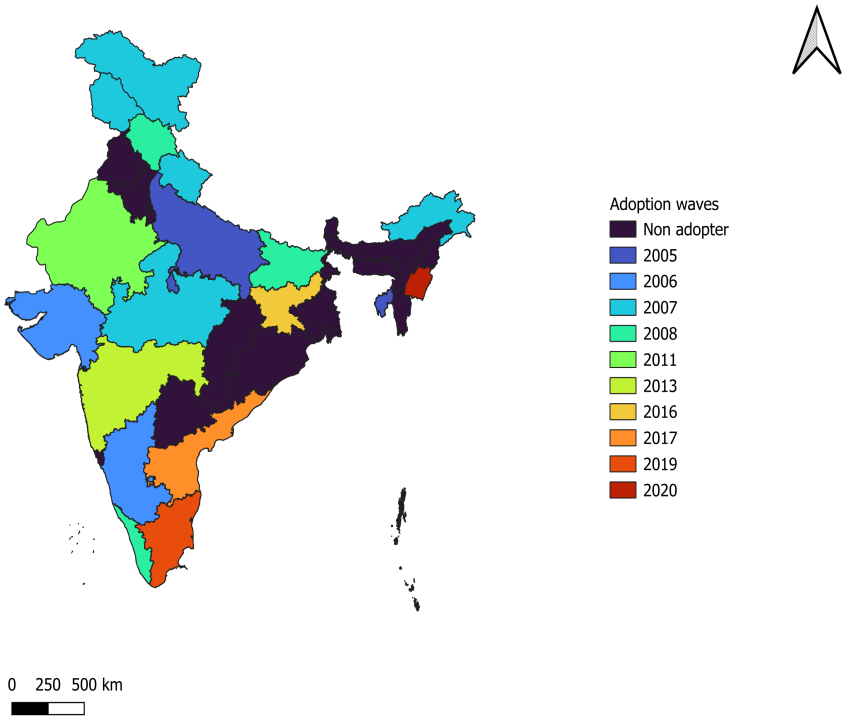

Figure 1.3: GB adoption waves (made by the author)

This thesis seeks to feel these gaps by examining the intersection of federalism, conflict dynamics and gender inequality in India. By analyzing how federalism shapes conflicts, and how in turn these processes affect gender inequality, this study wants to provide a nuanced understanding of these mechanisms. The study will also explore the role of gender budgeting within India's federal framework to assess its effectiveness to promote gender equality and how it can shape states' fiscal policy.

To address these questions, this thesis is organized in two complementary parts. Each part focusing on a distinct yet interconnected dimension of the relationship between federalism, conflicts and gender inequality.

The first part examines how federalism influences both the intensity of conflicts and the underlying gender dynamics. Federal systems by shaping decision-making authority, fiscal and political responsibilities can either mitigate or exacerbate conflicts. Then, it will assess how beyond its effects on conflicts federalism can affect the overall status of women in society. For instance, do federal systems that devolve significant power to local government create more opportunities for women or do they reinforce traditional gender hierarchies? Indeed, these conflicts (whether related to identity, autonomy, or resources) often carry gendered consequences, affecting access to services, mobility, and security for women. In turn, gender inequalities can rein-

force institutional and economic fragility (Altuzarra et al. (2021) and Jayachandran (2015)) and reduce the capacity of governments to respond effectively to social demands. To sum, how variations in subnational autonomy, institutional capacity, and center-state relations shape patterns of violence and gender inequality.

The second part shifts focus to gender budgeting as a policy tool within federal systems. Gender budgeting represents a deliberate effort to ensure that public spending contribute to reduce gender inequalities. However, its effects can vary significantly depending on the institutional context in which its implemented (Mishra and Sinha (2012) for example considers it at national level). This section will explore how gender budgeting van affect the composition and efficiency of public spending of Indian states. It will assess whether gender budgeting led to a more equitable and efficient allocations of resources and whether these allocations translate into tangible improvement in women empowerment.

By splitting the thesis into these two parts, this research aims to provide a comprehensive understanding how federalism affects conflicts and gender inequality. Then how a potential solution (gender budgeting) shapes fiscal policy and if it is an effective solution. The findings could provide practical insights for policymakers seeking to design more inclusive and effective governance reforms.

This thesis employs a multi-faceted methodological framework to explore the interplay between federalism, conflict and gender inequality. The empirical analysis is grounded in data from ACLED (Armed Conflict Location & Event Data Project) and Reserve Bank of India (RBI) complemented by a rich array of fiscal and political datasets. By integrating macro level indicators with micro level data (survey, and spatial data) the study tries to capture both the systemic and localized effects of federalism and gender budgeting. A key innovation of this research is the construction of a new measure of conflict intensity that considers internal conflict dynamics. By doing so, it allows comparison between Indian states. Additionally, the thesis leverage satellite data to provide some indications of development level at very local level (for micro analysis) and for climate shocks instead of using dummy variable. For the analytical approach the thesis combines a conceptual framework to identify the theoretically based expected effects with comprehensive empirical analysis. The empirical strategy employs a range of advanced econometric tools. These tools are Instrumental Variable (IV) to address endogeneity concerns, spatial analysis to consider regional and geographic interdependencies and DiD models for robust impact evaluation. Finally, by integrating macro and micro analyses, the study ensures a holistic understanding of mechanisms through which federalism and gender budgeting shape conflicts, public spending and gender outcomes.

These empirical strategies support the broader architecture of the thesis. Through

conceptual and empirical analysis, the first chapter examines how fiscal federalism and regional autonomy influence the dynamics of violent conflict across Indian states. It focuses on distinct types of conflict—namely, secessionist violence, disputes over natural resources, and demands for the creation of new states. The analysis highlights that granting greater fiscal and administrative autonomy to subnational governments can significantly reduce the intensity of secessionist and resource-related conflicts. In contrast, autonomy can increase the intensity of conflicts related to the creation of a new state. This chapter provides a conceptual and empirical framework to understand how tailored federal arrangements can serve as tools for conflict mitigation in heterogeneous societies.

The second chapter investigates the implications of fiscal autonomy for gender equality in India. It asks whether devolving financial authority to state governments can foster more inclusive development, particularly for women. The results suggest that while women gain in access and capabilities, men often continue to capture a larger share of policy benefits. Together, the two chapters show that fiscal autonomy affects not only the occurrence and intensity of conflict but also the beneficiaries of public goods and opportunities. In doing so, they underscore the broader potential of federalism to shape both peace, inclusion, and call for more gender-aware approaches in the design of decentralization policies.

The second part shifts the focus from institutional structure to policy instruments, analyzing how gender budgeting concretely influences the allocation and performance of public spending. Chapters 1 and 2 emphasized the enabling role of fiscal autonomy in addressing local grievances and promoting women's empowerment. Chapters 3 and 4 investigate whether integrating gender objectives into fiscal policy leads to more inclusive and efficient outcomes. The third chapter turns to the adoption and effects of gender budgeting across Indian states between 1991 and 2020. It evaluates whether institutionalizing gender concerns within the budget process influences fiscal behavior. However, while the reform seems strengthens states' credibility in prioritizing gender outcomes, it also constrains their fiscal autonomy This raises questions about the balance between central oversight and state-level discretion. The fourth chapter deepens the analysis by focusing on the efficiency dimension of public spending, specifically in the health sector. It assesses whether the adoption of gender-responsive budgeting enhances states' ability to allocate health expenditures effectively. The results show that GRB-adopting states perform better in terms of spending efficiency, due in part to improvements in administrative capacity and budgetary accuracy. In addition to these institutional effects, GRB is associated with tangible micro-level outcomes, such as reduced pregnancy loss and broader access to health insurance. These findings indicate that gender budgeting not only promotes fiscal discipline but

also delivers social returns by improving women's health protection and access to essential services. Taken together, the chapters in this thesis offer a multidimensional perspective on how federal structures and gender-oriented fiscal reforms interact to shape public governance.

In sum, this thesis investigates the political economy of federalism and gender budgeting in India It emphasizes their effects on conflict dynamics, gender equality, and the effectiveness of public spending. It combines conceptual modeling, causal inference techniques, and policy evaluation methods to examine how institutional design and fiscal instruments interact in shaping developmental outcomes. By drawing on rich subnational data and exploiting institutional reforms, the thesis contributes both to academic debates and to policy discussions on the role of decentralization and gender budgeting in complex federations. The findings highlight the importance of aligning fiscal autonomy with accountability, and of embedding equity considerations into public finance systems. The remainder of the thesis is organized as follows. Chapter 2 analyzes the relationship between fiscal federalism and conflict intensity across states. Chapter 3 evaluates the impact of state-level fiscal autonomy on women's human development outcomes. Chapter 4 investigates the influence of gender budgeting on fiscal allocations and state credibility. Chapter 5 examines how gender-responsive budgeting affects the efficiency and social outcomes of health spending. The concluding chapter summarizes the main findings, discusses their implications, and outlines avenues for future research.

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Chapter 2

Designing autonomy: federalism, conflict, and the lessons of fragility

This paper investigates how fiscal federalism shapes conflict in India. Using disaggregated data on secessionist violence, demands for new states, and resource disputes across states from 1991 to 2020, We estimate instrumental variable regressions and spatial models. Results show that revenue autonomy reduces secessionist and resource conflicts but heightens pressures for internal partition in heterogeneous regions, while spending autonomy has mixed effects with significant spillovers across neighboring states. These findings demonstrate that decentralization is not a uniform remedy: its stabilizing potential depends on conflict type and the spatial structure of federal arrangements. By connecting subnational evidence to global fragility frameworks, the paper shows how federal design can both mitigate and redirect contestation, clarifying when fiscal autonomy fosters stability in diverse societies.

2.1 Introduction

Federalism, broadly understood as the transfer of authority and resources from the central government to subnational entities such as states or regions, is often promoted to improve public service delivery and manage ethnic diversity more effectively (Brancati (2006); Bakke and Wibbels (2006)). By allowing local governments to tailor policies to the specific needs of their populations, federal arrangements are assumed to increase the responsiveness and legitimacy of institutions. In deeply divided societies, federalism is also seen as a potential tool to reduce tensions and prevent conflict by granting ethnic or regional groups a degree of political autonomy. However, the actual effectiveness of federalism in mitigating conflict remains contested (Peluso (2007); Arellano-Yanguas (2011)). While some studies highlight its stabilizing effects, others point to cases where decentralization has exacerbated divisions or fueled secessionist claims. The existing empirical evidence is therefore mixed, and further research is needed to understand under which conditions federalism can promote peace and improve governance.

Most existing studies adopt a cross-country approach, making it difficult to identify the causal impact of federalism within a specific institutional, social, and historical context. This comparative perspective, while useful for broad patterns, tends to overlook the heterogeneity of local dynamics and the distinct mechanisms through which decentralization may influence conflict. Moreover, much of the literature relies on a single methodological framework, typically ignoring potential spatial spillovers or interdependencies between neighboring regions—factors that may significantly shape both governance outcomes and conflict diffusion (Mainali et al. (2022)). Another key limitation is the treatment of conflict as a homogeneous phenomenon. Few studies disaggregate between different types of conflict, such as secessionist violence, statehood demands, or contestation over natural resources, despite the fact that each may respond differently to institutional arrangements like federalism. Finally, widely used conflict indicators often lack granularity, making it difficult to capture variation in conflict intensity or escalation over time and space. This paper wants to address these gaps by adopting a subnational approach within a single country, distinguishing conflict types, incorporating spatial dynamics, and developing refined measures of conflict intensity. To do it, instead of relying on cross-country comparisons, which often obscure context-dependent mechanisms, the study concentrates on a single country—India—where significant variation in federal arrangements and conflict dynamics exists across states and over time. This choice allows for a more precise identification of causal relationships. The paper addresses two interrelated research questions. First, does the impact of federalism—measured through both revenue and expenditure

autonomy—vary depending on the type of conflict? Rather than treating conflict as a uniform phenomenon, the study disaggregates between secessionist violence, demands for state creation, and disputes over natural resources, each of which may respond differently to federalism. Second, do spatial spillovers matter? That is, does greater autonomy in neighboring states influence the likelihood or intensity of conflict in a given region?

These questions emerge from a clear mismatch between what the literature has so far assumed—namely, a homogeneous and linear relationship between federalism and conflict—and the complex, multi-dimensional reality on the ground.

This paper makes three main contributions to address the shortcomings identified in the literature. First, it differentiates the effects of federalism based on the nature of the conflict. By disaggregating between secessionist violence, state creation demands, and natural resource-related disputes, the analysis captures the heterogeneity of conflict dynamics and moves beyond the simplistic assumption of a uniform federalism-conflict relationship. Second, the paper introduces a spatial dimension to the analysis by accounting for regional interdependencies. It explores whether the level of autonomy in neighboring states influences conflict patterns, thereby incorporating spillover effects that are sometime ignored in existing work . Third, it develops a harmonized measure of conflict intensity that allows for consistent comparisons across states and over time. This refined measurement addresses previous limitations in the operationalization of conflict variables and enhances the robustness of the empirical results. Together, these contributions offer a more nuanced understanding of how different forms of autonomy affect distinct types of conflict within a single-country framework, while providing a replicable methodology for other decentralized contexts.

The analysis builds on a combination of theoretical and empirical approaches. First, a formal empirical model is developed to clarify the mechanisms through which federalism may affect different types of conflict and to derive testable hypotheses. Second, the empirical strategy relies on a two-stage least squares (2SLS) approach using instrumental variables, to address potential endogeneity between federal autonomy and conflict outcomes. Third, spatial econometric models are employed to capture the influence of neighboring states, explicitly accounting for spatial spillovers and interdependencies in conflict dynamics across Indian states. This multi-layered methodology allows for both internal and external sources of variation to be rigorously analyzed.

The findings reveal a nuanced relationship between federalism and conflict, which varies depending on the type of dispute and the broader regional context. While some forms of autonomy appear to reduce tensions, others may generate new political demands, highlighting the complex effects of decentralization in a heterogeneous

federation like India. The results also suggest that the institutional configuration of one state can influence conflict dynamics in neighboring regions, underscoring the importance of spatial interdependencies.

The rest of the paper proceeds as follows. Section 2 presents the conceptual framework, which formalizes the strategic interactions between central and subnational actors and generates the hypotheses to be tested. Section 3 describes the empirical approach, based on two-stage least squares (2SLS) estimation using instrumental variables to address endogeneity. Section 4 presents the results. Section 5 conducts a series of robustness checks to test the stability of the results under alternative specifications and measurements. Section 6 incorporates spatial econometric models to capture cross-state interdependencies and the diffusion of conflict. Section 7 concludes by drawing policy implications for institutional design in ethnically diverse and politically decentralized settings.

2.2 Conceptual framework

In this framework we will consider the different ethnic groups present in each state as the protagonists. Each group got a demographic weight $\alpha_i \in (0; 1)$ for each group i, such that:

$$\sum_{i=1}^{N} \alpha_i = 1.$$

These groups are active in region $\mathcal{R}$ composed of N identity groups $G = \{1, \ldots, N\}$. We will also consider that this weight is akin to their representation in the local parliament and, more broadly, to their relative political power within the state. In this interpretation, the weight reflects not only a group's numerical strength but also its effective capacity to influence policymaking and the allocation of resources. This assumption is admittedly strong and subject to criticism, since local members of parliament are formally elected directly by popular vote from a set of candidates who contest elections in their respective constituencies, rather than through any proportional mechanism of group representation.

Nonetheless, in practice, ethnic and caste considerations play a central role in shaping electoral outcomes in India, as in many other developing and emerging democracies. Voters often align their preferences along ethnic or caste lines, which strongly affects both the selection of candidates by political parties and the voting decisions of the electorate (Nellis et al. (2016); Chandra (2007)). This ethnic bias in political competition means that representation in parliament, though formally determined by constituency-level elections, tends to map onto the demographic weight of groups in

a given territory.

Moreover, political parties in India frequently mobilize support by explicitly appealing to ethnic or caste identities, further reinforcing the connection between demographic composition and political power. Thus, while the assumption that parliamentary representation mirrors group weight is not institutionally guaranteed, it captures an empirically relevant mechanism of political influence, especially in contexts where ethnic identities structure party competition and coalition-building. This also implies that shifts in demographic balance or the relative mobilization capacity of groups can have direct consequences for legislative representation and, consequently, for local governance and intergovernmental bargaining.

We define a measure of *effective heterogeneity* as:

$$H = 1 - \max_{i \in G} \alpha_i.$$

A *homogeneous state* has $H \approx 0$, while a *highly fragmented state* has $H \approx 1$.

The region has a degree of autonomy represented by a total fiscal rent $R > 0$, decomposed into two components:

$$R = R_T + R_R,$$

where R_T denotes transfers or non-natural tax revenues (e.g., subsidies, tax shares), and R_R refers to revenues from local control over natural resources. In the Indian context, states receive a portion of royalties from natural resources, making R_R a central component for stabilization. An increase in R driven mainly by R_T may cause frustration if some groups feel excluded from R_R, which they perceive as confiscated wealth. However, the ability of states to use royalties as a budgetary resource helps ease such tensions.

The regional government is formed by a coalition $S \subseteq G$ such that:

$$\sum_{i \in S} \alpha_i \geq \theta, \quad \text{with } \theta \in (0.5; 1].$$

The rent R is then shared among the coalition members in proportion to their demographic weight (which is close to their political power and their impact in the coalition):

$$u_i^S = \frac{\alpha_i}{\sum_{j \in S} \alpha_j} R.$$

In case of secession, if a group i wants to become independent as a country, it will

obtain γR (with $\gamma \in [0;1]$ representing scale losses). Its new utility function will be

$$u_i^{sec} = \alpha_i \gamma R - c_i^{sec}$$

This reflects the fact that secession generally reduces efficiency, since the new country becomes smaller and loses the benefits of belonging to a larger political and economic union. It is important to note, however, that for secession to occur and remain viable, the new state must be relatively homogeneous. Otherwise, internal divisions would undermine their cohesion and stability. In addition, the tax base could be reduced by the emigration of people who disagree with secession or of firms established in the territory. The "new country" would also lose transfers from the central government and, finally, would have to bear further costs related to secession, such as conflict costs and diplomatic challenges. Overall, secession may provide autonomy and control over local resources, but it also implies strong trade-offs: the political and cultural benefits must outweigh the fiscal, economic, and conflict-related costs for it to be sustainable. The secession will occur only if $u_i^{sec} > u_i^S$. This condition is less likely to be satisfied, as R will be smaller after secession and additional costs will arise from secessionist conflicts (Couttenier et al. (2024) and Madiès et al. (2018)). Therefore, according to our conceptual framework, an increase in autonomy will reduce conflict intensity. The situation will be similar for conflicts related to natural resource management. Indeed, if the share of R coming from natural resources increases through an agreement with the central government and a rise in autonomy, the incentives for conflict will also be reduced.

For conflict related to a partition the context is different. A group i may consider forming a new autonomous entity with a coalition $T \subseteq G$, $i \in T$, such that $\sum_{j \in T} \alpha_j \geq \theta$. This new entity receives a rent $R' = \gamma R$, where $\gamma \in (0;1]$ reflects a potential loss in efficiency or endowment. We define:

$$\beta_i^T = \frac{\alpha_i}{\sum_{j \in T} \alpha_j}, \quad \text{thus} \quad u_i^T = \beta_i^T \cdot \gamma R - c_i^T.$$

The incentive condition for partition becomes:

$$u_i^T > u_i^S \Leftrightarrow \left(\frac{\gamma}{\sum_{j \in T} \alpha_j} - \frac{1}{\sum_{j \in S} \alpha_j} \right) \alpha_i R > c_i^T.$$

This condition is more likely to be satisfied when:

- Group i has a relatively greater weight in T than in S,
- γ is close to 1 (indicating minimal loss from partition),

- $\alpha_i R$ is large enough that group i could expect to govern independently in the new entity, though not already dominant in the original setting. Partition is attractive only if it improves group i's standing compared to a previous situation where it could not govern alone. Too small a group makes partition unviable; a dominant group has no incentive to exit a favorable setup.

To conclude, in this context where multiple alternative coalitions can meet the θ threshold, if there is a strong heterogeneity an increase of autonomy (through) R can increase the intensity of conflict.

Type of Conflict	**Effect of R**	**Effect of R_R**	**Role of H**
Secession	Reducing	Weak	Weak
Natural Resources	Reducing	Reducing	Weak
Internal Partition	Amplifying	Indirect	Strong

Thus, we show that local autonomy can have ambivalent effects. When it includes actual transfer of powers, especially in natural resource management, it tends to stabilize center-region relations and reduce secession risks. Conversely, in regions marked by significant political or identity heterogeneity, it can intensify internal competition for control over local rents and revive partition dynamics. The effect of autonomy thus heavily depends on the internal population structure, the composition of rents, and the prevailing rules (state creation, royalties, etc.), as illustrated by Baron and Ferejohn (1989).

To summarize, in contexts of high heterogeneity, federalism may exacerbate conflict intensity, particularly for internal partition. The costs associated with secession are typically higher than those of internal partition, making the latter a more viable and attractive option for groups seeking greater autonomy or control over resources. Thus, increased federalism in highly heterogeneous regions can amplify internal tensions and partition dynamics. However, the increase of autonomy can provide more autonomy and avoid the costs and consequences of secessionist claims (or conflicts). Federalism can be a solution for secessionist conflicts by reducing their intensity. Conversely, in contexts of low heterogeneity, federalism tends to dampen conflict intensity, especially in areas such as natural resource management. Federalism can solve the management issue and provide a satisfactory answer to claimers. So, federalism can reduce natural resources management related conflicts.

Application to the Indian Context

The theoretical framework aligns well with the Indian federal structure, where fiscal decentralization coexists with significant vertical and horizontal imbalances. In India, state governments derive revenues from two main sources: non-natural resource revenues (R_T) and natural resource-based revenues (R_R).

The component R_T could represent all forms of revenue excluding natural resources. This includes states' own tax collections (such as state GST, VAT on petroleum products, and excise duties), non-tax revenues (like interest receipts, user charges).

On the other hand, R_R captures revenues derived from the state's direct control over natural resources, including royalties from minerals, coal, oil, and forest products. States like Odisha, Chhattisgarh, and Jharkhand depend heavily on these, making R_R a politically sensitive and economically crucial component.

In practice, when R (total fiscal rent) is high and well-distributed among groups, the likelihood of natural resource-based and secessionist conflicts diminishes. For example, mining royalties (a component of R_R) allocated fairly to tribal areas in Chhattisgarh have sometimes helped ease local grievances. However, inequitable access or perceptions of exclusion from R_R, especially by marginalized groups or tribal populations, can escalate into contestation or calls for greater autonomy.

The model's predictions about internal partition are consistent with India's state reorganization history. States like Telangana, Jharkhand, and Uttarakhand were formed amid perceptions that local groups were inadequately benefiting from R or lacked political dominance in the existing state coalition S. Here, the condition $u_i^T > u_i^S$ was met—groups believed they would fare better, even after accounting for administrative inefficiencies (i.e., low c_i^T and high γ).

This framework thus captures how the interplay of fiscal autonomy, demographic structure, and rent distribution shapes political stability and conflict in federal India.

2.3 Empirical methodology

2.3.1 Data

This study relies on an original combination of high-quality datasets that provide detailed and complementary information essential for understanding the links between fiscal federalism and conflict dynamics in India. The core economic and fiscal data are sourced from the Reserve Bank of India (RBI), which offers a uniquely detailed and reliable account of the fiscal position and economic performance of each Indian

State and Union Territory. The RBI's disaggregated statistics on revenues and expenditures allow for precise measurement of both revenue autonomy and expenditure autonomy, which are central to this analysis of fiscal federalism. Political variables are drawn from official electoral data provided by the Election Commission of India, ensuring accurate and consistent information on the political context at the state level. These data are crucial to control political factors that may influence both fiscal choices and conflict outcomes. Conflict data comes from the Armed Conflict Location and Event Dataset (ACLED), a widely used and reputable source for detailed geo-referenced information on conflict events worldwide. ACLED's granular event-level records, including the number of fatalities and identities of actors, make it possible to capture not only the scale but also the nature of violent incidents. This richness of detail allows for classifying conflicts according to the underlying motivations of actors (e.g., secession, state creation, natural resource management), which is vital for disentangling the mechanisms through which fiscal autonomy may affect specific types of violence. To construct the outcome variable, conflict intensity, the number of fatalities reported by ACLED is aggregated by state and year. A standardization procedure is then applied to these totals to account for national trends and structural differences across states. By standardizing fatalities relative to the national mean and standard deviation each year and for each conflict type, we remove the influence of structural differences between states, such as population size, historical conflict prevalence, or geographic factors that make some areas more prone to violence than others. Without this adjustment, states with larger populations or historically high conflict levels would always appear more intense, even if recent violence is not unusually high for them. Standardization makes the measure dimensionless and comparable because it expresses how much each state-year observation deviates from what is typical for that year in the whole country. This way, an increase in fatalities in a normally peaceful state can be meaningfully compared to the same increase in a historically violent state, because both are interpreted in relation to their distance from the national pattern. This approach adjusts for heterogeneous baseline levels of violence, allowing for meaningful comparisons and highlighting deviations from the national norm.

Formally, the standardized conflict intensity is calculated as:

$$Intensity_{ijt} = \frac{(fatalities_{ijt} - fatalities_{m}ean_{jt})}{standard_{d}eviation_{jt}} \tag{2.1}$$

Where $Intensity_{ijt}$ denotes the standardized intensity of conflict type j in state i at time t. This method aligns with the view that perceptions and impacts of conflict depend on context-specific baselines (Weingart et al. (2015)).

The main explanatory variables capture both dimensions of fiscal federalism. Rev-

enue autonomy is measured as the ratio of own-source revenues to total revenues for each state-year. Expenditure autonomy is calculated as the share of local public expenditure net of Centrally Sponsored Schemes (CSS), which are transfers determined and earmarked by the central government but spent locally. Excluding CSS ensures that the measure reflects the discretionary spending power of local governments, which is a key aspect of their capacity to respond to local needs and potentially manage tensions (Tranchant (2010)).

Several relevant control variables are included to account for socioeconomic factors known to affect conflict dynamics. The urbanization rate captures demographic pressures and urban crowding, which have been linked to higher unrest (Gizelis et al. (2021)). Indeed, urban population growth is associated with increased unrest specifically in peri-urban areas. This suggests that rapid urban expansion at the edges of cities can create social and economic pressures that elevate the risk of conflict, independently of environmental factors like droughts. GDP per capita is included to control for income effects, as higher living standards generally reduce incentives for rebellion (Goodhand (2003) and Premand and Rohner (2024)). Population size is added to reflect the scale of potential contestation and resource competition (Raleigh and Hegre (2009)). Finally, a dummy variable for the presence of a fiscal rule captures whether budgetary constraints might limit local governments' spending flexibility, which could either mitigate or exacerbate conflict risks depending on how effectively these constraints ensure equitable service delivery.

Table 2.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
state autonomy	48.938	25.713	5.466	100	887
log(GDP per capita)	10.287	1.061	7.886	12.832	849
Urbanization (%)	33.568	19.098	7.98	99.900	734
trend	16.815	9.352	1	33	887
fiscal rule	0.381	0.486	0	1	887
log(population size)	20.847	0.125	20.608	21.025	798
creation	0.067	0.859	-0.255	5.570	887
secession	0.021	0.741	-0.586	5.562	887
natural	0.049	0.752	-0.247	5.570	887

2.3.2 Identification Strategy

To empirically assess the effects of states' autonomy on conflict intensity, we use a Two-Stage Least Squares (2SLS) model, as applied by Sanogo (2019), Bartolini et al.

(2019), and Tselios (2023) for example. The 2SLS approach is particularly suitable in this context because it addresses endogeneity concerns that would otherwise bias the estimates.

Endogeneity arises mainly through two channels: reverse causality and omitted variable bias. On one hand, fiscal autonomy may impact conflict by affecting local governments' capacity to manage grievances, allocate resources, and provide services. On the other hand, conflict intensity may influence the degree of autonomy granted to or demanded by a state. For example, persistent violence might push states to seek greater self-rule or justify stronger central intervention. Moreover, unobserved factors such as entrenched ethnic cleavages, historical governance legacies, or local institutional capacity could simultaneously affect both fiscal autonomy and conflict outcomes, resulting in biased estimates if not properly addressed.

To overcome this, we apply a 2SLS estimation strategy that uses instrumental variables (IVs) correlated with states' fiscal autonomy but plausibly exogenous to conflict intensity. In the first stage, these instruments predict the level of autonomy, removing endogenous variation. In the second stage, the predicted values are used to estimate the causal effect of fiscal autonomy on conflict intensity, isolating the exogenous component and yielding consistent results.

The first instrumental variable is the duration since a state's official creation. Over time, older states tend to develop stronger administrative institutions, deeper fiscal capacity, and more stable governance frameworks (Broschek (2010)). This accumulated institutional maturity increases their ability to raise and manage revenues independently, supporting greater fiscal autonomy. At the same time, the timing of a state's creation is historically determined and unlikely to be directly linked to short-term changes in conflict intensity, satisfying both the relevance condition and the exclusion restriction for a valid instrument. Figure .1 (in appendix) shows the positive relationship between the time since a state's creation and its tax autonomy level. This relationship is consistent with the findings of Vu (2021), who show that accumulated statehood experience strengthens fiscal and legal capacity, supporting more equitable economic development.

The second instrumental variable exploits exogenous fiscal changes resulting from the Finance Commission's periodic recommendations. The Finance Commission is a constitutional body established under Article 280 of the Indian Constitution and reconstituted every five years to determine how net tax revenues are distributed between the central and state governments, and to establish principles for grants and fiscal transfers. Its members are appointed by the President of India and typically include independent economists, jurists, or senior administrators rather than active politicians, which insulates the body from direct political bargaining. The Commis-

sion's mandate is highly formalized: it applies macroeconomic and structural criteria—such as population, per capita income, fiscal discipline, tax effort, and geographic considerations—to design allocation formulas. These nationally applied rules generate predictable adjustments in states' fiscal space that are plausibly exogenous to contemporaneous state-level political or conflict dynamics. The instrument satisfies the relevance condition because Finance Commission recommendations directly alter the volume and composition of transfers received by states, thereby expanding or constraining their fiscal capacity and, by extension, their effective autonomy. A state awarded a higher share of centrally collected taxes or grants gains exogenous fiscal space, which increases its ability to finance expenditures and address local grievances, while a lower share reduces its autonomy. This systematic, formula-driven reallocation produces the kind of external variation in fiscal resources that is essential for identification. The exclusion restriction is also plausible: the criteria employed by the Commission are determined at the national level and updated only once every five years, making them insensitive to short-term conflict shocks in any individual state. Moreover, the weights applied to these criteria reflect equity and efficiency objectives rather than state-specific political pressures. This design ensures that the fiscal adjustments triggered by the Commission are orthogonal to unobserved local drivers of violence. A possible concern, however, is that some of the criteria used by the Finance Commission (most notably population and per capita income) are also included in the empirical models as controls. Since these factors are both part of the Finance Commission formula and potential determinants of conflict, one could worry that the instrument partially transmits their effect on conflict outside of the controlled regression pathway, thereby weakening the exclusion restriction. This risk is mitigated by explicitly including GDP per capita and population as control variables in the regressions, so that their direct effects are absorbed within the model. The identifying variation in FC transfers therefore comes from the residual component of the formula (such as fiscal effort, discipline, and equity adjustments) that is not mechanically correlated with unobserved conflict dynamics. Nevertheless, some residual risk remains if Finance Commission recommendations systematically favored poorer or more populous states beyond what the controls capture, and if such characteristics also shaped conflict trajectories through unobserved channels. This possibility is addressed through robustness checks. Taken together, the institutional features of the Finance Commission and the empirical safeguards provide strong justification for treating its recommendations as a valid instrument for fiscal autonomy.

Formally, the empirical model starts with the following structural equation, which includes state (i) and time (t) fixed effects:

$$Y_{it} = \beta_0 + \beta_1 FD_{it} + \gamma_1 X_{it} + \mu_i + \lambda_t + \epsilon_{it}, \tag{2.2}$$

where Y_{it} is the conflict intensity, FD_{it} is fiscal autonomy, X_{it} is a vector of control variables, μ_i represents state fixed effects, λ_t represents time fixed effects, and ϵ_{it} is the error term.

Because FD_{it} is endogenous, we instrument it in the first stage using Z_{it} (state duration and Finance Commission dummy):

$$FD_{it} = \pi_0 + \pi_1 Z_{it} + \mu_i + \lambda_t + u_{it}. \tag{2.3}$$

The fitted values $\hat{FD}_{it}$ from this first stage are then substituted back into the structural equation:

$$Y_{it} = \beta_0 + \beta_1 \hat{FD}_{it} + \gamma_1 X_{it} + \mu_i + \lambda_t + \epsilon_{it}. \tag{2.4}$$

Including state and year fixed effects controls for unobserved time-invariant heterogeneity and national-level shocks that could simultaneously influence fiscal autonomy and conflict.

2.4 Results

The results seem to suggest a negative effect of taxes autonomy on conflict intensity. Federalism measured as share of own local revenues seems to dampen the intensity of conflict which has as objectives the creation of a new state or secession from the Union. Indeed, federalism in terms of revenue in India can dampen the intensity of conflict by promoting equitable resource distribution and empowering local governments. When states have greater control over their revenue sources, they can tailor fiscal policies to meet the specific needs of their populations, addressing disparities within their borders and grievances. By providing states with a stake in the economic well-being of their constituents, revenue-based federalism can mitigate tensions and promote stability, ultimately reducing the likelihood of violent conflict. These results are like those of Brancati (2006) who found that decentralization decreases ethnic conflict and secessionism directly by giving groups control over their own political, social and economic affairs.

	Secession	**Creation**	**Natural**
	(1)	(2)	(3)
Autonomy	−0.006***	0.003	−0.010***
	(0.002)	(0.003)	(0.003)
Observations	508	508	508
R^2	0.097	0.166	0.012
Adjusted R^2	0.084	0.154	0.002
Residual Std. Error (df = 500)	0.797	1.011	0.888

Table 2.2: IV Regression Results for revenue federalism
Note: *p<0.1; **p<0.05; ***p<0.01

Results are also similar for spending side of federalism. Indeed, when expenditure powers are devolved, states can design social services, infrastructure, and welfare programs that are responsive to local needs, addressing specific regional grievances that might otherwise fuel conflict. For example, when healthcare, education, and employment are provided at a regional level, there's less likelihood that marginalized groups will seek autonomy as a solution to their problems. Expenditure federalism also allows regions to express their unique cultural identities through local policies without resorting to secessionist measures. States can allocate funds toward programs that honor and preserve local languages, traditions, and cultural practices, reducing cultural tensions by reinforcing a sense of belonging within the larger federal framework. In addition, by directing federal funds to regions that are conflict-prone, expenditure federalism can address socio-economic issues underlying secessionist tensions. When federal spending targets fragile regions for development, job creation, and security, it can weaken the appeal of secession by creating more stability and prosperity (Eaton (2006)).

	Secession	**Creation**	**Natural**
	(1)	(2)	(3)
Decentralization	-0.155^{***}	0.122^{**}	-0.247^{***}
	(0.046)	(0.053)	(0.057)
Observations	508	508	508
R^2	0.461	0.186	0.236
Adjusted R^2	0.403	0.106	0.190
Residual Std. Error (df = 501)	1.003	1.163	1.259

Table 2.3: IV Regression Results for spending federalism

Note: *p<0.1; **p<0.05; ***p<0.01

The combined structure of tax and spending federalism means that regional disparities in both fiscal capacity and spending autonomy can be addressed through central redistribution, but with enough independence to respect regional autonomy. Such a balance ensures that no region feels marginalized to the extent of secession. When states are more financially autonomous, but still benefit from federal support, they have a stake in maintaining the current system for economic security. This reduces incentives to pursue statehood or secession, as states realize they benefit more within the union than outside of it. Federalism creates a platform for accommodating political demands through institutional channels rather than conflict. By enabling power-sharing and collaboration between central and regional governments, federalism can offer a political outlet for grievances that might otherwise manifest as violent movements. This responsive political structure reduces the intensity of such conflicts by presenting alternatives to secession or new statehood. While federalism alone cannot eliminate conflicts, it provides a framework to address economic and cultural grievances, and if used effectively, it can substantially reduce the intensity of conflicts by meeting local demands through peaceful, integrative mechanisms. The results go in the same way than those of Siegle and O'Mahony (2006) who found that decentralization initiatives that support increased levels of local government expenditures, employment, and elected leaders have been less likely to succumb to ethnic conflicts.

2.5 Robustness

2.5.1 alternative indicator of intensity

To ensure the robustness of our results we investigate further the analysis to check potential effects on occurrences of conflicts instead of intensity. The computation is

similar to the intensity one.

$$Occurrences_{ijt} = \frac{(number_{ijt} - mean_{jt})}{standard\_deviation_{jt}} \tag{2.5}$$

Examining how federalism—through taxation and spending—affects both the intensity of individual conflicts and the yearly number of events provides valuable insight into conflict dynamics. While intensity measures the severity of each event, occurrences, defined as the annual number of events, capture the persistence and spread of conflict. Decentralized tax and spending powers within a federal system can enable local governments to address region-specific grievances, potentially reducing both the frequency of conflicts and their intensity. For instance, effective public spending on social services or infrastructure could alleviate economic disparities that might otherwise fuel recurrent unrest. By analyzing both dimensions, we can better understand how fiscal federalism may contribute to regional stability, whether by reducing the triggers of conflict or limiting the severity of violence when conflicts occur, leading to more informed policy recommendations.

The results are available in the appendix section (tables B.1 and B.2). These results paint a compelling narrative about the contrasting roles of autonomy and decentralization in shaping conflict dynamics. Autonomy, reflecting the revenue federalism dimension, appears to have a stabilizing influence, particularly on secessionist and natural-resource-related conflicts. The negative and significant coefficients suggest that when states have more control over their revenue generation, the pressures that often lead to these conflicts are alleviated. This might be because states with financial autonomy are better equipped to address local grievances and fund tailored policies, reducing the incentives for groups to push for secession or clash over natural resources.

In contrast, decentralization, which captures spending federalism, tells a more nuanced story. The results indicate that decentralization is associated with higher secessionist pressures and reduced stability, especially in resource-related contexts. While spending power can empower states to address local needs, the lack of matching revenue control might create inefficiencies or feelings of dependence on the central government, fueling dissatisfaction. Moreover, decentralization may inadvertently empower local elites or actors whose agendas conflict with broader national stability, or generate an interest to have a control on the use of money at local level (Tranchant (2010), Fisman and Gatti (2002)). These findings highlight a tension between empowering states financially and giving them the spending autonomy to act on those resources. It underscores the need for a careful balance: revenue autonomy appears to mitigate conflict, but spending federalism, without complementary mechanisms,

may exacerbate it, especially in regions already prone to unrest.

2.5.2 Placebo test

We now examine whether there are confounding factors that could affect the results, which have remained stable so far (especially for conflicts' intensity). The empirical literature shows that the adoption of an economic policy or implementation of fiscal reforms is generally associated with parallel reforms, making the variation of conflicts' intensity a non-random factor. One could therefore imagine that unobservable variables correlated with outcome and potentially with the outcome variable could affect the baseline results. While we are aware that the empirical — method used in this study aims to address these types of concerns, we still — strengthen the results by conducting a placebo test on conflict intensity. To do this, we randomly attributed some values for intensity conflict by keeping some characteristics of the original distribution (mean, maximum and minimum). The main idea behind this test is that if the results are biased by unobservable variables, the placebo — test might also show significant effects. Random treatments within the sample do not affect my conflicts' intensities measures (Tables C.1 and C.2, in Appendix). Therefore, we can rule out the possibility of confounding — factors influencing our results.

2.5.3 Instrument diagnostic

The `ivdiag` function from the `AER` package in R is an essential tool for diagnosing Instrumental Variables (IV) models, particularly when dealing with potential endogeneity issues. This function comes from Lal et al. (2024) and is partly inspired by Rueda (2017). Endogeneity arises when some explanatory variables are correlated with the error term, which can lead to biased estimates in ordinary least squares (OLS) regression. The `ivdiag` function conducts a series of diagnostic checks on IV models to evaluate the validity and relevance of the instruments used. These diagnostics include tests for weak instruments, which occur when the instruments have a weak correlation with the endogenous regressor, and over-identification tests, which assess whether the number of instruments exceeds the number of endogenous variables, thereby ensuring that the instruments do not introduce bias into the model (Olea and Pflueger (2013) and Chernozhukov and Hansen (2008)). Additionally, `ivdiag` tests for instrument exogeneity, confirming that the instruments are uncorrelated with the error term in the structural equation (Lee et al. (2022)).

In the context of this research on federalism and conflict dynamics, the use of IV methods is crucial for addressing endogeneity concerns in the relationship between fiscal autonomy and conflict. Many of the factors influencing conflict intensity, such as fiscal policies or decentralization measures, may be endogenous, complicating causal

inference. By utilizing appropriate instruments, such as political fragmentation for example, these endogeneity concerns can be mitigated. The `ivdiag` function helps to validate the strength and relevance of these instruments, ensuring that the results are not compromised by weak or invalid instruments. This diagnostic process is vital for ensuring the credibility of the analysis and drawing robust conclusions regarding the impact of federal structures and fiscal policies on conflict dynamics in Indian states.

The results of the `ivdiag` test confirm the validity of my instrument. The graph D.1 available in the Appendix sections summarizes the fact that the adjusted results are close to those obtained previously with our instruments. This confirms the robustness and validity of our results.

2.6 Spatial analysis

Spatial modeling approach

To ensure that our results are robust, we must consider the fact that conflicts and their determinants, such as armed groups' activities, often exhibit spatial interdependence across regions. An increase in state autonomy in State i could influence the intensity of conflict in neighboring states, either directly through spillover mechanisms or indirectly by altering the strategic calculations of armed groups. For example, greater autonomy in one state may encourage armed groups in contiguous areas to reduce their demands or redistribute their efforts, leading to a spatial reallocation of conflict intensity. Considering spatial effects is therefore indispensable when analyzing the relationship between federalism and conflicts (Mainali et al. (2022)). Conflict dynamics are rarely confined within administrative boundaries, and neighboring regions often share economic, political, and cultural linkages that amplify interdependencies. These connections can manifest as shared grievances, cross-border recruitment, or the spillover of violence. Additionally, policy measures implemented by one state to address conflict may inadvertently affect neighboring states, either by diffusing violence or by altering incentives for armed groups in the region. Ignoring these spatial dependencies could bias the analysis, underestimating the broader effects of federalism and state-level policies on regional stability. The graphs E.1a and E.1b in the appendix section show a significant concentration of conflict intensity in specific states, and more generally in the eastern states. This observation raises concerns about the potential spatial effects of these conflicts (in 2019). To address these concerns, we combine two complementary spatial econometric approaches: the Spatial Error Model (SEM) and the Spatial Autoregressive Model (SAR). The SEM explicitly incorporates spatial autocorrelation in the error terms, which is especially useful when unobserved

factors—such as regional governance quality or historical grievances—affect conflict intensity and are spatially correlated. The SEM framework corrects for these hidden influences, isolating the effect of observed variables such as autonomy and decentralization. The SAR model, in contrast, assumes that conflict intensity itself is spatially autocorrelated—that is, that outcomes in one region directly influence outcomes in neighboring ones. This is appropriate when behaviors, institutions, or shocks diffuse across borders through imitation, contagion, or coordination. By employing both models, we capture distinct but complementary spatial mechanisms: outcome-driven spillovers across neighboring units (SAR), and structural spatial dependence due to unobserved contextual factors (SEM). This dual strategy improves the robustness of our findings and avoids conflating direct causal effects with spatial dependencies. In the sections that follow, we detail the specification and estimation of each model and interpret their respective results. We formally specified below the econometric models to assess.

Spatial Error Model (SEM) The SEM captures spatial correlation in the error term and is specified as follows:

$$Y_{it} = X_{it}\beta + u_{it}, \quad u_{it} = \lambda W u_{it} + \epsilon_{it} \tag{2.6}$$

where Y_{it} denotes the intensity of conflict in state i at time t, X_{it} is a matrix of explanatory variables (including autonomy, decentralization, and controls), β is a vector of parameters, W is the spatial weights matrix, λ is the spatial error coefficient, and ϵ_{it} is an i.i.d. error term.

Spatial Autoregressive Model (SAR) The SAR accounts for spatial dependence in the dependent variable:

$$Y_{it} = \rho W Y_{it} + X_{it}\beta + \epsilon_{it} \tag{2.7}$$

Here, ρ captures the strength of spatial spillovers, with WY_{it} representing the spatially lagged dependent variable. As before, X_{it} includes autonomy, decentralization, and relevant controls, and ϵ_{it} is the disturbance term.

These specifications provide two complementary lenses on spatial dynamics: the SEM corrects for omitted spatially correlated influences, while the SAR identifies how conflict levels propagate across space.

Results

The results of the spatial analysis are available in appendix section and provide an interesting perspectives on the relationship between federalism and conflicts. Indeed, the results highlight the impact of autonomy on three distinct outcomes within a spatial error model framework, providing insights into the relationship between autonomy and various socio-economic indicators. The coefficient for autonomy is statistically significant in two of the three models, with magnitudes of -0.0148 and 0.0053, suggesting that autonomy has a negative association in one context and a positive association in another (by considering spatial model). This variation indicates that the effect of autonomy may depend on the specific outcome being examined. The coefficient Lambda in the Spatial Error Model (SEM) represents the spatial dependence of intensity in different types of conflicts. A negative and statistically significant Lambda across all models indicates that the intensity of conflict in one region is negatively correlated with the intensity in neighboring regions. This suggests that when one region experiences a high intensity of conflict, surrounding regions tend to have lower levels of conflict intensity. One possible explanation for this is that conflicts may be concentrated in certain areas due to regional dynamics such as political instability, competition for resources, or governance issues (Siegle and O'Mahony (2006)), which could reduce the likelihood of conflict in neighboring regions. Additionally, the presence of ethnic or armed groups that operate across borders may explain these spatial patterns. These groups could be incentivized to attack in one region due to geographical or economic factors, such as access to resources, strategic positioning, or political vulnerabilities, while neighboring regions might be spared if they offer less incentive or resistance. For example, regions with greater autonomy might be able to address underlying issues like resource allocation or political grievances, potentially reducing conflict intensity locally but possibly exacerbating tensions in nearby regions. The spatial dependence of conflict intensity highlights the interconnectedness of regions and suggests that conflicts do not occur in isolation, but rather spill over or influence one another across borders. Understanding these spatial patterns is crucial for designing policies that aim to reduce conflict in one region without inadvertently increasing it in neighboring areas.

The SAR model estimations provide a more granular view of how autonomy and decentralization influence different types of conflict. The table below reports the estimated coefficients and standard errors for the variables of interest—autonomy, decentralization (measured as spending autonomy), and their spatial lag counterparts—across the three conflict types. The results reveal important spatial dynamics in the relationship between federalism and conflict. In *creation*-related conflicts, both

autonomy and its spatial lag are statistically significant and positive, while spending autonomy at the local level is not significant, and its spatial lag is negative and highly significant. These findings suggest a complex pattern: higher local autonomy may raise demands for statehood, while increased spending autonomy in neighboring states might discourage such claims by making devolution short of full statehood appear viable. This stands in partial contrast to the IV results, where autonomy showed no significant effect and spending autonomy (decentralization) had a positive and significant relationship with creation-related conflict. The SAR model thus suggests that the local effect of spending autonomy may be overstated in models that ignore spatial spillovers. In fact, the spatial lag of spending autonomy has a strong negative association with state creation conflict, indicating that institutional reform in one region can deflate parallel demands elsewhere. In *secessionist* conflicts, the SAR results show no significant direct effects for autonomy or spending autonomy, but again the spatial lag of spending autonomy is negative and significant. This suggests a regional deterrent effect: when nearby states are empowered fiscally, it may reduce incentives to escalate secessionist claims locally. One possible explanation is that fiscal decentralization in neighboring states signals the viability of peaceful institutional accommodation, leading minority groups to reconsider violent strategies and engage instead through political channels. In such a context, subnational elites or marginalized ethnic groups observing successful reforms elsewhere may shift from confrontation to negotiation, entering the institutional game with expectations of achieving meaningful concessions over time. This adjustment in strategy helps deescalate conflict intensity by framing decentralization not as a zero-sum demand, but as a step toward inclusion. These dynamics align with theories of endogenous conflict resolution, where groups internalize the potential rewards of institutional integration when the system appears increasingly responsive and representative. More broadly, this pattern supports the idea that fiscal reforms in one state send institutional signals across borders. These signals can reshape the perceived payoffs of conflict versus cooperation, especially in federal systems where regional coordination, political imitation, and elite bargaining are frequent. The effectiveness of decentralization therefore transcends local boundaries and functions as a regional public good in conflict management. Furthermore, the presence of trans-state ethnic or armed networks may amplify these spatial effects. Armed groups or regional coalitions operating across multiple territories might respond to reforms in one area by reducing activities in another, reallocating strategic efforts based on relative political opportunity structures. In this way, institutional developments in one state can lead to a reconfiguration of conflict geography, redistributing contestation away from regions where reform is perceived as viable. Turning to fiscal autonomy (autonomy), the positive coefficient for

creation-related conflict indicates that when states possess more discretion over their own revenues, they may also develop stronger institutional capacities and ambitions. This can embolden regional elites to push for full statehood as a means to consolidate power and access federal transfers more directly. Conversely, the negative spatial lag of autonomy suggests that when neighboring states hold greater fiscal autonomy, the local pressure for state creation diminishes, possibly because the central government is perceived as more flexible or responsive across the federation. This apparent contradiction between the SAR and IV results can be interpreted econometrically. IV estimates capture an average treatment effect of local decentralization on conflict, assuming spatial independence. In contrast, the SAR explicitly models interdependence in outcomes, revealing how reforms in one location shape outcomes in another. When spatial dynamics are omitted, as in IV, conflict responses may appear stronger because they fail to account for offsetting effects in neighboring units. The SAR highlights that some of the conflict-mitigating effects of fiscal autonomy might be externalized. Overall, the SAR results qualify and refine the IV findings. While IV regressions pointed to a conflict-dampening role of spending autonomy, the SAR model reveals that such effects may be primarily external rather than internal to the reforming state. These findings emphasize the importance of spatially aware policymaking: institutional reforms may influence conflict patterns beyond the territories where they are enacted. Our SAR results also suggest that these effects are not uniformly local. Instead, decentralization generates regional externalities that can either deter or inspire demands in neighboring jurisdictions. Federalism thus functions as both a conflict management mechanism and a policy tool for regional integration. The SAR results underscore the importance of designing decentralization policies that account not only for intra-state equity and representation, but also for their inter-state effects. Ignoring these spatial linkages would underestimate both the risks and the benefits of fiscal and institutional reform.

2.7 Conclusion

This paper has examined how fiscal autonomy shapes the intensity of different types of conflicts—specifically secessionist violence, demands for new state creation, and disputes over natural resources—using a panel of Indian states from 1991 to 2020. Combining a Two-Stage Least Squares estimation with a spatial perspective, we have captured not only the direct impact of autonomy within states but also the broader regional context in which these dynamics unfold.

Our results show that greater autonomy (in spending and revenues) tends to reduce conflicts driven by secessionist claims and natural resource management, suggesting

that when states have more control over their own finances, they are better equipped to address local grievances and manage competition over resources. However, we also find that increased autonomy is associated with a rise in demand for state creation, indicating that while decentralization can defuse some forms of unrest, it may simultaneously encourage new claims for political recognition and administrative separation. These findings highlight that the effects of fiscal federalism are not uniform and depend on the type of conflict at stake. They confirm that local autonomy can help contain certain tensions by bringing decision-making closer to local needs but can also generate new pressures if it fuels aspirations for further fragmentation. Moreover, the analysis underlines the importance of considering interregional dynamics: what happens in one state (whether more autonomy is granted or not) can send signals and shape incentives in neighboring areas.

Taken together, this work suggests that federalism should not be seen as a one-size-fits-all solution for managing conflict. Its stabilizing potential depends on how it is designed, balanced, and coordinated across regions. For policymakers, this means that empowering local governments can help address local demands and reduce violence linked to secession and resource struggles, but it should go hand in hand with safeguards to manage emerging claims for new administrative divisions and ensure that regional cooperation prevents fragmentation.

In short, well-calibrated fiscal autonomy can contribute to stability, but its impact reaches beyond state borders. Understanding these spillovers is key for designing federal systems that balance local empowerment with cohesion and long-term peace.

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Appendices

Appendix A

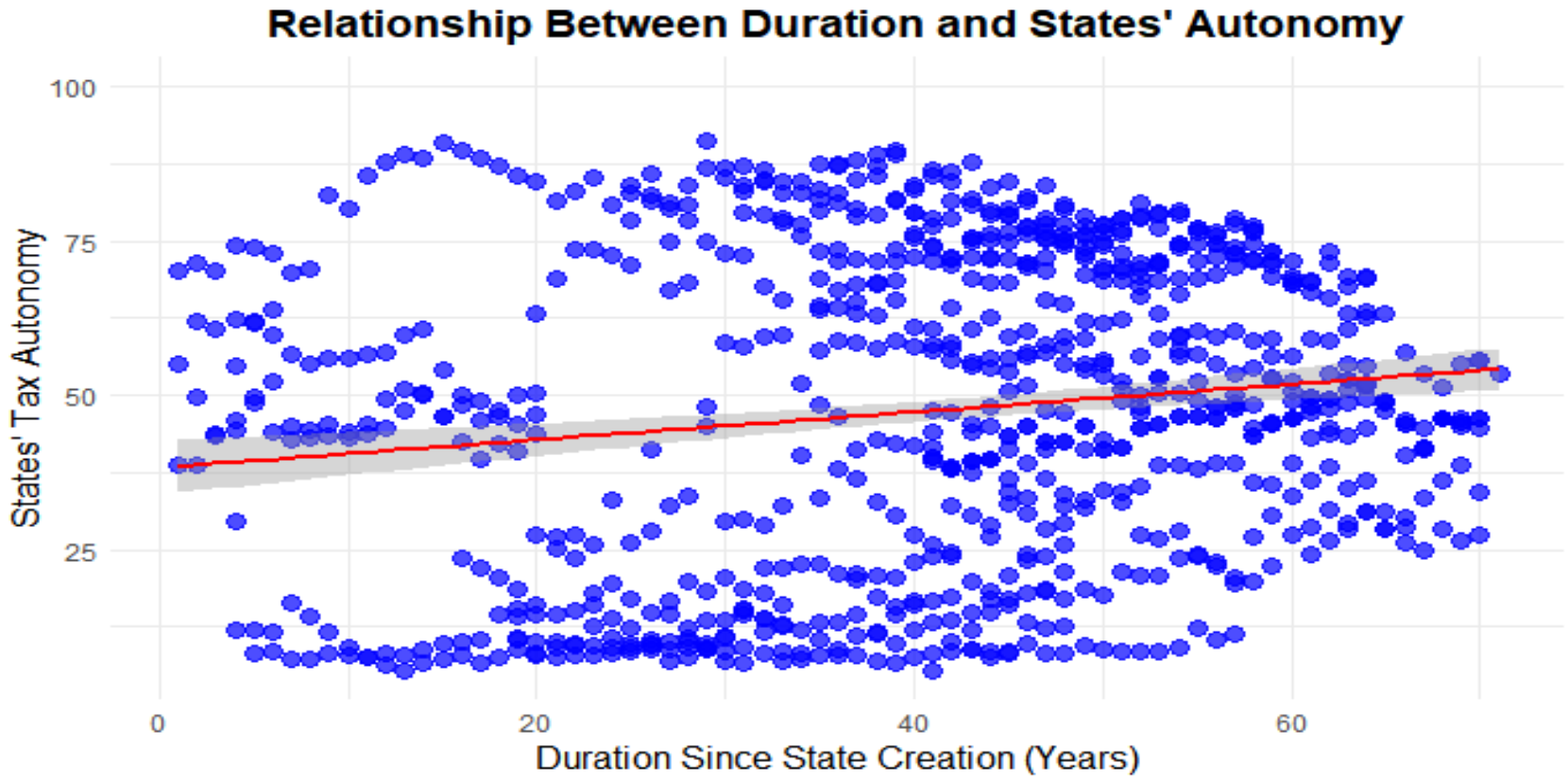


Figure .1: Correlation between tax autonomy and duration

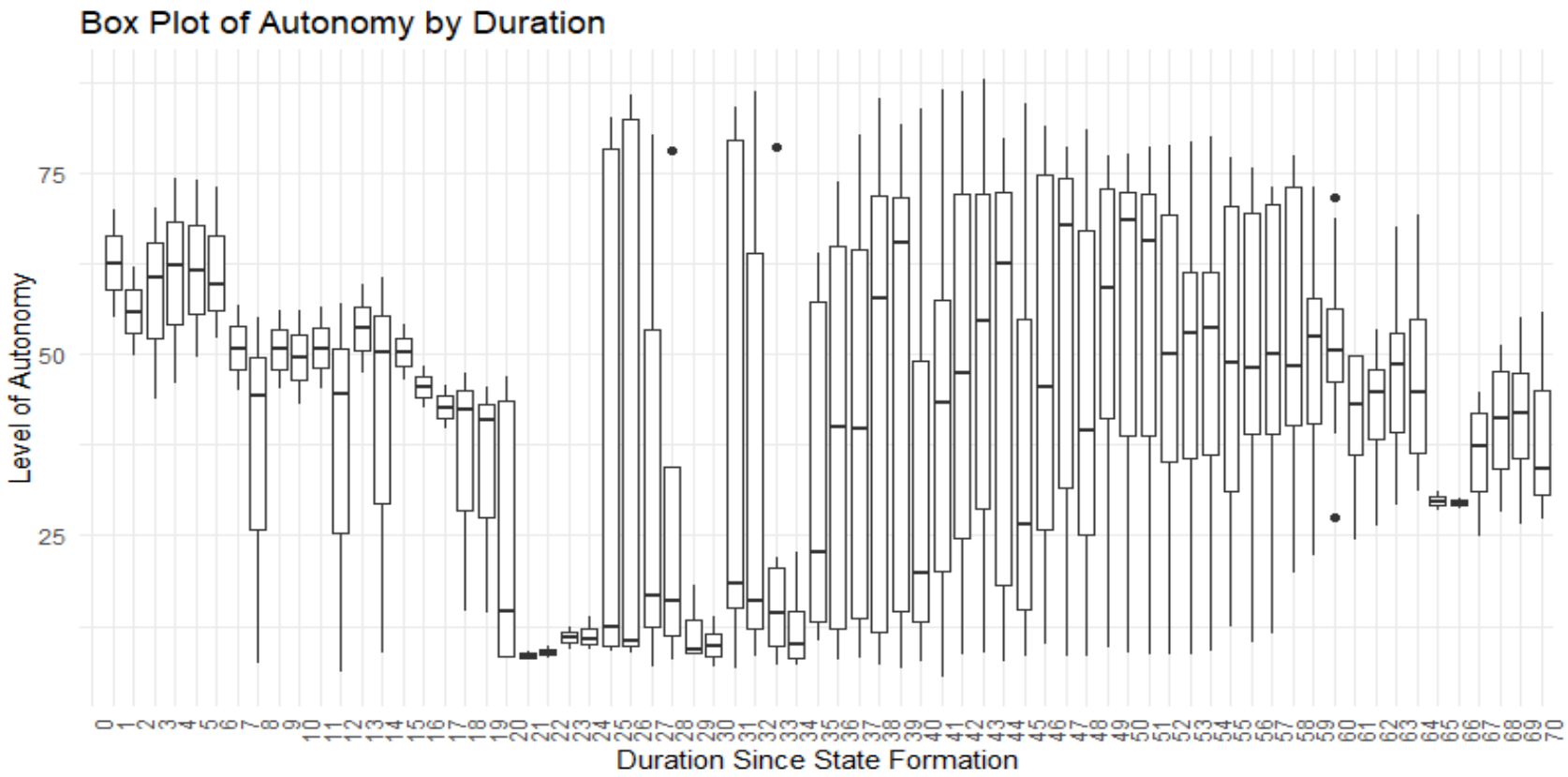


Figure .2: Relation between tax autonomy and duration

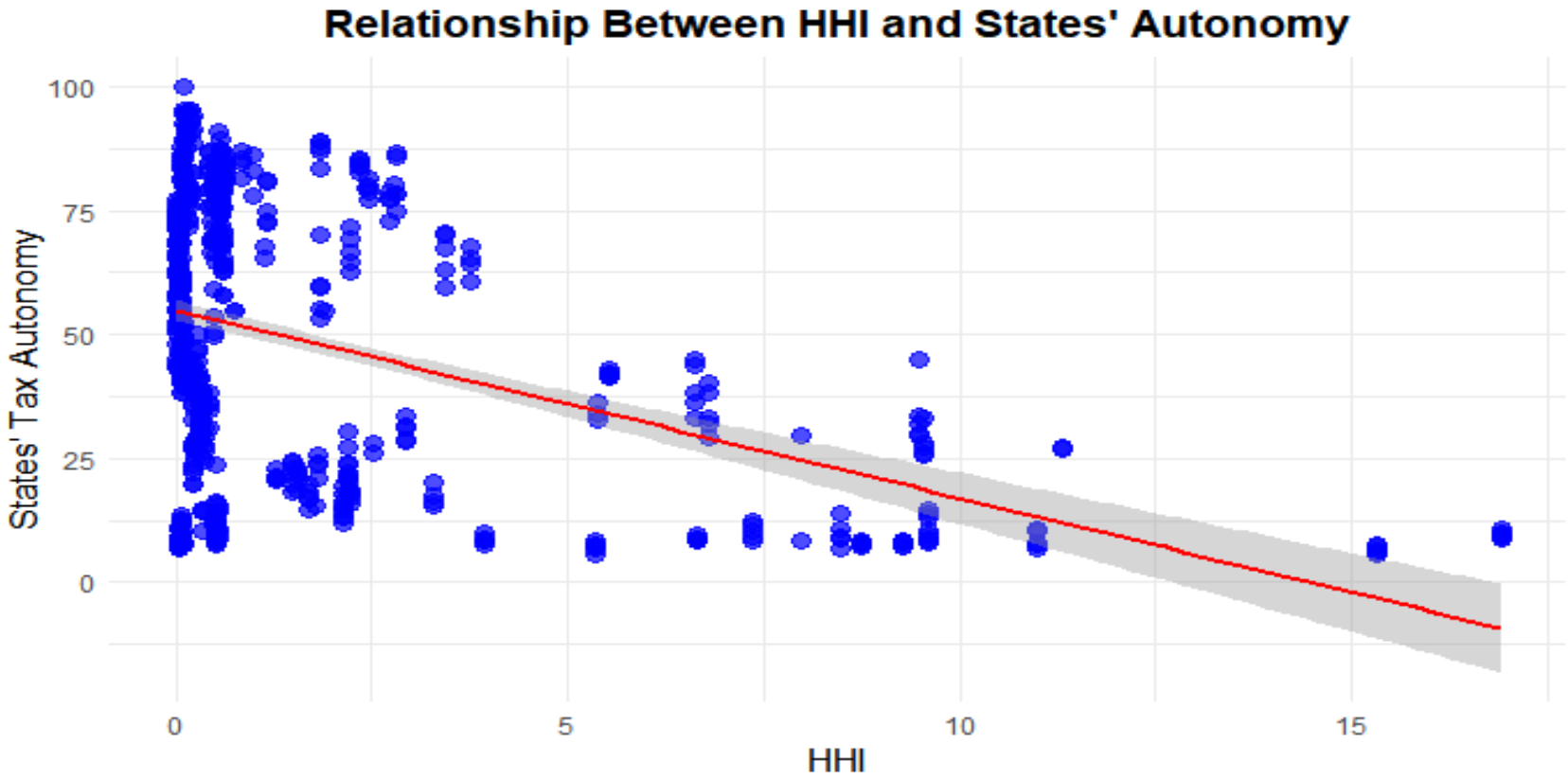


Figure .3: Relation between tax autonomy and political fragmentation

	Secession	Natural	Creation
Autonomy	-0.0001	-0.018	0.003
	(0.005)	(0.018)	(0.002)
Spending Autonomy	-0.002	-0.511	0.010
	(0.130)	(0.608)	(0.008)
Observations	508	508	508

Table .4: Summary of OLS Results

Appendix B

A 2SLS Results

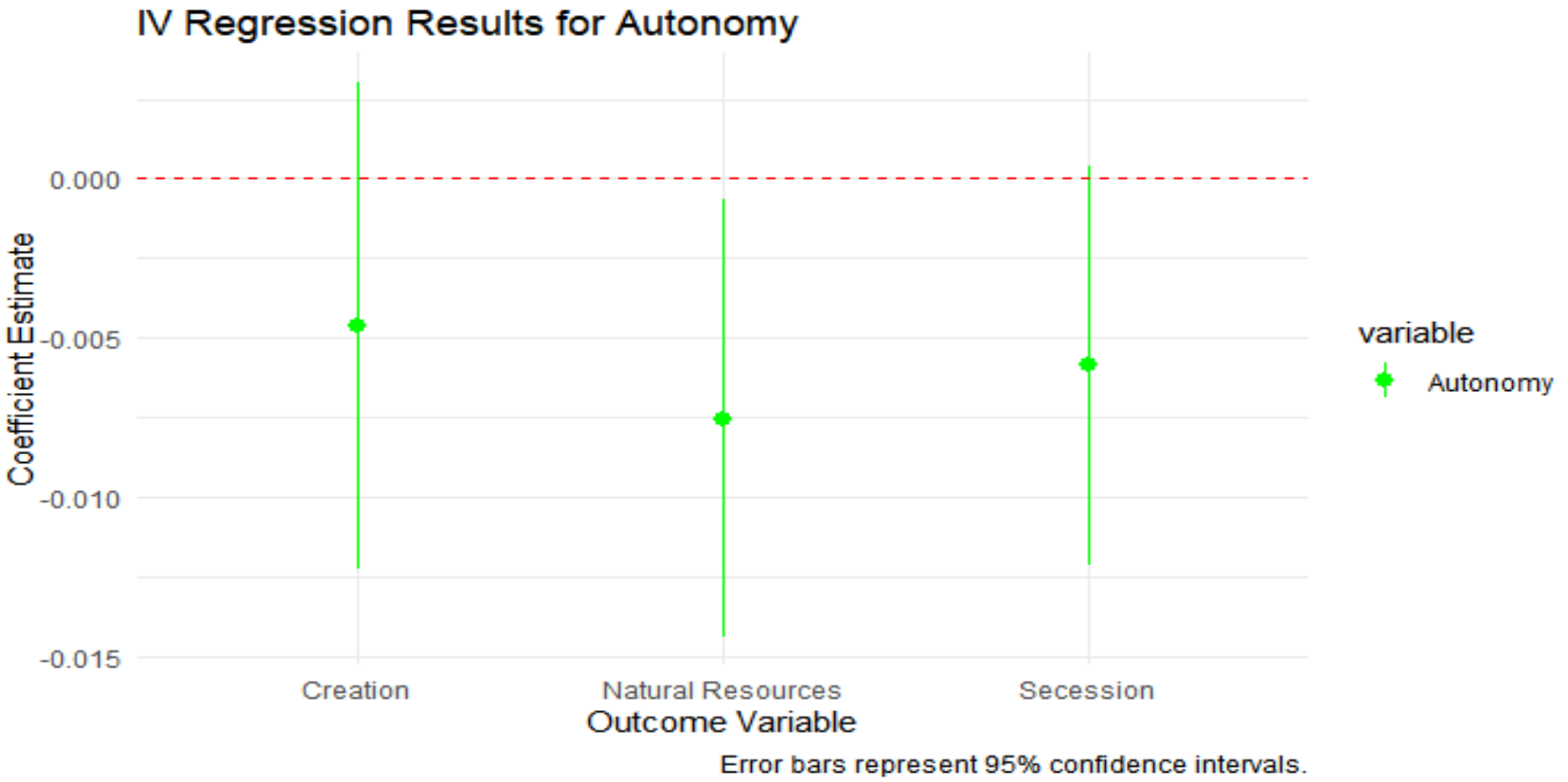


Figure A.1: Results for autonomy

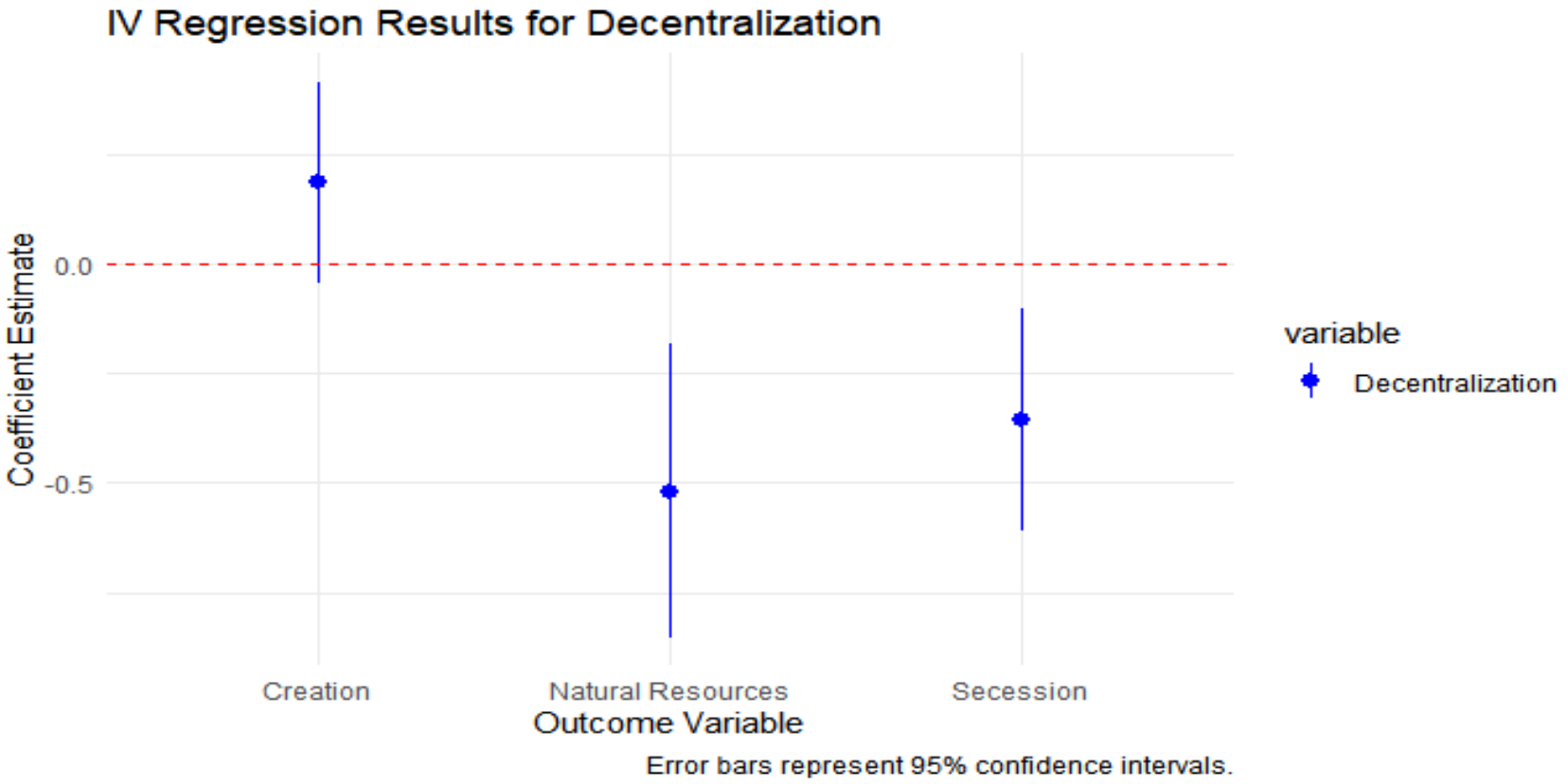


Figure A.2: Results for decentralization

B Occurences results

Table B.1: Results for autonomy effects on occurences

	Dependent variable:		
	secession	*creation*	*natural*
	(1)	(2)	(3)
autonomy	-0.007^{***}	-0.005	-0.010^{***}
	(0.003)	(0.004)	(0.004)
Observations	361	361	361
R^2	0.154	0.273	0.069
Adjusted R^2	0.137	0.259	0.051
Residual Std. Error	0.829 (df = 353)	1.121 (df = 353)	1.060 (df = 353)

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table B.2: Results for autonomy effects on occurences

	Dependent variable:		
	secession	*creation*	*natural*
	(1)	(2)	(3)
decentralization	-0.416^{***}	0.198^{*}	-0.596^{***}
	(0.137)	(0.119)	(0.189)
Observations	361	361	361
R^2	-2.443	-0.218	-3.419
Adjusted R^2	-2.501	-0.238	-3.494
Residual Std. Error	1.669 (df = 354)	1.448 (df = 354)	2.307 (df = 354)

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

C Placebo results

Table C.1: Placebo results for autonomy

	Dependent variable:		
	random_session	random_creation	random_natural
	(1)	(2)	(3)
Autonomy	0.011	−0.004	−0.003
	(0.005)	(0.005)	(0.004)
Constant	−34.990	291.461**	−51.848
	(143.182)	(129.179)	(127.995)
Observations	508	508	508
R2	0.021	0.025	0.010
Adjusted R2	0.012	0.013	0.002

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table C.2: Placebo results for expenditures

	Dependent variable:		
	random_session	random_creation	random_natural
	(1)	(2)	(3)
Decentralization	0.133	−0.017	−0.086
	(0.088)	(0.077)	(0.078)
Constant	118.064	274.397*	−154.088
	(184.371)	(159.871)	(162.153)
Observations	508	508	508
R2	0.109	0.022	0.053
Adjusted R2	0.096	0.010	0.041

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

D IV Diagnostic

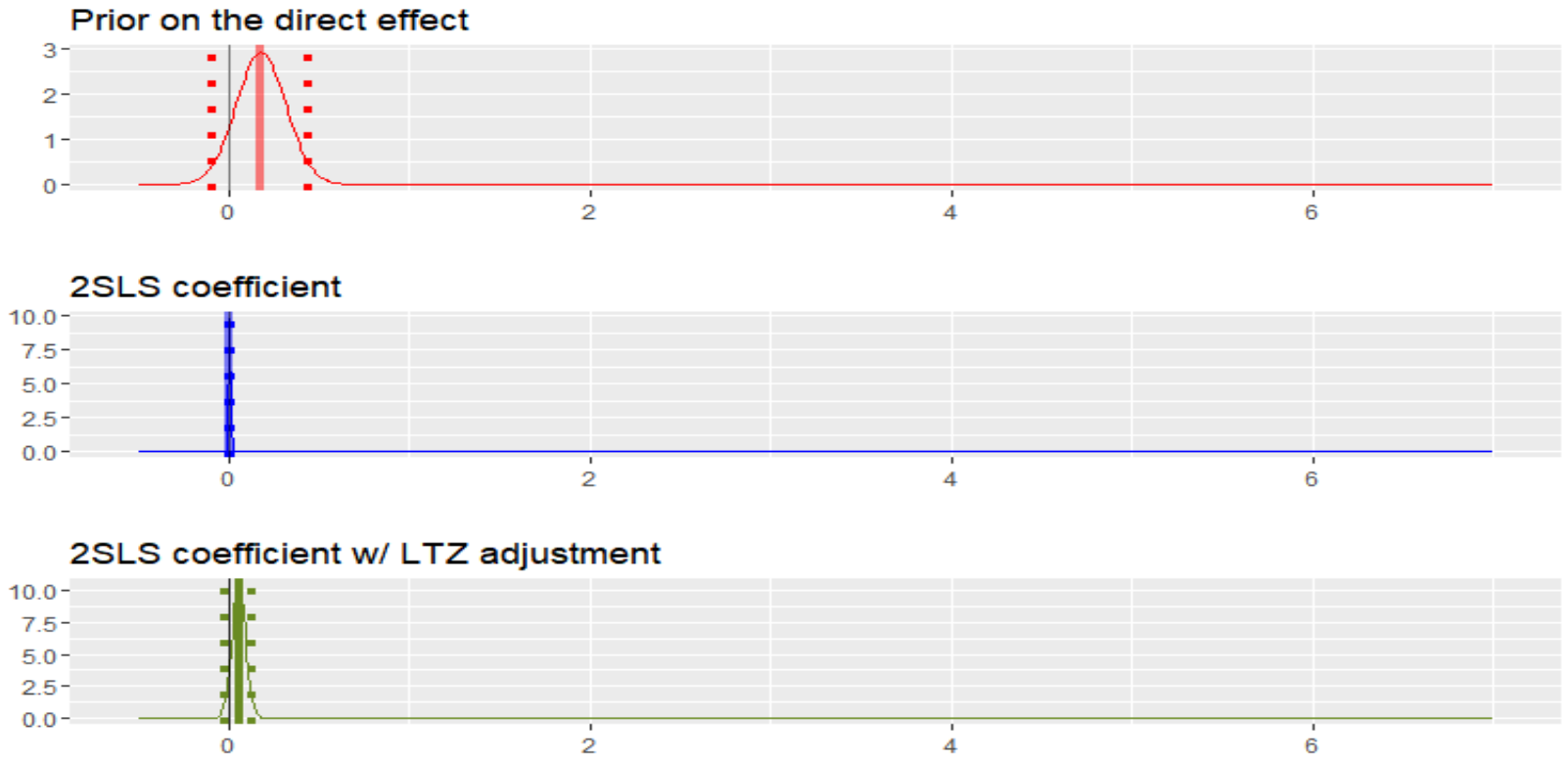
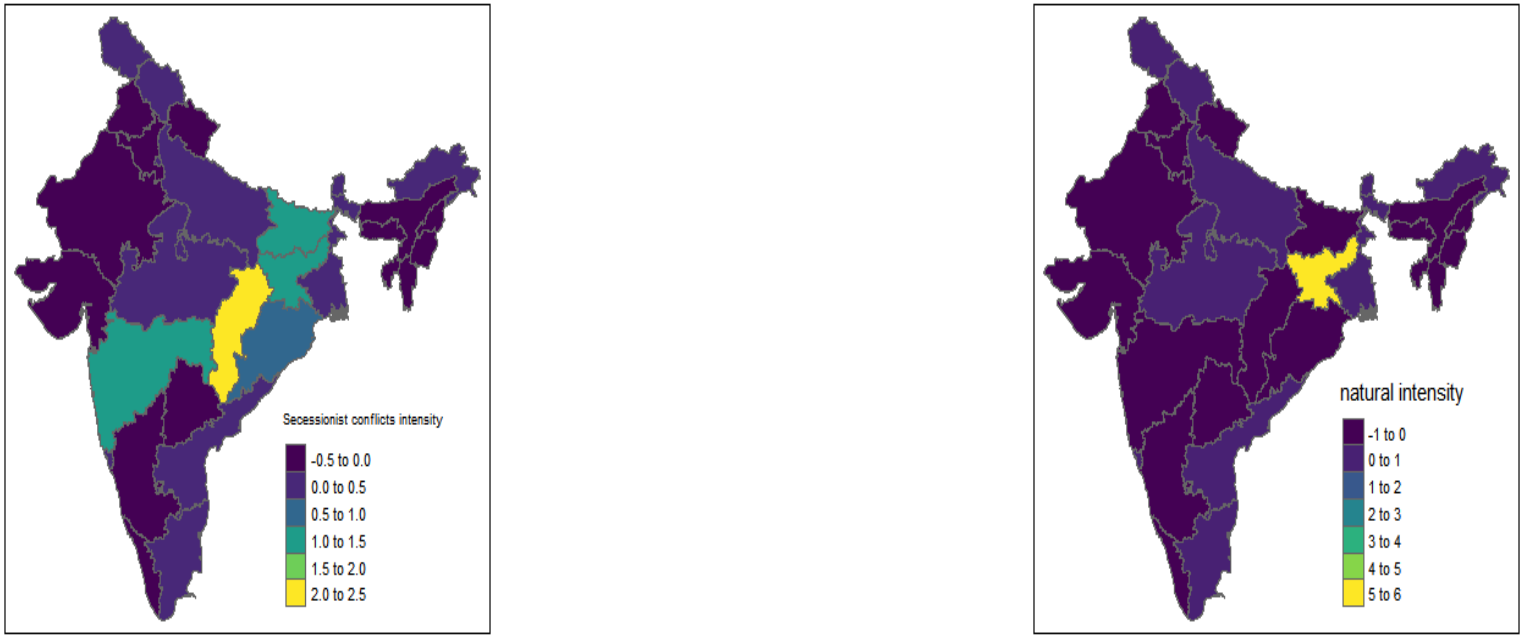


Figure D.1: IV Adjustment

E Spatial analysis



(a) Secessionist conflicts intensity

(b) Natural resources conflicts intensity

Figure E.1: Comparison of conflict intensities by type in 2019

	Secession	**Creation**	**Natural**
Autonomy	0.00059	-0.0148***	0.0053***
	(0.00087)	(0.00073)	(0.00079)
Lambda	-1.8321*	-4.2717***	-2.9496**
	(0.7067)	(0.1342)	(0.5302)
Observations	668	668	668
AIC	1493.9	1632.7	1564
Log Likelihood	-738.97	-808.36	-774.01

Table E.1: Summary of Spatial Error Model Results with autonomy

	Secession	Creation	Natural
Decentralization	-0.00017	-0.0198***	-0.00173
	(0.00562)	(0.00704)	(0.00645)
Lambda	-1.6232**	-0.4896**	0.3339
	(0.7306)	(0.6595)	(0.3971)
Log Likelihood	-985.35	-1116.67	-1001.83
AIC	1986.7	2249.3	2019.7
Observations	668	668	668

Table E.2: Summary of Spatial Error Model Results with spending

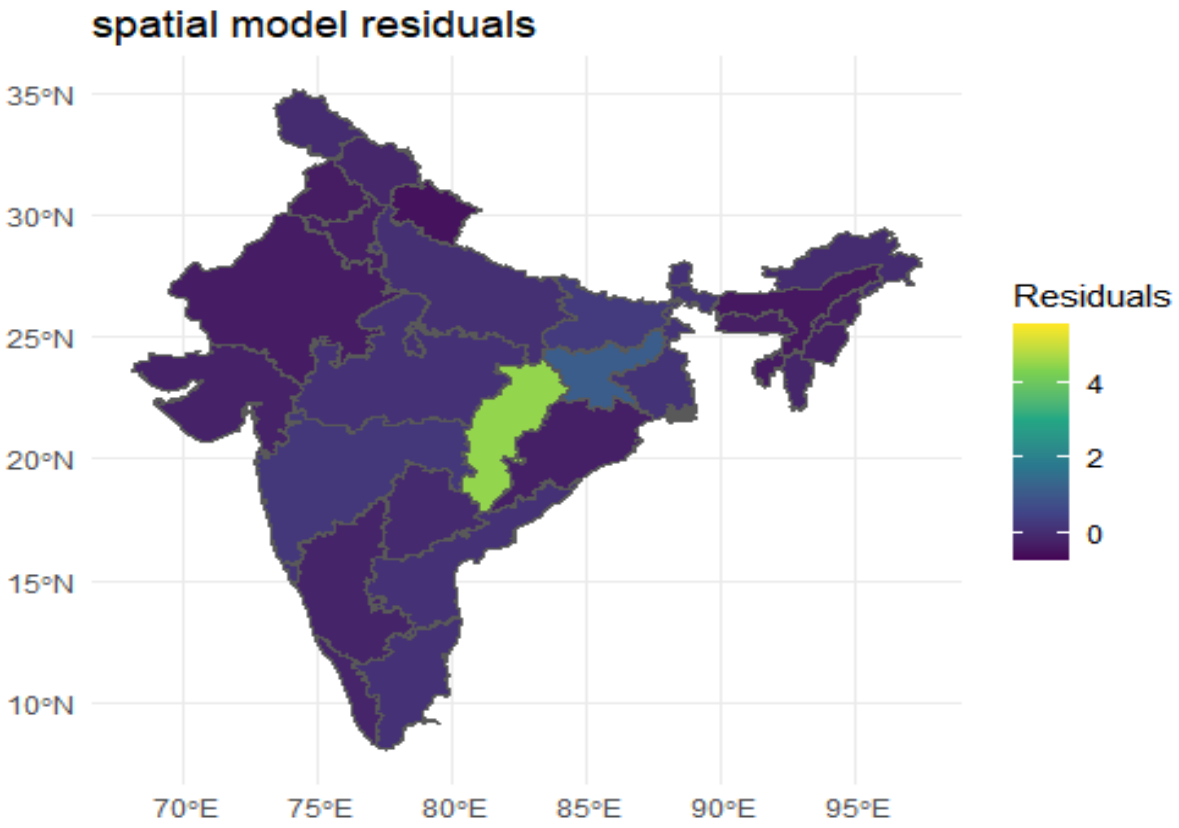


Figure E.2: Residuals from SEM

	Secession	Creation	Natural
Autonomy	0.00236	0.00801***	0.00008
	(0.00166)	(0.00184)	(0.00170)
Autonomy (neigh.)	-0.00820**	-0.05131***	-0.00245
	(0.00407)	(0.00684)	(0.00412)
Spending Autonomy	0.00840	0.00057	0.00021
	(0.00648)	(0.00739)	(0.00662)
Spending Aut. (neigh.)	-0.09681**	-0.43274***	-0.04394
	(0.04188)	(0.07746)	(0.03995)
Log Likelihood	-978.5	-1073.7	-1000.6
AIC	1977.1	2167.4	2021.1
Observations	887	887	887

Table E.3: Summary of Spatial Autoregressive Model Results

Chapter 3

Federalism and women empowerment in India

This paper examines the effect of fiscal autonomy on women's empowerment in Indian states. Using two-stage least squares with political factors, including partisan affiliation, as instruments, the analysis shows that greater fiscal autonomy raises women's Human Development Index (HDI) while reducing gender inequality, measured by the female-to-male HDI ratio and the Gender Development Index (GDI). The results suggest that fiscal decentralization expands women's access to education, health, and economic opportunities. However, men remain the primary beneficiaries of these policies, highlighting persistent asymmetries in how federal arrangements translate into empowerment.

3.1 Introduction

Federalism serves to bring rulers closer to citizens. It allows people to more easily express their needs and preferences for public services such as schools, roads, or hospitals. In theory, this should make government action more responsive and efficient by tailoring policies to local conditions (Besley and Coate (2003), Grossman et al. (2017), Heller et al. (2007), Mitchell and Bossert (2010),Ghuman and Singh (2013), Kis-Katos and Sjahrir (2013), Joshi (2006), Caldeira and Rota-Graziosi (2014) and Mehrotra (2006)). However, federalism can also deepen inequalities between regions and within regions. On the one hand, wealthier regions benefit from a larger and stronger tax base, which enables them to deliver better-quality public services compared to poorer regions (Sacchi and Salotti (2014), İrepoğlu Carreras (2016)). This fiscal imbalance can perpetuate territorial inequalities and limit convergence across regions, especially when there are no strong equalization mechanisms. On the other hand, within a single region, federalism can amplify social and economic disparities if local elites capture the decision-making process. Those who hold greater electoral power—such as dominant ethnic groups, influential families, or male-dominated elites—are often better positioned to influence how resources are distributed and how local policies are designed (Fisman and Gatti (2002), Albornoz and Cabrales (2013)). This capture effect means that marginalized communities may remain excluded from the benefits of decentralization. In contexts with significant gender inequality, this dynamic is especially relevant. If women have limited voice or representation in local politics, federalism can reproduce or even strengthen gender gaps. For example, local leaders may prioritize spending that aligns with the interests of dominant groups, neglecting investments that could improve women's access to education, healthcare, or economic opportunities. Therefore, while federalism can enhance participation and local accountability, it can also entrench unequal power structures if checks and safeguards for gender rights are weak. Understanding these competing effects is key to knowing whether bringing government closer truly reduces gender gaps or reinforces them. Most studies on women's rights and gender equality in developing countries focus on very local levels—districts, villages, or small communities—without examining how federal structures shape gender outcomes at scale. This means research often looks at women leading a village, gender quotas, or local empowerment impacts on households (Angrist (2002), Duflo (2012), Mehra (1997), Chiappori et al. (2002), Miller (2008), Barnes and Córdova (2016), Siahaan (2003), Tan (2016), Heller et al. (2007), Bruhn (2003)). While this local evidence is useful, it does not show whether federalism itself closes or widens gender gaps nationally. In developed countries like the United States, Spain, or the United Kingdom, research shows how federal or de-

volved systems allow local governments to test new policies and compete, which can help or harm women's rights depending on institutions and politics (Francis and Francis (2011), Lemke (2016), Shaw and Stein (2016), Weeks (2018), Kenny and Verge (2012)). This raises the core question of this paper: can federalism, by bringing rulers closer to citizens, also worsen gender inequality when dominant groups capture power? This remains understudied. This research focuses on India—a federal country with high gender inequality (123 out of 189 countries in the UNDP Gender Inequality Index and 140 out of 156 countries in the Global Gender Gap Index; United Nations in India (2022), Dehingia et al. (2023)). It brings a new perspective by analyzing how federal structures shape gender gaps at the state level, showing how local choices can sometimes reinforce, rather than reduce, inequalities. To answer this question, the paper uses a two-stage least squares (2SLS) approach with instrumental variables. The instruments are the time since a state's creation and the timing of the Financial Commissions—federal budget commissions. These shocks, which are independent of the states' own actions, affect only their resource levels, with no direct effect on gender inequality. The analysis uses the gender-specific Human Development Index (HDI) and an HDI ratio to assess women's relative progress compared to men. The results show that greater state autonomy improves women's access to education and health but that women still lag behind men. As expected, federalism, without targeted measures, tends to deepen existing divides—including gender inequality. The rest of the paper is structured as follows: Section 2 presents the conceptual framework and the Indian context. Section 3 describes the empirical strategy, data, and main results. Section 4 reports robustness checks that address gender differences. Section 5 concludes.

3.2 Conceptual framework

India's federal system is one of the largest and most complex in the world, designed to govern a vast and diverse population spread across states with wide differences in culture, language, wealth, and social norms. The Constitution grants significant powers to states to manage their own budgets, design policies, and deliver essential services such as education, health, and welfare. This decentralized structure allows local governments to adapt policies to local needs and preferences, which is especially important in a country as diverse as India. However, India also faces persistent and deep gender inequalities. Despite progress in laws and development indicators, women's access to education, healthcare, and economic opportunities remains far behind that of men in many states (Varughese and Bairagya (2020) and Jose and Sivaraman (2023)). Local norms, political representation, and budget priorities could

play a key role in shaping these gaps. Because states control large parts of spending and policy implementation, the way power and resources are distributed across states can directly influence women's everyday lives. Studying the Indian federal context is therefore highly relevant for understanding how decentralization can shape gender equality. If local leaders use their powers to expand women's rights and improve access to services that benefit women—such as schools for girls or maternal health programs—federalism can be a tool for progress. But if political power remains concentrated in dominant groups with little interest in gender equity, decentralization risks reinforcing the very inequalities it could help reduce. This makes India a critical setting to test whether bringing government closer to people really helps narrow gender gaps—or whether, without strong safeguards, it can also reproduce or deepen them. To shed light on this, it is useful to draw on a clear theoretical framework that explains how federalism can shape gender outcomes through local power dynamics, resource distribution, and the influence of social norms.

We develop a simple theoretical model to explain how federalism—defined as the combination of political and fiscal decentralization—may structurally favor men over women in the allocation of public resources, even if women benefit indirectly. The model builds on the idea that fiscal autonomy increases the capacity of subnational governments to respond to local preferences. However, when political power is unevenly distributed and men dominate local decision-making structures, this autonomy tends to reinforce existing gender biases. In the Indian context, this is particularly salient: men overwhelmingly occupy leadership positions in state legislatures and local councils, while gender budgeting remains limited in both scope and enforcement across most states.

Let R be the total revenue available to a state government. It consists of two components: central transfers T, and own-source revenues ψ, which represent the state's fiscal autonomy. Thus,

$$R = T + \psi.$$

This revenue is allocated between two categories of public goods. The first, G_H, includes goods and services that primarily reflect male preferences and interests, such as roads, irrigation, electricity for productive uses, and security infrastructure. The second, G_F, includes goods that directly benefit women's well-being and autonomy, such as maternal health programs, crèches, sanitation, and protection against gender-based violence. We assume that the state allocates a share $\lambda \in [0, 1]$ of its budget to G_H, and the remaining share $1 - \lambda$ to G_F, so that:

$$G_H = \lambda R, \qquad G_F = (1 - \lambda)R.$$

The share λ is not fixed: it reflects the relative influence of male versus female actors in the political process. Let $\theta \in [0, 1]$ denote the political influence of women at the state level, proxied by their share in legislative assemblies, their presence in executive positions, or their ability to shape the budget process. We assume that the gender allocation bias is increasing in male dominance and write:

$$\lambda = \lambda_0 + \delta(1 - \theta),$$

where λ_0 is the baseline allocation share in a gender-neutral setting, and $\delta > 0$ captures the extent of male bias in the absence of female political influence. When θ is low, allocation favors male-oriented goods; when θ is high, the bias is reduced, and the allocation becomes more balanced.

We are particularly interested in the marginal impact of increased fiscal autonomy on gendered spending. Taking the derivative of each category of spending with respect to ψ, We got:

$$\frac{dG_H}{d\psi} = \lambda, \qquad \frac{dG_F}{d\psi} = 1 - \lambda.$$

An increase in fiscal autonomy when θ is low, disproportionately increases spending on male-oriented goods. This result implies that although women benefit from greater public spending in a general sense, they are structurally disadvantaged when the budget expands under conditions of gender-unequal political power. Their needs are not ignored but are addressed only insofar as they overlap with or are subordinate to male priorities.

In India, where female political representation remains limited across most states and own-source revenue capacities have expanded (especially following the 14th Finance Commission), this mechanism is highly relevant. For example, increased untied revenue has often translated into infrastructure investment focused on male-dominated agricultural production, with little expansion in social care services or programs aimed at women's safety and mobility. Unless women's political voice is institutionally strengthened or gender-responsive budgeting is systematically imposed, fiscal federalism may reproduce or deepen gender inequalities in public goods provision.

This framework clarifies why women could not be entirely excluded from the benefits of federalism but continue to be secondary beneficiaries in a structure that is implicitly designed around male preferences and political agency. Increasing female political influence and making fiscal transfers conditional on gender-sensitive outcomes could be a useful policy levers for more equitable public spending.

3.3 Empirical Approach

3.3.1 Data

This study relies on an original combination of datasets that provide detailed and complementary information essential for understanding the links between fiscal federalism and gender inequality in India. The core economic and fiscal data come from the Reserve Bank of India (RBI), which offers a uniquely detailed and reliable account of the fiscal position and economic performance of each Indian State and Union Territory. The RBI's disaggregated statistics on revenues allow for precise measurement of revenue autonomy, which is central to this analysis of fiscal federalism. These data have been used for example by Rao (2002) and Sinha (2004).

Political variables, such as the share of women in local parliaments, are drawn from official electoral data provided by the Election Commission of India, ensuring accurate and consistent information on the political context at the state level. These data are crucial to control for political factors that may influence both fiscal choices and gender outcomes. Economic and political data are available from 1991 to 2020.

The outcome data come from the *Global Data Lab*, which provides harmonized subnational indicators on human development, wealth, and inequality for over 160 countries. These measures, available at the state level—such as the Subnational Human Development Index (SHDI) and the International Wealth Index (IWI)—are constructed using standardized household surveys like DHS, MICS, and IPUMS to ensure consistency across regions and years. The HDI data used in this study cover the period from 2000 to 2020.

To measure how federalism affects gender equality, two outcome variables are used in the first estimation. The first is a measure of the Human Development Index (HDI) specific to women, to assess how federalism can affect women's outcomes in health, education, and income. The second is the ratio between women's and men's specific HDI. This allows us to capture the relative evolution of HDI for both groups. While separate HDI values show absolute progress for each gender, the ratio highlights whether improvements are shared equitably or whether one gender advances faster than the other. A value close to 1 suggests near parity in human development outcomes, while a value below 1 reflects a persistent gap in favor of men. This ratio is particularly useful for analyzing whether autonomy and resource control at the state level translate into equitable gains for both women and men. The ratio is defined as:

$$HDI\_ratio_{it} = \frac{HDI\_women_{it}}{HDI\_men_{it}} \tag{3.1}$$

Several relevant control variables are included to account for socioeconomic factors known to affect gender inequality. Urbanization can influence gender inequality in multiple ways. It often expands women's access to education, health services, and formal employment, which can reduce gender gaps in income and human capital. Urban areas may offer more opportunities for political participation and social mobilization, supporting women's rights movements. However, urbanization can also create new forms of inequality if women are overrepresented in informal, low-paid, or precarious jobs and face higher risks of gender-based violence (McIlwaine (2013)). GDP per capita is included as a control variable because it captures the general level of economic development, which can shape gender inequality through its effects on income, employment opportunities, and access to services (Stefko et al. (2020)). Controlling for GDP per capita helps isolate the effects of other factors by accounting for differences in resources and living standards that may independently shape gender gaps in education, health, and labor market outcomes. Fiscal rule and population size are also included as control variables because they reflect key institutional and demographic characteristics that can shape gender outcomes. The presence of a fiscal rule indicates whether a government follows binding guidelines for budget balance, debt, or expenditure, which can constrain or prioritize funding for social sectors that benefit women, such as education, health, and welfare (Hartwig and Sturm (2019); Brändle and Elsener (2024)). Regions with strict fiscal rules may have less flexibility to expand gender-responsive spending during downturns. Population size matters because larger populations often require more complex administrative systems and greater public spending to deliver services equitably (Facchini and Mayda (2009)). It can also influence political bargaining, urbanization patterns, and the scale at which gender policies are implemented, all of which may affect how effectively gender inequality is addressed.

The next table presents a summary of different variables used in our empirical estimation.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
HDI_female	0.633	0.064	0.467	0.782	420
HDI_ratio	0.928	0.016	0.871	0.96	308
state autonomy	48.938	25.713	5.466	100	887
log(GDP per capita)	10.287	1.061	7.886	12.832	942
Urbanization (%)	33.568	19.098	7.98	99.900	870
trend	16.815	9.352	1	33	942
fiscal rule	0.381	0.486	0	1	942
log(population size)	20.847	0.125	20.608	21.025	843

The next graphs show the correlation between female HDI and states autonomy The visual analysis suggests a light and positive link between these variables.

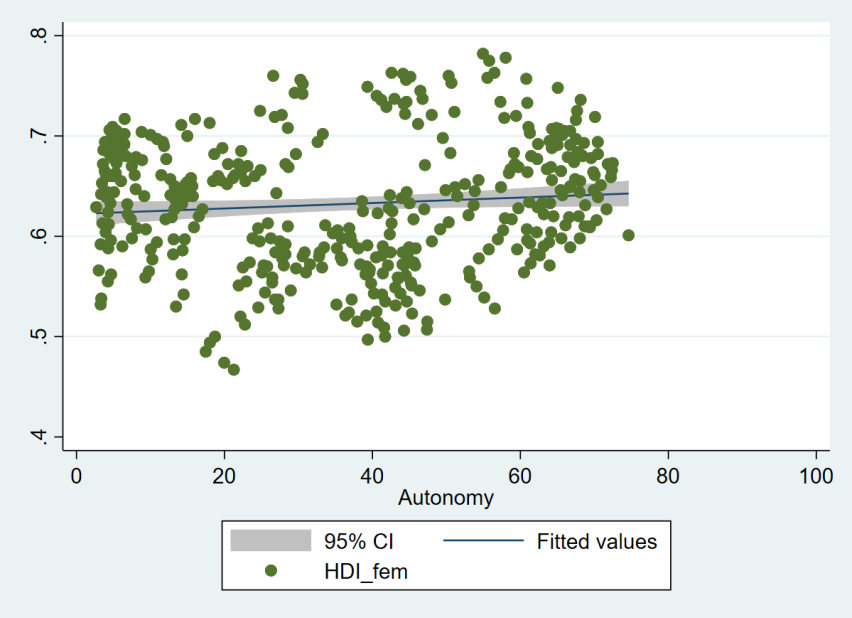


Figure 1: Correlation between female HDI and fiscal autonomy

3.3.2 Identification Strategy

To empirically assess the effects of states' fiscal autonomy on gender inequality, we apply a Two-Stage Least Squares (2SLS) estimation strategy, in line with approaches used by Bhavnani and Lacina (2017), Constantelos (2010), and Fowler (2020). This method addresses potential endogeneity that could otherwise bias the estimated relationship between fiscal autonomy and gender outcomes.

Endogeneity in this context may arise mainly through reverse causality and omit-

ted variable bias. On one hand, greater fiscal autonomy can influence gender inequality by expanding states' capacity to fund and implement gender-responsive programs in education, health, and social welfare. On the other hand, regions with higher or lower levels of gender inequality may exert pressure on governments to decentralize or centralize fiscal authority. Gender inequality can also affect the local tax base by shaping women's participation in the formal labor market and overall household incomes. Unobserved factors such as cultural norms, historical governance patterns, or local institutional quality may also affect both fiscal arrangements and gender outcomes if not properly addressed.

To address these concerns, we use instrumental variables (IVs) that are strongly correlated with states' fiscal autonomy but plausibly exogenous to gender inequality levels. In the first stage, these IVs explain variation in fiscal autonomy that is not driven by local gender dynamics. In the second stage, the predicted values of fiscal autonomy are used to estimate its effect on gender inequality, isolating the exogenous variation.

The first instrument is the number of years since a state's official creation. Over time, older states typically develop stronger administrative capacity and more stable fiscal frameworks (Broschek (2010)), enhancing their ability to mobilize revenue and manage expenditures independently. This historical factor is unlikely to be directly related to recent changes in gender inequality, satisfying the relevance and exclusion criteria for a valid instrument.

The second instrument exploits periodic, exogenous fiscal adjustments resulting from the recommendations of India's Finance Commission, which determines how national tax revenues and grants are allocated across states. The Commission's formula-based transfers are designed to address fiscal imbalances using macroeconomic criteria, not state-specific gender concerns. Consequently, these fiscal changes affect states' revenue capacity while remaining orthogonal to unobserved determinants of gender inequality.

The identification relies on the following empirical specification, which includes state (i) and year (t) fixed effects:

$$Y_{it} = \beta_0 + \beta_1 FD_{it} + \gamma_1 X_{it} + \mu_i + \lambda_t + \epsilon_{it}, \tag{3.2}$$

where Y_{it} denotes gender inequality (measured through the women-specific HDI and the HDI ratio), FD_{it} is fiscal autonomy, X_{it} is a vector of control variables, μ_i are state fixed effects, λ_t are year fixed effects, and ϵ_{it} is the error term.

In the first stage, fiscal autonomy is instrumented using the chosen IVs (Z_{it}):

$$FD_{it} = \pi_0 + \pi_1 Z_{it} + \mu_i + \lambda_t + u_{it}. \tag{3.3}$$

The fitted values $\hat{FD}_{it}$ are then substituted into the structural equation:

$$Y_{it} = \beta_0 + \beta_1 \hat{FD}_{it} + \gamma_1 X_{it} + \mu_i + \lambda_t + \epsilon_{it}. \tag{3.4}$$

State and year fixed effects control for time-invariant heterogeneity across states and national trends that might simultaneously influence fiscal autonomy and gender inequality.

The next section presents the estimation results using the identification strategy described above.

3.3.3 Results

Tables 3 and 2 report the estimated effects of states' fiscal autonomy on gender-specific human development outcomes. Table 3 shows the results for the HDI ratio between women and men, while Table 2 presents the results for the HDI specific to women.

Table 2: Effect of Fiscal Autonomy on Women's HDI

Dependent variable:	HDI_female			
	(1)	(2)	(3)	(4)
Autonomy	0.001***	0.001***	0.001***	0.001***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Observations	472	472	472	472
R^2	0.774	0.792	0.779	0.793
Adjusted R^2	0.771	0.782	0.769	0.776
Hansen/Sargan (p-value)	0.360	0.999	0.287	0.999
States FE	No	Yes	No	Yes
Year FE	No	No	Yes	Yes

Table 3: Effect of Fiscal Autonomy on the Gender HDI Ratio

Dependent variable:	HDI_ratio			
	(1)	(2)	(3)	(4)
Autonomy	-0.001***	-0.001***	-0.001***	-0.001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	472	472	370	472
R^2	0.588	0.685	0.584	0.692
Adjusted R^2	0.582	0.670	0.557	0.666
Hansen/Sargan (p-value)	0.360	0.999	0.287	0.999
States FE	No	Yes	No	Yes
Year FE	No	No	Yes	Yes

The results show a clear and consistent pattern across both outcome variables. The estimates for the HDI ratio in Table 3 indicate that greater fiscal autonomy significantly reduces the HDI ratio between women and men. This means that, as states gain more fiscal independence, the relative gap in human development outcomes tends to widen to the disadvantage of women.

At the same time, the results for women's HDI in Table 2 suggest that fiscal autonomy is associated with an increase in women's HDI. Interpreting the sign as positive implies that women do experience absolute improvements in health, education, and income when fiscal autonomy expands.

However, the simultaneous decline in the HDI ratio shows that men benefit even more than women from the additional fiscal space, leading to a relative widening of gender inequality. In other words, while women's well-being improves, the gains for men are larger, so the gender gap persists or even grows.

These findings highlight an important dynamic: in the absence of specific safeguards or gender-responsive fiscal policies, increased fiscal decentralization can reinforce structural advantages that favor men. This reflects the risk that federal arrangements, when focused primarily on fiscal capacity without explicit gender targeting, may end up amplifying rather than narrowing existing inequalities.

Overall, the results support the view that fiscal federalism, by itself, is not inherently inclusive. Its effect on gender inequality depends on how effectively states use their fiscal autonomy to address the specific barriers that limit women's equal access to the benefits of development.

3.4 Robustness checks

3.4.1 Placebo Test

To strengthen the robustness of my findings and ensure that the observed relationship between fiscal autonomy and gendered development outcomes is not driven by spurious correlations or model specification biases, we conduct a placebo test. The purpose of this test is to verify whether the estimated effects persist when the dependent variable is replaced by a randomly generated placebo variable that mirrors the statistical properties of the original. We apply this placebo strategy to both outcome variables: the HDI for women and the HDI ratio between women and men. For each, we generate a new variable in which values are randomly assigned across states and years, while preserving the same distributional characteristics as the original variable. Specifically, the placebo variable is constructed to match the mean, standard deviation, minimum, and maximum of the original series.

The logic of this approach is the following: if the estimated relationship between fiscal autonomy and the actual outcome variables is meaningful and not a statistical artifact, then applying the same estimation procedure to the placebo variable should yield coefficients that are close to zero and statistically insignificant. On the contrary, if significant effects persist with randomized outcomes, this will cast doubt on the validity of the original findings. By maintaining the distributional structure of the original outcomes, we ensure that the placebo variable is not trivially distinguishable from the true data. This makes the test more conservative and informative. We estimate the same regression model used in the main analysis, replacing the true outcome with its placebo counterpart:

$$Y_{it}^{placebo} = \beta_1 \widehat{FD}_{it} + \alpha_1 \log(GDP\_pc)_{it} + \alpha_2 X_{it} + \mu_i + \epsilon_{it}$$

This placebo regression serves as a falsification test. If the estimated coefficient β_1 is not significantly different from zero, it supports the credibility of my main results and suggests that the observed relationship between fiscal autonomy and gender inequality is not driven by random associations.

The results of this placebo analysis are available in the appendix section (table 4).

3.5 Spatial analysis

Understanding the dynamics of gender inequality requires more than analyzing conditions within individual states in isolation. In practice, gender outcomes are not

confined by administrative borders: policies, social norms, and economic changes in one state often affect neighboring regions through various spillover channels. For example, when a state strengthens its gender-responsive fiscal measures—by expanding funding for women's education, health, or employment—these improvements can indirectly benefit surrounding states. Mechanisms such as labor mobility, migration, diffusion of best practices, or shared socio-economic ties can spread positive effects beyond the jurisdiction that first implements them.

Recognizing these spatial interdependencies is crucial. Standard panel models assume that states operate independently from one another, overlooking how progress in one place can influence outcomes elsewhere. This omission risks producing biased or incomplete estimates of the real impact of fiscal autonomy. If spillover effects exist but are ignored, we may underestimate or misinterpret the broader consequences of fiscal federalism for gender inequality. Integrating a spatial perspective makes it possible to identify whether local fiscal decisions contribute to collective regional improvements or if they unintentionally widen disparities between regions.

To address this, we adopt a Spatial Autoregressive (SAR) model, which extends the baseline estimation by explicitly incorporating spatial linkages. The SAR approach allows us to capture both the direct effect of fiscal autonomy within a state and the indirect effects transmitted through spatial connections with neighboring states. This helps reveal whether decentralization and locally financed gender policies generate wider benefits or remain contained within state borders.

Formally, the SAR model introduces a spatially lagged dependent variable into the estimation framework. The model is specified as:

$$Y_{it} = \rho W Y_{it} + \beta_0 + \beta_1 FD_{it} + \gamma_1 X_{it} + \mu_i + \lambda_t + \epsilon_{it}, \tag{3.5}$$

where Y_{it} denotes the gender inequality outcome for state i at time t, which can be measured by the HDI ratio. The term WY_{it} represents the spatial lag, constructed using a spatial weights matrix W that reflects how states are connected geographically or economically. The parameter ρ captures the degree to which gender outcomes in one state are shaped by those in neighboring states. A significant and positive ρ would suggest that progress (or setbacks) in one region have measurable effects on others.

The term FD_{it} denotes fiscal autonomy, while X_{it} is a vector of control variables capturing other relevant socio-economic factors. The specification also includes state fixed effects μ_i and year fixed effects λ_t to control for time-invariant state characteristics and national trends. The error term ϵ_{it} captures unexplained variation.

By estimating this model, we can test whether fiscal autonomy generates spillover effects that extend the reach of gender-responsive policies beyond local boundaries.

This spatial lens is essential for designing effective fiscal federalism: it shows whether decentralization fosters collective progress toward closing gender gaps or whether its benefits remain unequally distributed across regions. In this way, the SAR framework enriches the understanding of how local governance interacts with regional dynamics in shaping gender inequality.

3.5.1 Results

Table 5 available in appendix reports the main direct and spatial effects estimated from the SAR model, focusing on the direct impact of fiscal autonomy and the spillover effect captured by *HDI_ neighbors*.

The coefficient for *autonomy* is negative and marginally significant, indicating that, when controlling for spatial effects, fiscal autonomy is associated with a slight decrease in the gender HDI ratio or the women-specific HDI. This means that states with higher fiscal autonomy tend to have lower gender development scores, all else equal.

The coefficient for *HDI_ neighbors* is positive and statistically significant at the 5% level. This shows that the gender development outcome in a given state is positively correlated with the same outcome in neighboring states. In other words, states surrounded by neighbors with higher levels of gender-related human development also tend to show higher scores themselves.

These results show that the model captures both a direct association between fiscal autonomy and gender outcomes, and a spatial association that links each state's gender development to its regional context. The significance of *HDI_ neighbors* confirms that controlling for spatial dependence is necessary to avoid biased estimates and to properly account for spatial linkages between states.

3.6 Conclusion

This paper has explored whether fiscal federalism contributes to reducing gender inequality by analyzing the relationship between states' fiscal autonomy and gender-specific human development outcomes in India. Using a two-stage least squares (2SLS) strategy with exogenous instruments — the duration since a state's creation and periodic recommendations from the national Finance Commission — the study provides robust evidence that greater fiscal autonomy can indeed improve women's access to essential public services such as education and health. This is captured by higher female-specific HDI scores in states with greater control over their own revenues and spending decisions. However, the findings also show that these benefits are not equally distributed between men and women. While states with more fiscal resources tend to

raise living standards for women, the comparative advantage remains with men, as the HDI ratio between women and men tends to decrease. In other words, men benefit at least as much — and often more — from the additional fiscal space, which means that fiscal decentralization, in its current form, does not automatically reduce the gender gap. Instead, it can reinforce existing inequalities if no explicit gender focus is applied. These results make an important contribution to the research literature by clarifying the distinction between overall development gains and the actual narrowing of gender gaps. They suggest that greater local autonomy alone does not guarantee that disadvantaged groups benefit equally, especially when local preferences or power structures are not always favorable to advancing women's rights. By showing that spatial spillovers exist — that states with higher levels of gender-specific human development tend to influence neighboring states positively — the paper also highlights the need to view gender equality as a process that can cross administrative boundaries. This dimension has been largely overlooked in previous research that focuses mainly on local outcomes without accounting for interregional dynamics. From a policy perspective, these results imply that decentralization policies should not be designed in isolation from targeted gender measures. Simply transferring fiscal powers to lower levels of government may improve the overall quality of public services, but it does not automatically translate into equal progress for women and men. If local elites or political incentives do not prioritize gender equality, the additional fiscal capacity may benefit groups that already hold more influence. The evidence therefore supports the idea that fiscal federalism must be accompanied by concrete instruments, such as gender budgeting and gender-responsive planning, to ensure that increased autonomy translates into balanced progress for all. While this study focuses on the Indian context, the methodological approach can be extended to other federal or decentralized settings to test whether similar patterns hold. Future work could examine how specific institutional safeguards, local political conditions, or more explicit gender-focused spending programs influence this relationship. More detailed indicators of fiscal autonomy and gender outcomes — such as disaggregated spending by sector, subnational gender quotas, or measures of women's political representation — would also help refine our understanding of how local fiscal power shapes gender inequality. Overall, the findings remind us that decentralization is not automatically a tool for social equity. It can be a lever for inclusion only if it is backed by clear mechanisms to prioritize the rights and well-being of groups that historically face barriers — in this case, women. Studying these interactions at scale and across regions helps clarify when local autonomy serves as a bridge to gender equality and when it risks entrenching disparities if supportive policies are absent.

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3.7 Appendix

3.7.1 Placebo test

Table 4: Instrumental Variable Regressions – Effect of Autonomy

	HDI_fem	**HDI_sim**
autonomy	0.001	-0.0002
	(0.001)	(0.0003)
Observations	598	598
R^2	0.64	0.36
Adjusted R^2	0.53	0.25

Note: *p<0.1; **p<0.05; ***p<0.01

3.7.2 SAR model results

Table 5: Direct and Spatial Effects: SAR Model Estimates

	Estimate	Std. Error	p-value
Direct Effect			
Autonomy	-0.00014	0.00008	0.085
Spatial Effect			
HDI_neighbors	0.821	0.331	0.013

Chapter 4

Do fiscal reforms need a gender lens? Evidence from Indian states

Do fiscal reforms need a gender lens? This paper examines the adoption of gender budgeting in Indian states between 1991 and 2020. Using a Difference-in-Differences framework with robustness checks, it shows that gender budgeting reallocates spending toward education and infrastructure—sectors central to women's empowerment—while strengthening the credibility of pro-gender commitments. Central transfers, especially Centrally Sponsored Schemes, act as key transmission channels. At the micro level, gender budgeting reduces tolerance of IPV and improves women's access to information, demonstrating that fiscal reforms with a gender focus can shift both budgets and social norms. These findings suggest that transparency in gender budgeting not only redirects public resources but also redefines the politics of fiscal credibility.

4.1 Introduction

Despite a global decline in gender inequalities, they remain widespread, especially in developing countries where structural barriers (such as unequal access to education, health care, decent work, and political participation) continue to restrict women's opportunities. In response, Gender Budgeting (GB) has developed as a practical tool to integrate gender priorities into the design, planning, and monitoring of fiscal policies. This approach reframes budgets from neutral instruments into active levers that governments can use to challenge unequal power relations and redistribute resources more fairly. By analyzing how revenues are raised, how taxes impact men and women differently, and how spending is distributed across sectors, gender budgeting aims to make fiscal choices that directly reduce gender gaps. Making gender equality an explicit goal of public finance aligns budget processes with broader commitments to equity and sustainable development. Since its first introduction by Australia in 1974, GB has spread widely and today over 80 countries include a gender perspective in their budget processes (Rubin and Bartle (2023)).

Its relevance is even greater at the local level, where governments are directly responsible for delivering essential public services (such as schools, health centers, water supply, housing, and welfare programs) that have immediate impacts on women's daily lives and empowerment opportunities. Local governments decide how resources are allocated for these services, how priorities are set, and how responsive spending is to community needs. Implementing gender budgeting at this level means that fiscal policies can be shaped to address specific barriers faced by women and girls in their communities, ensuring that funds are reallocated where they are most needed to close gender gaps in access, quality, and outcomes. This local focus makes it possible to link fiscal choices directly to concrete improvements in women's social and economic empowerment such as better access to education, safer public spaces, or targeted support for women's livelihoods. Moreover, local gender budgeting helps strengthen democratic accountability by opening budget decisions to community participation and scrutiny, giving women a voice in how public money is spent and ensuring that fiscal policy becomes an effective driver of gender equality where its impact is most tangible.

Most studies on gender budgeting still focus on the conditions that make its adoption possible, such as political will, administrative capacity, and civil society involvement (Chakraborty (2016); Quinn (2016); Jung (2022); Puig-Barrachina et al. (2017); Elomäki and Ylöstalo (2021)). However, they seldom explore how gender budgeting is implemented in practice or whether it actually shifts how public funds are spent (Stotsky and Zaman (2016)). Many works also overlook how expenditures are re-

allocated across sectors to tackle gender gaps. In addition, existing research often separates macroeconomic and microeconomic perspectives, analyzing overall fiscal trends without linking them to effects on households, or studying household impacts without connecting them to budgetary choices (Khera (2016); Das et al. (2015); Buchmann et al. (2008); Kleven and Landais (2017); Mbodji (2023); Cannonier and Mocan (2018)). This gap limits a full understanding of how gender budgeting works in practice and how it can deliver real changes for gender equality, especially at the local level where its effects should be most visible.

This paper addresses a critical gap in the literature by providing an empirical assessment of the macro- and micro-level effects of gender budgeting in Indian states. The research question arises from a key concern: although many local governments announce gender budgeting measures, the absence of binding enforcement or sanctions means that these commitments may remain largely symbolic, producing limited or no real changes in how public funds are reallocated or in the everyday lives of women. In contexts like India, where the effectiveness of policy often depends on strong local implementation and accountability, gender budgeting risks becoming a mere rhetorical or technocratic tool—adopted to signal political commitment without translating into concrete shifts in spending priorities.

This makes it essential to examine whether gender budgeting actually leads to a reallocation of public resources and measurable improvements for the targeted populations. By focusing on Indian states—where subnational governments are responsible for delivering key public services that directly shape women's empowerment—this paper fills an important gap by testing if gender budgeting can function as a credible instrument of fiscal policy rather than a policy label with little practical effect. It responds to three main shortcomings in the existing literature: the lack of evidence on how gender budgeting influences expenditure patterns in practice; the neglect of the reallocation dimension across sectors; and the frequent disconnect between macro-level fiscal analysis and micro-level impacts on households and communities. By combining these perspectives, this research clarifies whether gender budgeting, when implemented at the local level without strong enforcement, but with an obligation of transparency can still act as an effective mechanism for redirecting public spending (Gadenne (2017) and Besley and Smart (2007)) and advancing gender equality in a meaningful way.

To address these questions, this paper combines a theoretical framework with an empirical strategy that integrates both macroeconomic and microeconomic analyses. The empirical design relies on a difference-in-differences approach and entropy balancing to estimate the causal effects of gender budgeting adoption by comparing states that have implemented gender budgeting measures with those that have not, while

controlling for potential selection bias and observable differences. At the macro level, this allows for the assessment of whether the introduction of gender budgeting results in significant changes in the allocation and composition of public expenditures. At the micro level, the analysis uses probit models to examine whether these fiscal changes translate into measurable impacts on individual and household outcomes related to women's empowerment. This mixed approach responds to data constraints typical of subnational studies while providing robust evidence on whether gender budgeting is linked to meaningful shifts in public spending and tangible improvements for the populations it targets.

The results show that states adopting gender budgeting allocate a larger share of their public spending to sectors that promote gender equality, particularly education and infrastructure, with these effects supported by central transfers that strengthen the credibility of local pro-gender commitments. At the microeconomic level, this reallocation translates into measurable improvements in women's empowerment, including positive changes in attitudes towards gender equality and a reduction in tolerance for intimate partner violence, demonstrating that gender budgeting can produce concrete social outcomes alongside shifts in fiscal policy.

The remainder of this paper is structured as follows. The next section presents the conceptual framework that underpins the analysis. This is followed by the empirical strategy, detailing the identification framework used to estimate the effects of gender budgeting. The paper then discusses the robustness checks implemented to validate the results. The following section explores the microeconomic impacts on women's empowerment. Next, the transmission channels through which gender budgeting affects fiscal allocations are examined. Finally, the paper concludes with a discussion of the main findings and their policy implications.

4.2 Indian federal system and Gender Budgeting adoption

As explained by Shair-Rosenfield et al. (2021), India is a federal republic composed of 28 States (some with asymmetry in shared rule) plus 5 standard union territories, 2 non-standard union territories, and one special autonomous region (the State of Jammu and Kashmir) which had lost its special autonomy status in 2019. India became independent from the British in 1947, the first constitution was enacted in 1950 and, as of 2019, there have been 102 amendments. Indian elites have struggled to balance internal diversity with a cosmopolitan identity and centralization with decentralization. On the whole, they have leaned to the side of centralization (Swen-

den (2015) and Jennings (1953)). Unusual for a federation, the constitution is very detailed in prescribing the internal organization of each constituent unit. Also, the national parliament can unilaterally change State boundaries as well as the conditions governing State representation in the Senate. And, except for the State of Jammu and Kashmir, which (until 2019) had its own Constitution, the rest of the States have no separate constitutions of their own.

From 1957, each State had a directly elected parliament, named the legislative council, and a centrally appointed governor. The governor holds executive power. He in turn appoints a council of ministers, with the chief minister at the head. The chief minister is the head of the local majority at the State parliament. The governor, on the advice of the chief minister, appoints members of the council of ministers– the cabinet that advises the chief minister. Despite the power vested in the chief minister, which includes advising the governor and chairing the legislature and the council of ministers, the governor is more than a figurehead. They have considerable authority, including the right to dismiss State governments' discretion over a state's contingency fund, the ability to enter into and execute contracts, the ability to grant pardons and suspend, remit, or commute sentences of convicted persons, and in some cases, can appoint a small subset of State legislators. States have exclusive authority over local police, education, welfare (pensions, unemployment, and disability), the economy (trade and commerce within the state, money-lending, and lenders), and culture (theatres, sports, religious societies, libraries, museums, and other similar institutions controlled or financed by the State; ancient and historical monuments and records).

The National Capital Territory of Delhi (NCT) was controlled by a chief commissioner appointed by the central government from 1947 until 1951. From 1952 to 1956, the NCT was authorized to create a directly elected 48-member unicameral assembly and a chief minister of Delhi selected by the assembly. In 1956 the States Reorganization Act eliminated the assembly and the chief minister of Delhi and replaced both with a union minister appointed by the president of India. This was the beginning of a long period of President's Rule. In September 1966 President's Rule was softened with the Delhi Administration Act, which restored a weakened version of the prior representational structure. The new dual structure consisted of an advisory Delhi Council, with 56 directly elected members, 5 appointed members, and a centrally appointed lieutenant governor. The Constitution Act of 1991 created a directly elected legislative assembly and an executive council of ministers elected among assembly members and chaired by a chief minister of Delhi. While in the states the chief minister is appointed by a centrally appointed governor, the chief minister of Delhi is appointed by the president. The position of lieutenant governor continues

to exist and now resembles the position of State governor.

The next graph represents the repartition of States and Union Territoiries in 2021.

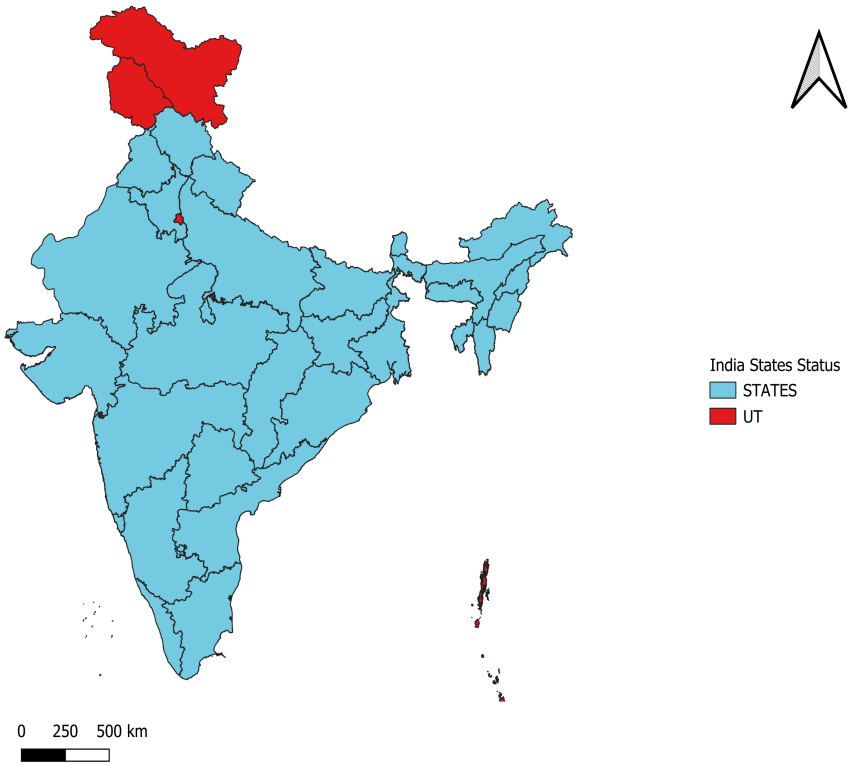


Figure 1: Indian States vs UT

4.3 Conceptual framework

In India's federal system, state governments play a central role in financing and delivering core public services like education, health, and infrastructures. These areas are crucial for reducing gender inequalities while also benefiting the wider population. Yet the discretionary power local governments hold over budgets, combined with weak citizen oversight, could often create information asymmetries that make it difficult for voters to verify whether announced policies translate into real spending shifts (Blagrave and Gonguet (2020) and Goetz and Jenkins (2001)). In this context, the principal-agent framework is particularly relevant: voters (principals) delegate authority to local leaders (agents) but face challenges in observing their true effort and intentions. Gender budgeting, if rigorously applied, could help close this gap by enforcing transparency, requiring states to disclose spending plans and report on how well they align with gender equality objectives. This transparency could act as a credible signal, lowering the informational advantage of local governments and enabling

citizens to better monitor the match between commitments and action. Subsequently, the use of the term 'transparency' will refer to the implementation of gender budgeting and the transparency resulting from its implementation. When transparency raises the political returns to visible, easy-to-monitor spending, leaders may have stronger incentives to reallocate budgets toward sectors like education and infrastructure that are both politically popular and clearly linked to women's empowerment. In this way, the model shows why, in the Indian context, gender budgeting has the potential to transform symbolic announcements into credible budgetary shifts that advance both gender goals and broad-based development.

The theoretical framework of this study is built upon the principal-agent theory of Meckling and Jensen (1976), which is particularly apt for examining the relationship between local leaders (agents) and their constituents (principals) as in Revelli (2002) and Vermeir and Heyndels (2006). This framework is chosen because voters, through the act of voting, delegate power to local leaders with the expectation that these leaders will implement public policies that align with the voters' expectations. The agent's behavior is influenced by a trade-off between the compensation received (such as political power and social status) and the effort exerted in promoting gender equality. Voters can observe and sanction the agent's actions, particularly during elections, by either re-electing the leader or negatively sanctioning them if expectations are not met.

A central aspect of this study is the role of transparency in reducing information asymmetry between voters and local governments. Transparency is modeled as a cost function that increases quadratically with the level of transparency (T):

$$C(T) = c \cdot T^2$$

where c represents the cost coefficient. Increased transparency allows voters to better observe the government's actions, thereby enhancing accountability. The voter's utility function is given by:

$$U_P = \alpha \cdot \theta_v + \beta \cdot T$$

where θ_v represents visible expenditures, and α and β are parameters reflecting the importance of visible expenditures and transparency, respectively.

The government's utility function, which includes political returns from transparency, is expressed as:

$$U_A = \gamma \cdot T \cdot (\delta \cdot \theta_v + (1 - \delta) \cdot \theta_{nv}) - c \cdot T^2$$

where γ measures political returns, δ captures the share of utility from visible expenditures, and θ_{nv} represents non-visible expenditures. The cost c is influenced by the local context, such as population size and urbanization, which affect the financial cost of transparency efforts.

The government's effort in promoting gender equality is modeled as an effort premium, where political support and activist actions are exchanged for the effort exerted. The optimal level of transparency (T^*) is derived by maximizing the government's utility function:

$$T^* = \frac{\gamma \cdot (1 - \delta)}{2c - \gamma \cdot (2\delta - 1)}$$

This solution shows that optimal transparency increases with political returns (γ) and decreases with costs (c). Visible expenditures (θ_v) are driven by transparency, highlighting the importance of transparency in political decision-making.

We extend the baseline model by incorporating a stock of institutional capital K_t, which accumulates through past transparency efforts. We do it to consider potential persistence in the effects of transparency due to gender budgeting adoption. Transparency at time t is assumed to depend linearly on this stock:

$$T_t = a_0 + a_1 K_t,$$

where a_0 denotes a baseline level of transparency and $a_1 > 0$ captures how strongly transparency responds to accumulated institutional capacity. The stock of transparency-related institutional capital evolves according to:

$$K_{t+1} = (1 - \delta_K)K_t + \psi T_t,$$

with $\delta_K \in (0, 1)$ representing the depreciation rate of institutional capital and $\psi > 0$ measuring the effectiveness of transparency in building this capital. To derive the dynamic behavior of transparency, express the stock of capital in terms of transparency:

$$K_t = \frac{T_t - a_0}{a_1} \qquad \Rightarrow \qquad K_{t-1} = \frac{T_{t-1} - a_0}{a_1}.$$

Substituting the law of motion for capital into the transparency rule gives:

$$T_t = a_0 + a_1 \left[(1 - \delta_K)K_{t-1} + \psi T_{t-1}\right].$$

Replacing K_{t-1} by its expression in terms of T_{t-1} yields:

$$T_t = a_0 + a_1 \left[(1 - \delta_K) \frac{T_{t-1} - a_0}{a_1} + \psi T_{t-1} \right].$$

Simplifying:

$$T_t = a_0 + (1 - \delta_K)(T_{t-1} - a_0) + a_1 \psi T_{t-1},$$

$$T_t = \left[(1 - \delta_K) + a_1 \psi \right] T_{t-1} + \delta_K a_0.$$

Thus, transparency follows an autoregressive process of order one:

$$T_t = \lambda T_{t-1} + \delta_K a_0, \qquad \lambda = (1 - \delta_K) + a_1 \psi.$$

This dynamic formulation shows that transparency induce by gender budgeting adoption becomes persistent through the accumulation of institutional capacity. The parameter λ governs the degree of persistence. Higher accumulation efficiency (ψ), stronger responsiveness to capital (a_1), and lower depreciation (δ_K) all increase the extent to which past transparency affects current transparency. When $\lambda < 1$, transparency converges to a steady-state level; when $\lambda > 1$, transparency grows over time unless constrained by institutional or political limits.

So, from this conceptual analysis we can expect a persistent effect of gender budgeting. Indeed, the transparency associated with gender budgeting framework must persist through the time. This can generate a positive effect that will last over time, instead of acting like a one-shot deal.

To summarize, the theoretical framework highlights the following key insights. Gender budgeting enhances accountability by reducing information asymmetries between voters and local governments through transparency. Transparency increases the political returns to visible, gender-relevant spending, incentivizing leaders to reallocate budgets toward sectors like education, infrastructures and health as announced by local government. The institutional capital of transparency accumulates over time, making the effects of gender budgeting persistent and self-reinforcing. And finally, the model predicts sustained shifts in public spending behavior aligned with gender goals, providing a strong foundation for empirical testing.

4.4 Empirical Approach

4.4.1 Data

This study relies on an original combination of various datasets that provide detailed and complementary information about economic, political and fiscal variables at state level. The core economic and fiscal data are sourced from the Reserve Bank of India (RBI), which offers a uniquely detailed and reliable account of the fiscal position and economic performance of each Indian State and Union Territory. The RBI's disaggregated statistics on revenues and expenditures allow for precise measurement of both revenue autonomy and expenditure autonomy, which are central to this analysis of fiscal federalism. Political variables are drawn from official electoral data provided by the Election Commission of India, ensuring accurate and consistent information on the political context at the state level. These data are crucial to control political factors that may influence both fiscal choices and Gender Budgeting adoption.

The Gender Budgeting adoption variable is a dummy which takes 1 if gender budgeting is implemented in a State and 0 otherwise. It comes from the paper of Stotsky and Zaman (2016) and has been updated by further research from literature and State governments disclaims.

As outcome variables we used "pro-gender" public spending (expressed as percentage of total expenditures). In this paper, we define "pro-gender" spending as the share of budget allocated to four key sectors: education, health, infrastructure, and water. These items are selected because they appear consistently in common gender budgeting templates and have been identified by adopting states as priority areas for advancing gender equality. Education spending can directly reduce gender gaps by improving girls' enrollment, retention, and learning outcomes, which in turn expands women's future economic opportunities and bargaining power (Buchmann et al. (2008) and Kleven and Landais (2017)). Health expenditure is critical for ensuring women's access to maternal care, reproductive services, and basic health infrastructure, which lowers gender-specific barriers to well-being(Okojie (1994) and Sen and Östlin (2008)). Investment in infrastructure, such as roads and transport, eases women's mobility, connects them to markets and services, and can reduce time poverty linked to unpaid care work (Parikh et al. (2015); Das et al. (2015); Calvo et al. (1994)) Finally, spending on water supply and sanitation addresses burdens that disproportionately fall on women and girls, freeing time and improving health and safety conditions, especially in rural areas (Weiss (1999)). Together, these sectors represent concrete channels through which public spending can be reoriented to address structural gender gaps and promote women's empowerment in daily life.

To measure the combined weight of these priority sectors in state budgets, we build an indicator that sums expenditures on education, health, water, and infrastructure and expresses them as a percentage of each state's total annual spending. Formally, this "pro-gender" share is calculated as:

$$Pro\_gender_{it} = \frac{(Education_{it} + Health_{it} + Water_{it} + Infrastructures_{it})}{Total\_expenditure_{it}} * 100 \tag{4.1}$$

This indicator allows us to assess whether gender budgeting is associated with a meaningful reallocation of public resources toward spending that can help close gender gaps. If these sectors become explicit priorities through gender budgeting, then adopting states should allocate a higher share of their total expenditure to this aggregate "pro-gender" spending than non-adopting states.

The next table summarizes the "pro-gender"variable and its components.

Table 1: outcomes Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
pro_gender	5.193	2.858	0.338	16.794
infrastructures	2.311	1.474	0.053	12.235
education	0.73	0.852	0	5.517
health	0.582	0.626	0	5.849
water	1.534	1.461	-0.004	7.805
N		857		

The control variables are a set of covariates used in the literature on public spending composition which can also affect the likelihood of adopting gender budgeting.

Fiscal autonomy can affect spending size and composition and is associated with a smaller public sector size at the local level for Fiva (2006). Siwińska-Gorzelak et al. (2020) shows a U-shaped relationship between the ratio of own local taxes and the share of capital expenditures and a negative relationship between the former ratio and the share of education spending for Polish municipalities.

These states are also less dependent on central government transfers and are more autonomous in their political choices. The fiscal autonomy variable is a ratio between states' own local revenues and their total revenues (transfers and grants included).

The most urbanized states can generate some scale economies, or sometimes some congestion effects which make less effective and less efficient public spending and policies related to health and education issues. To avoid this, more urbanization may call for more expenditure centralization by attracting the rural population towards

big centers, favoring a certain concentration of public expenditures(Sacchi and Salotti (2016)).

GDP per capita affects the sensibility to women rights and gender equality. Indeed, Doepke et al. (2012) found a strong connection between women's rights and economic development.

The share of seats held by women in local parliament influences the composition of public spending at the subnational level (Svaleryd (2009)). The presence of women in local parliament also affects the political decisions and the choice of gender budgeting adoption.

All the variables have a year lag to tackle or reduce the endogeneity.

The following table summarizes the main variables used in the estimation process.

Table 2: Controls summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
gender_budgeting	0.22	0.414	0	1	930
state autonomy	48.938	25.713	5.466	100	857
log(GDP per capita)	10.287	1.061	7.886	12.832	866
Urbanization (%)	33.568	19.098	7.98	99.900	736
trend	16.815	9.352	1	33	930
women in parliement (%)	48.53	1.878	42.39	54.87	902
fiscal rule	0.381	0.486	0	1	930
Agriculture (%GDP)	26.575	20.109	0.052	130.834	866
log(population size)	20.847	0.125	20.608	21.025	787

4.4.2 Stylized facts

The graphs 2 and 3 highlight a comparison between the average share of "pro-gender" expenditures for treated (1) and untreated units (0). The adopters seem to allocate more of their funds to "pro-gender"items than the non-adopters. This result seems to suggest that gender budgeting adopters spend more on "pro-gender"items than others. However, this correlation does not mean anything in terms of causes and consequences because a correlation does not necessarily imply causality.

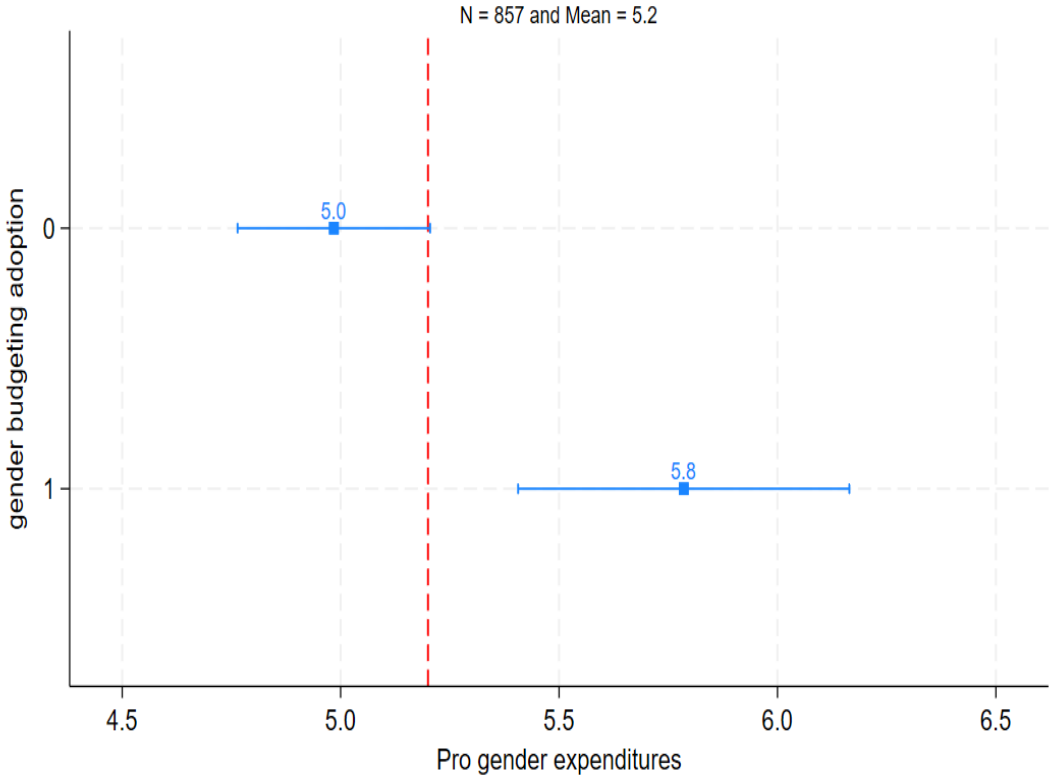
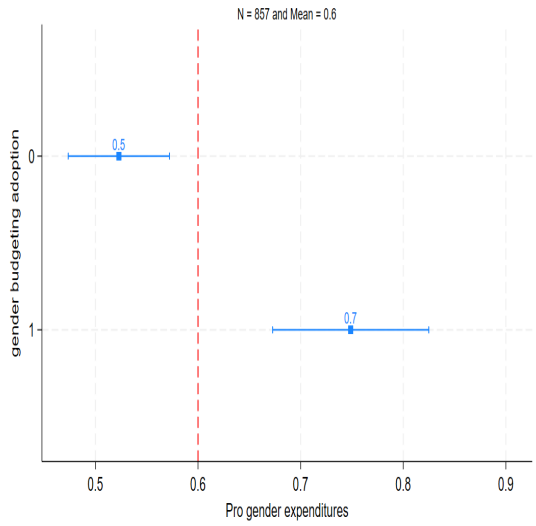


Figure 2: Pro-gender spending by treatment status

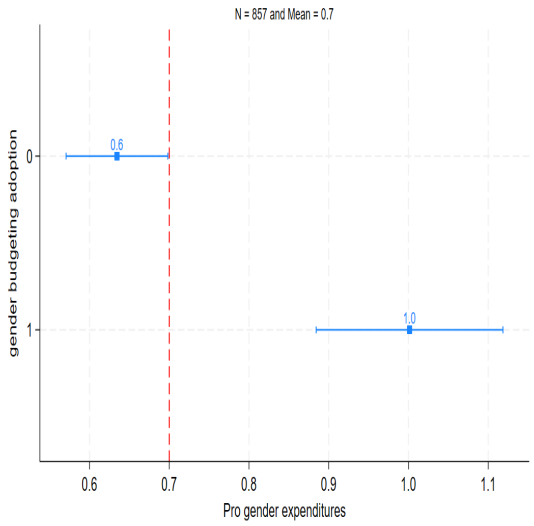
Always to analyze the potential difference in the average share of total expenditures between treated and untreated units, we computed the same statistics and made the same graph for the different components of "pro-gender" expenditures.

The graph 3 summarizes the average public expenditures for untreated (0) and treated units (1) by comparison to the global average of the sample (the vertical red line). The difference between both means suggests that the treated units seem to spend more for the three items (health, infrastructure, and education) than the untreated ones. In addition, their average expenditures in these items are more important than the average of the global sample. However, the situation is different for the water and sanitation services. Indeed, for this item, the treated units spend less on average on this item than the untreated ones. So, maybe the reallocation of public money is made to the detriment of water and sanitation services. However, we have to be cautious about this conclusion and the interpretations and need further investigations. All these elements tend to suggest that States that have adopted gender budgeting spend significantly more than the others. However, we can conclude that this difference is due to the gender budgeting adoption. The difference can be due to a simple correlation between the variables or to the fact that States which dedicated a greater share of their expenditures to these items got more incentives to adopt gender

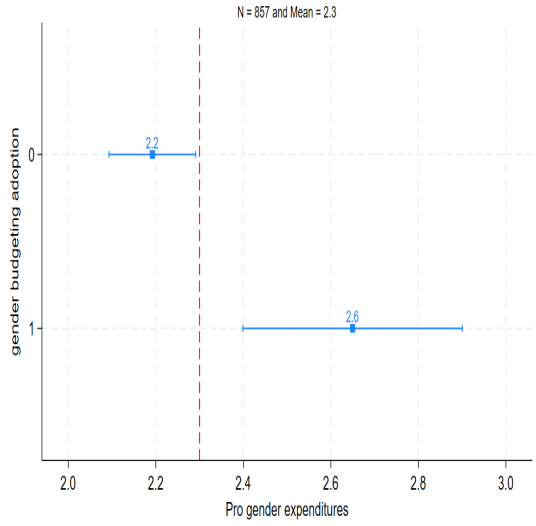
budgeting. This is why we have to go further in the analysis.



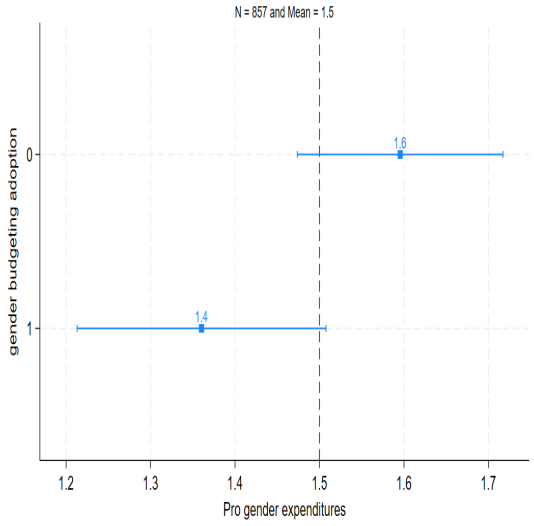
(a) Average expenditures share for health



(b) Average expenditures share for education



(c) Average expenditures share for infrastructures



(d) Average expenditures share for Water and sanitation services

Figure 3: Stylized facts

The graph 1 illustrates the staggered adoption of gender budgeting across various states in India. It highlights the timeline and sequence in which different states implemented gender budgeting practices, showcasing the varying pace of adoption. The data underscores how some states embraced the initiative earlier, while others followed more gradually, reflecting the diverse policy responses to gender equity concerns across the country.

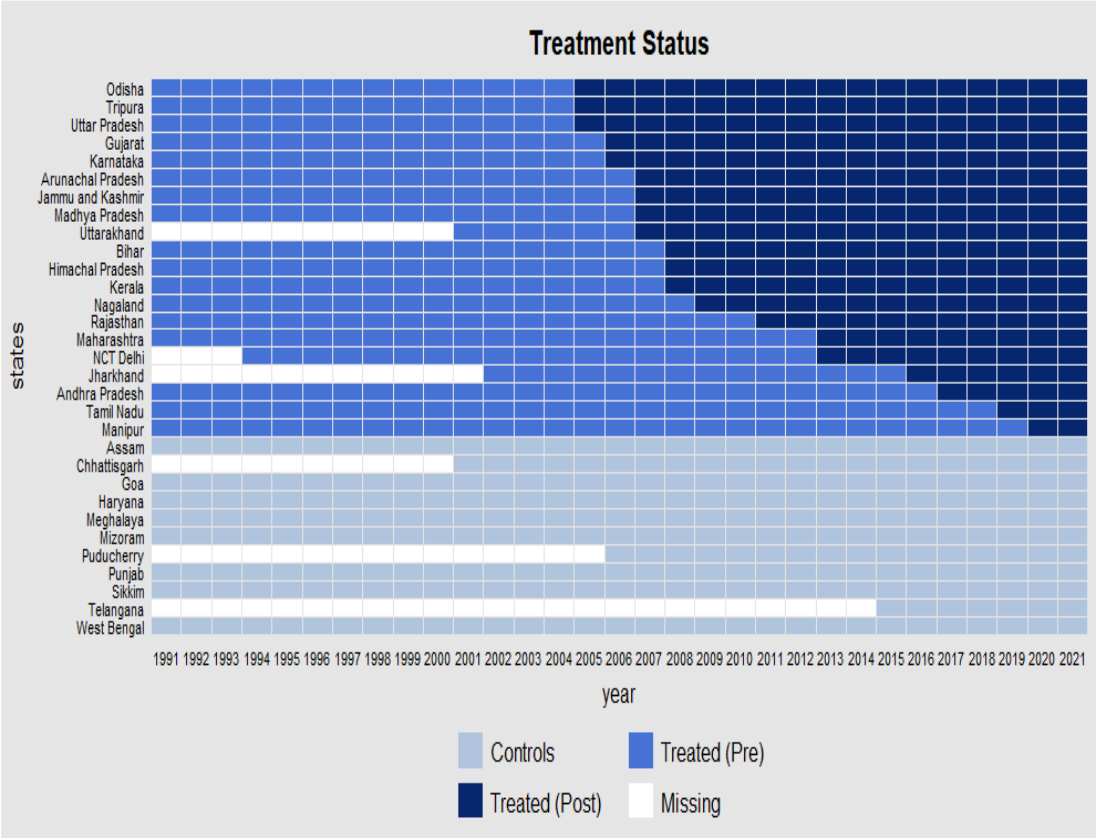


Figure 4: Gender budgeting adoption by states

Missing data often arises because some states did not exist prior to a certain point in time. Consequently, these states could not have been subject to any "treatment" immediately upon their creation. This situation ensures that there are "not yet treated" observations for all states, as newly formed states naturally fall into this category until they eventually receive treatment. This allows for a clearer comparison between treated and untreated states over time.

4.4.3 Identification strategy

The identification method used is a Difference in Difference (DiD) strategy, using a comprehensive panel dataset. We focus on the share of "pro-gender" public spending among the total expenditures for each State and each year through the period 1991-2020. The decision to adopt gender budgeting in each State is not random. Therefore, the main challenge is to correct for selection into the reform, i.e., to account for differences between adopter and non-adopter jurisdictions that could have influenced the outcome. The DiD identification strategy makes it possible to correct for the initial difference in public expenditures and thus estimate the differential changes in these outcomes across states before and after each wave of adoption.

However, using several years of data makes our approach closer to two-way fixed

effects (TWFE) linear regression. Recent methodological papers characterize the potential issues surrounding TWFE with multiple periods and multiple treatments (Callaway and Sant'Anna (2021), Borusyak et al. (2024) Goodman-Bacon (2021) and De Chaisemartin and d'Haultfoeuille (2020)). One issue addressed in this literature is the cross-unit heterogeneity of treatment. Other issues include the time-heterogeneity of treatment and the use of units that eventually become treated as control groups. When extending to 1991–2020, we try to capture longer-term effects and check if there is an increasing advantage of early adoption. We also acknowledge a group of states that have adopted gender budgeting after the first wave, which might slightly perturbate the control group as some units become treated. To address this, we suggest additional estimations where we explicitly account for the two types of treatment. In technical terms, we estimate the following equation in which Y_it is the outcome variable, i.e., public expenditures for State i in year t = 1, ..., T

$$Y_{it} = \alpha + \beta^W {D_{it}}^W + \rho X_{it} + \theta_i + \gamma_t + \epsilon_{it} \tag{4.2}$$

With the treatment dummy variable equal to 1 if the State i belongs to the group of states that have adopted gender budgeting in year k and are observed after that year.

Table 3: Repartition of treatment

Treated	223
Untreated	707

To slightly enhance the DiD setup, we use the Callaway and Sant'Anna (2021) DiD approach. The Callaway and Sant'Anna (2021) DiD estimator allows us to use inverse probability weighting as in Abadie (2005). As with Abadie (2005), we must estimate the propensity score. However, because we have multiple treatment dates for multiple groups, there is a unique propensity score for every group. However, we do not have the luxury of a large reservoir of untreated units necessarily in many applications with multiple periods and differential timing. To create implicit pairings of units in the treatment and comparison groups, Callaway and Sant'Anna (2021) allows two options. We are using a pool of units as our comparison group who never are treated during the duration of the panel. Or we may use a pool of units that have simply not yet been treated by the time of treatment. Another key concept in Callaway and Sant'Anna (2021) is the group-time ATT. The group-time ATT is a unique ATT for a cohort of units treated at the same point in time.

The *csdid* package used for this estimation allows us to estimate with Callaway

and Sant'Anna (2021) methods an estimator like Abadie (2005), but by considering the staggered adoption and heterogeneous effects. This type of approach usually brings flexibility to traditional DiD setups. Most importantly, it is used here to try to reduce unobserved time-varying differences between early- and late-gender budgeting-adopting states that could confound our results. For this, we are going to mobilize a set of variables X_{it} that are assumed to be correlated to some extent with time-varying confounders and that allow for comparing subgroups of treated and control states that are more alike.

For example, if states with the greatest GDP per capita are the ones that adopted gender budgeting first and, at the same time, are the ones that benefit from public expenditures (internal validity issue) or stand to benefit most from gender budgeting because their important GDP per capita can mean greatest interest for central government to rule this state. So, it can increase the discretionary transfers that are targeted at specific purposes (external validity issue), and then we might overstate the benefits of the gender budgeting adoption. Assuming that the unobservable advantages (e.g. economic and cultural dynamics, political leverage, or interest) are correlated with observable characteristics (e.g. population size, autonomy, GDP per capita), we could reduce the bias by comparing treated and control states that are most similar along a relevant set of observed characteristics of that sort. Rather than using matching on many different characteristics, which brings a 'curse of dimensionality issue, we rely on a propensity score (PS) that concentrates all the useful information from these characteristics. The propensity score, denoted p hereafter, is obtained as the prediction of a first-stage estimation of a gender budgeting dummy on the set of relevant variables including key demographic dimensions such as urbanization ratio, density rate, GDP per capita, autonomy ratio (share of own revenues on total states revenues) and proportion of seats held by the women in State parliament. To consider treated and untreated states that are more like each other according to these different criteria simultaneously, we reweight observations using the inverse propensity score, as suggested by Abadie (2005) for the DiD approach. In this way, the modified estimation gives more weight to the late (early) gender budgeting adopters that are most similar to the early (late) gender budgeting adopters. We will also explore the heterogeneous impact of the reform by explicitly zooming in on groups with similar characteristics (e.g. treated and controlled states with high wealth). All estimations are clustered at the State level to account for autocorrelation.

The adoption of gender budgeting in Indian states was largely driven by institutional and political processes rather than short-term economic considerations directly linked to the outcomes studied. At the national level, the Women Component Plan of the late 1990s and the introduction of the Gender Budget Statement in 2005–06

provided a formal framework encouraging states to integrate a gender perspective into budget formulation and monitoring. States adopted gender budgeting at different points in time (Odisha in 2004, Karnataka in 2006/07, Kerala in 2008/09, among others) typically following the creation of dedicated gender cells, the publication of state-level gender budget statements, and the implementation of training programs and gender audits. Evidence from Stotsky and Zaman (2016) shows that adoption is more closely associated with political and institutional variables than with economic performance indicators, suggesting that these decisions were part of broader governance and equity initiatives rather than responses to anticipated changes in fiscal or social outcomes. This institutional narrative, combined with test showing no pre-treatment differential trends and robustness checks supports the view that the timing of adoption can be treated as plausibly exogenous for identification purposes.

4.4.4 Parallel trend assumption

We compute a *t-test* to compare the mean of our outcome variable for both (adopters and non-adopters) before the first year of implementation. The results available in table 4 show that the mean of the outcome variable is relatively close for both (adopters and non-adopters) before the treatment was applied. So, to compare treated and control states that are most similar, We also suggest DiD estimations adjusted by a quasi-matching strategy. Assuming that the matching variables are highly related to unobserved confounders, this approach should reduce the potential bias affecting trend differences between the groups of states that have adopted gender budgeting at different points in time.

Before adoption			
Outcomes	Adopters	non Adopters	Difference
Pro-gender spending	5.04	4.911	
Education	0.71	0.54	
Health	0.50	0.55	
Infrastructures	2.26	2.11	
Water	1.52	1.68	
After adoption			
Outcomes	Adopters	non Adopters	Difference
Pro-gender spending	5.72	4.76	***
Education	0.97	0.61	***
Health	0.73	0.53	***
Infrastructures	2.48	1.92	***
Water	1.49	1.68	*

Table 4: Outcome means before the treatment (by status)

The following graph (5) has been inspired by the work of Rambachan and Roth (2023) on a more credible approach to the parallel trend assumption. They propose some tools for robust inference in difference-in-differences and event-study designs where the parallel trends assumption may be violated. Instead of requiring that parallel trends hold exactly, they impose restrictions on how different the post-treatment violations of parallel trends can be from the pre-treatment differences in trends ("pre-trends"). They recommend that researchers use their methods to construct robust confidence intervals, under restrictions on the possible violations of parallel trends that are motivated by domain knowledge in their empirical setting. According to them, there are some key concerns about the pre-trend assumption. Despite the statistical or visual results, it's important to consider some macroeconomic shocks that can disturb the pre-trend evolution. Figure 5 shows robust confidence sets for the treatment effect, using different values of Mbar [1]. The figure shows that if we impose Mbar$<$1, meaning that we restrict the post-treatment violations of parallel trends to be no larger than the maximal pre-treatment violation of parallel trends, then we obtain a robust confidence set for the causal effect on the expenditures share. This is wider than the original (without covariates) confidence interval, which is only valid if parallel trends hold exactly, but rule out a null effect on expenditures share.

[1] Mbar is a degree of smoothness, or how much we allow a violation of pre-trend assumption

The intuition for why the confidence sets are larger through time is that we have bound the violation of parallel trends across consecutive periods by Mbar times the max in the pre-treatment period. Thus, the identified set will be larger for later periods, since the treatment and control groups have more time to diverge. If we are willing to bound the magnitude of economic shocks by the max in the pre-treatment period, we will thus typically obtain wider confidence sets for parameters involving later periods. As suggested by Rambachan and Roth (2023) the table 5 available in the appendix summarizes the different bands of confidence interval according to the Mbar values.

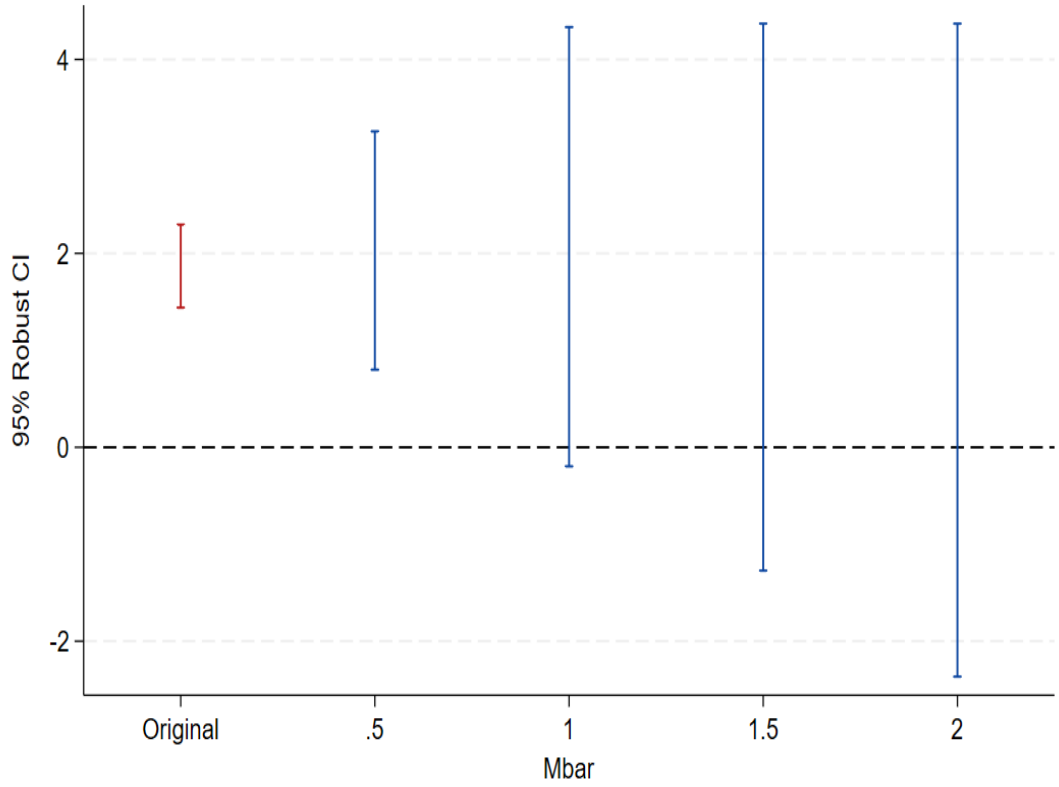


Figure 5: Parallel trend with honest DiD (Rambachan and Roth (2023))

4.4.5 Results

The results of the Average Treatment Effect on the Treated (ATT) are presented in Table 5. These results indicate that adopting gender budgeting has a positive and significant effect on the overall share of gender-friendly spending, as well as on specific items such as education and infrastructure for Indian states. This finding supports the idea that education and infrastructure are key sectors for reducing gender inequalities and are commonly highlighted as priorities in gender budgeting statements. This result is also consistent with Montes et al. (2019), who show that fiscal transparency

can improve the allocation and efficiency of public spending, especially in democratic contexts. In India, where regular elections and political alternation strengthen vertical accountability, the disclosure obligations linked to gender budgeting increase transparency and can push local governments to reallocate more spending towards visible, pro-gender sectors to maintain credibility and voter support.

The lack of significant effects for health and water may reflect slower or less visible impact pathways compared to education and infrastructure. Improvements in health and water typically require sustained investments and longer time horizons to generate outcomes that voters can clearly observe and attribute to local government action. In contrast, spending on education or infrastructure can deliver faster, more tangible results—such as schools, roads, or facilities—that are immediately visible and politically rewarding within electoral cycles. Furthermore, as health and water are basic services, non-adopter states could also maintain or gradually expand spending in these areas to meet minimum development standards, which reduces the difference between adopters and non-adopters and makes the reallocation harder to isolate over the study period.

Table 5: Diff-in-Diff results

	pro-gender	education	health	infrastructures	water
ATT	1.706**	0.371***	0.219	1.040***	0.102
	(2.41)	(3.59)	(1.28)	(2.69)	(0.25)
Observations	668	668	668	668	668

t statistics in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

To examine the dynamics over time, we also estimate an event-study model. Figure 6 shows that the adoption of gender budgeting is associated with a clear, sustained increase in the share of "pro-gender" spending. States that adopt gender budgeting consistently devote a larger proportion of their budgets to priority sectors such as education and infrastructure compared to non-adopters. This positive effect appears to hold over time, indicating that gender budgeting can contribute to a lasting reorientation of spending toward gender-friendly priorities. The event-study by components are available in appendix section (c.f figure 11).

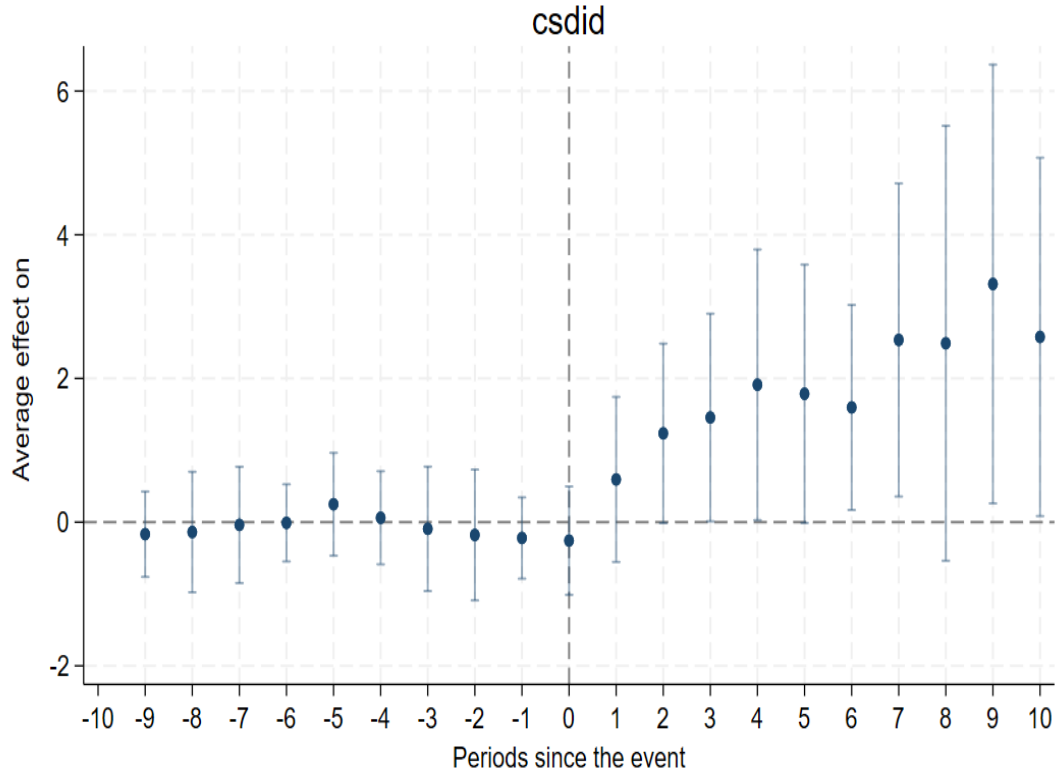


Figure 6: Event study results for "pro-gender" spending

4.5 Robustness Checks

4.5.1 Alternative DiD Estimators

As a robustness check, we complement our main results with additional Difference-in-Differences estimators that are also well suited to staggered adoption settings. First, we use the estimator proposed by Wooldridge (2025), which is designed for cases where treatment is implemented at different times across units. Wooldridge shows that the standard two-way fixed effects (TWFE) estimator is equivalent to a pooled OLS regression with unit-specific time averages and time-period-specific cross-sectional averages—what he calls the two-way Mundlak (TWM) regression. This flexible approach allows for considerable heterogeneity in treatment effects across time, treatment intensity, and covariates, and it can easily accommodate heterogeneous trends when the common trends assumption may not strictly hold. This makes the Wooldridge estimator a good fit for our context, where states adopt gender budgeting in different years and at different intensities. Table 8 available in appendix section shows that this estimator confirms a positive and significant effect of gender budgeting adoption on overall pro-gender spending as well as on education and infrastructure spending,

supporting our main findings. In addition, figure 12 also available in appendix section shows the event-study estimates using the Wooldridge framework, confirming that the positive effect is consistent over time.

To further strengthen our robustness checks, we also implement the estimators by Borusyak et al. (2024) and De Chaisemartin and d'Haultfoeuille (2020). The estimator of Borusyak et al. (2024) uses the average outcome from the entire pre-treatment period, which can increase precision but may be more sensitive to violations of the parallel trends assumption when trends diverge over longer horizons. In contrast, the estimator by Callaway and Sant'Anna (2021) uses only the last pre-treatment period as baseline, imposing weaker assumptions about parallel trends before treatment. Depending on the structure of pre-treatment dynamics, these choices help check the sensitivity of our results to alternative parallel trends assumptions. Finally, the estimator by De Chaisemartin and d'Haultfoeuille (2020) is especially relevant because it allows for treatment that can switch on and off and can handle both binary and continuous treatment. This flexibility is well suited for gender budgeting, which may have an evolving effect as states gain more experience with implementation over time. We define continuous treatment as the time since first adoption to capture whether earlier adopters show stronger or more persistent effects. The detailed results for Borusyak et al. (2024) are presented in Figure 13 in the appendix. The results for the De Chaisemartin and d'Haultfoeuille (2020) estimator are provided for both the binary treatment in Figure 14 and the continuous treatment in Figure 15 also in the appendix. Together, these additional checks provide reassurance that our main findings are robust to alternative identification strategies and assumptions.

4.5.2 Entropy Balancing

For the robustness check, we also use the entropy balancing method of Hainmueller (2012), as applied by Baccini et al. (2018) in work on fiscal decentralization and tax competition between local jurisdictions. Entropy balancing is particularly relevant here because macroeconomic shocks and political dynamics may change voters' and local governments' expectations, independently of gender budgeting adoption. The mere announcement of gender budgeting could raise citizens' demands for better services, while non-adopting states may also adjust spending quality to stay electorally competitive. This competition effect can affect pre-trends and bias DiD estimates. Therefore, we complement several DiD estimators with entropy balancing, which does not rely on the parallel trends assumption and is also well suited for our setting.

In general, matching estimators aim to mimic the random assignment of treatment by constructing a control group that is statistically comparable to the treated group in terms of all relevant pre-treatment characteristics. Entropy balancing achieves

this by pre-processing the data with a reweighting scheme that forces exact balance on specified moments of covariates. These weights can then be used in a regression framework just like sampling weights, ensuring that our treatment and control groups are directly comparable on observed characteristics that affect selection and outcomes. This is valuable for our panel data, where states differ in many structural factors that could bias the results if not well balanced.

Unlike traditional matching, which may struggle when the number of untreated units is limited or covariates are numerous, entropy balancing optimally adjusts weights to guarantee sufficient covariate balance. This reduces the risk of bias due to poor matches or model misspecification. Moreover, because it is non-parametric, entropy balancing does not require assumptions about the functional form of the treatment assignment process or the outcome model, which further limits risks of bias from incorrect specification.

Importantly, by combining reweighting with panel regressions, we can control for state and year fixed effects, accounting for unobserved heterogeneity across states and time. This makes entropy balancing a robust complement to our DiD analysis, especially given the heterogeneity in adoption timing and the possibility of anticipatory effects or local shocks.

The Average Treatment Effect on the Treated (ATT) is estimated as:

$$\pi ATT(x) = E[Y(1)|T = 1, X = x] - E[Y(0)|T = 0, X = x] \tag{4.3}$$

where Y is the outcome, X is the vector of balanced pre-treatment covariates, and T indicates treatment.

Our empirical model combines the entropy weights with a fixed effects panel regression:

$$Y_{it} = \beta_1 T_{it} + \alpha_1 \log(GDP\_pc)_{it} + \alpha_2 \log(density)_{it} + \alpha_3 X_{it} + \mu_i + \psi_t + \epsilon_{it} \tag{4.4}$$

where Y_{it} is the outcome for state i at time t, T_{it} is the treatment variable (1 if gender budgeting is adopted, 0 otherwise), X_{it} includes other controls, μ_i are state fixed effects, ψ_t are year fixed effects, and ϵ_{it} is the error term.

Entropy balancing is therefore an appropriate robustness check for our context, as it ensures balanced groups, handles limited untreated units, and fits well with our unbalanced panel structure and the policy variation we study.

The entropy balancing results, shown in Figure 17, confirm the main findings. They suggest that gender budgeting adoption is associated with a significant increase in the share of total spending devoted to pro-gender sectors, especially education

and infrastructure. However, consistent with the other estimators, the effect for health remains statistically weak, suggesting that improvements in this sector may require sustained investment and more time to materialize. Notably, the negative and significant result for water spending indicates that this sector may become less of a priority for adopter states once other visible or politically rewarding sectors, like infrastructure, attract more funds. This shift could reflect strategic choices by local governments under limited budget constraints, prioritizing expenditures that are more visible and electorally beneficial. Overall, these findings reinforce the robustness of our results by providing evidence that does not depend on the common trends assumption and by highlighting how gender budgeting can drive selective reallocation within the public budget.

4.5.3 Dose Response Function

To ensure the robustness of our findings, we also estimate a Dose Response Model (DRM). The DRM makes it possible to test whether the effect of gender budgeting varies with the intensity of the treatment, measured here by the duration since the first adoption. This is relevant because states that adopted gender budgeting earlier may have more experience implementing its principles and standard templates, which could reinforce its effects over time through institutional self-enforcement.

The DRM is particularly appropriate in this context as it allows us to examine the effect of a continuous treatment in the presence of possible endogenous selection, as developed by Cerulli (2015) and applied by Avenyo et al. (2019) and Janzen et al. (2023). This approach also complements and confirms the results obtained with the De Chaisemartin and d'Haultfoeuille (2020) estimator by testing the same identification strategy with a continuous version of the treatment variable. In this way, the DRM provides an additional layer of evidence to assess whether the duration of gender budgeting adoption strengthens the effects observed with binary treatment indicators.

Moreover, this framework allows us to test a learning by doing hypothesis, whereby the repeated application of gender budgeting practices and templates over time could gradually improve the alignment between fiscal allocations and gender equality objectives. The results confirm that a longer duration of gender budgeting adoption is associated with a significant increase in the share of spending allocated to pro-gender sectors, particularly education and infrastructure. The estimates also show a positive and significant effect for health spending when treatment duration is considered, while the effect for water remains statistically insignificant.

Overall, these findings support the idea that the impact of gender budgeting is reinforced over time through experience and institutionalisation, especially for priority sectors that are visible and politically salient. The detailed estimates from the DRM

are presented in Table 10 in the Appendix.

4.5.4 Placebo Test

We now examine whether there are confounding factors that could affect the results, which have remained stable so far (especially for education expenditures share). The empirical literature shows that the adoption of an economic policy is generally associated with parallel reforms, making the adoption of gender budgeting a non-random factor. One could therefore imagine that unobservable variables correlated with policy adoption and potentially with the outcome variable could affect the baseline results. While we are aware that the empirical — method used in this study aims to address these types of concerns, we still — strengthen the results by conducting a placebo test on gender budgeting adoption. To do this, we follow Apeti (2023) and Apeti and Edoh (2023) in setting placebo or arbitrary dates for gender budgeting, computed by randomly assigning gender budgeting episodes to countries in our sample after removing the actual adoption years. The main idea behind this test is that if the results are biased by unobservable variables, the placebo — test might also show significant effects. Random treatments within the sample do not affect both education and health expenditures share in total expenditures (Table 11, in Appendix). Therefore, we can rule out the possibility of confounding — factors influencing our results.

4.5.5 Anticipation effects

Always to check the robustness of our results and be sure that the effects observed are due to the treatment adoption, we change the date of the adoption to test for potential anticipation effects. An example of anticipation effects could be the fact that the reform could be discussed in newspapers years before their adoption and that there are economic or political reasons for rulers to change spending allocation before reforms. So, the anticipation effect can have an impact on the size of the outcome and the treatment effects estimation (Mertens and Ravn (2012) and Metiu (2021)) By construction, De Chaisemartin and d'Haultfoeuille (2020) use a placebo to estimate the pre-trend coefficients to assess the evolution of outcome if they were not treated. So, the fact that these coefficients are not significant during the three first periods before the adoption could mean an absence of anticipation effects.

However, we change the adoption wave date by considering that the treatment has been adopted two years before the effective date of adoption to test the presence or not of anticipation effects. The results obtained by using Callaway and Sant'Anna (2021) are presented in the appendix section at the table 16.

The results show a non-significant effect for our alternative adoption waves. We can conclude that an absence of anticipation effects of gender budgeting adoption on

the "pro-gender" public spending allocation. However, we found an existing anticipation effect for education allocation spending. This effect is less important than the effect after the adoption, and the anticipation effect didn't seem to explain all the results for education spending allocation.

4.5.6 Narrowing the control window

Finally, the effect captured in this work may suffer from some problems. Indeed, gender budgeting adoption can lead to a change in States' environments. In this sense, the effect captured may not be due to gender budgeting but to changes in institutional, political, social, or economic conditions after its adoption. Also, any other characteristic that may determine gender budgeting adoption may be a source of endogeneity. To circumvent these problems, we employ a similar approach as Neuenkirch and Neumeier (2015), Apeti (2023), and Apeti and Edoh (2023) by removing all observations before and after the initial year of adoption. Thus, we expect that this narrow time window characterizing our new treatment variable should provide a more robust estimate of its effect on public expenditures since the (generally slow-changing) institutional, political, social, and economic environment is more likely to be stable over a narrow time window. In total, we explore the robustness of our findings with two modifications to the sample period. In addition to the first adoption period, we consider (i) a window of five years around it, and (ii) a window of three years around it.

Using entropy balancing with this narrow time window, table 13 provides results that reinforce our previous findings. Thus, we can conclude that it seems unlikely that the estimated effects of gender budgeting are due to a coincidental change in the institutional, political, social, and economic environment in the gender budgeting adopters States' or to any other characteristics that may predict its adoption.

4.6 Microeconomic Effects

Beyond the effects that gender budgeting adoption can have on fiscal policy strategies and how it led to an increase of fiscal space dedicated to gender issues, we tried to assess how this can affect women daily lives. For example, Clots-Figueras (2011) finds that politicians' gender affects policy, but that their social position, i.e., their caste, should be consider as well. Female legislators in seats reserved for lower castes and disadvantaged tribes invest more in health and early education and favor "women-friendly" laws, such as amendments to the Hindu Succession Act, which was designed to give women the same inheritance rights as men. They also favor redistributive policies, such as land reforms. In contrast, female legislators from higher castes do

not have any impact on "women-friendly" laws.

In addition, India is a very large country with very large states. Indeed, some Indian states like Rajhastan are greater and more populous than countries like Finland, Norway, or Ivory Coast. So, it could be interesting to check the potential effect at the very local and individual level. It's also important to notice that gender budgeting seems to become bottom-up approach. That means it is not the allocation of resources in the budget at national and or state levels that has to see but the resources that flow to and are available to women at the field level i.e. the women in the villages, cities and towns of the country that need to be monitored (Sharma and Garg (2014)). To measure the effect of this policy reform of women empowerment and/or gender equality, we used intimate partner violence (IPV) as a measure of gender equality evolution and women empowerment. Indeed, we assumed that an improvement of women empowerment will lead to a decrease of the likelihood to accept or agree with IPV. Schuler and Nazneen (2018) findings suggest that women's empowerment has evolved in several ways that may be contributing to reductions in IPV: in its magnitude (for example, many women are earning more income than they previously did), in women's perceived exit options from abusive marriages, in the propensity of community members to intervene when IPV occurs, and in the normative status of empowerment (it is less likely to be seen as transgressive of gender norms). Dalal (2011) shows that economic empowerment is not the sole protective factor. Economic empowerment, together with higher education and modified cultural norms against women, may protect women from IPV. By focusing on the education and integrating ender issues into fiscal policy strategies and reflexion gender budgeting can help to reduce IPV. So, it could be an interesting outcome to assess the microeconomic effect (on women) of gender budgeting adoption.

4.6.1 Data and empirical strategy

Data on IPV come from the *Data Health Survey* (DHS), which have been conducted in Indian states since the 1990's. The DHS household surveys typically interview a representative sample of between 10,000 to 20,000 women (aged 15-49) and men (aged 15-59). By collecting answers about IPV among others from representative samples of the population, the DHS Program provides representative estimates of IPV tolerance rates among Indian states.

To assess the microeconomic effects of gender budgeting adoption, we use the three last waves of *Data health survey*. This choice is due to the availability of data about IPV tolerance from the respondents. We also merge the DHS repeated cross sections dataset with the previous dataset with macroeconomic indicators at states level. This process leaves me with a dataset combining macro and micro indicators

for a sample of around 75,000 women in 31 Indian States/UT The use of many waves allows to consider a potential time effect on the IPV tolerance among states and check the effect of the time since the first adoption wave.

The next table summarizes the main variables used for our probit regression analysis on the microeconomics effects of gender budgeting adoption.

Table 6: Summary statistics

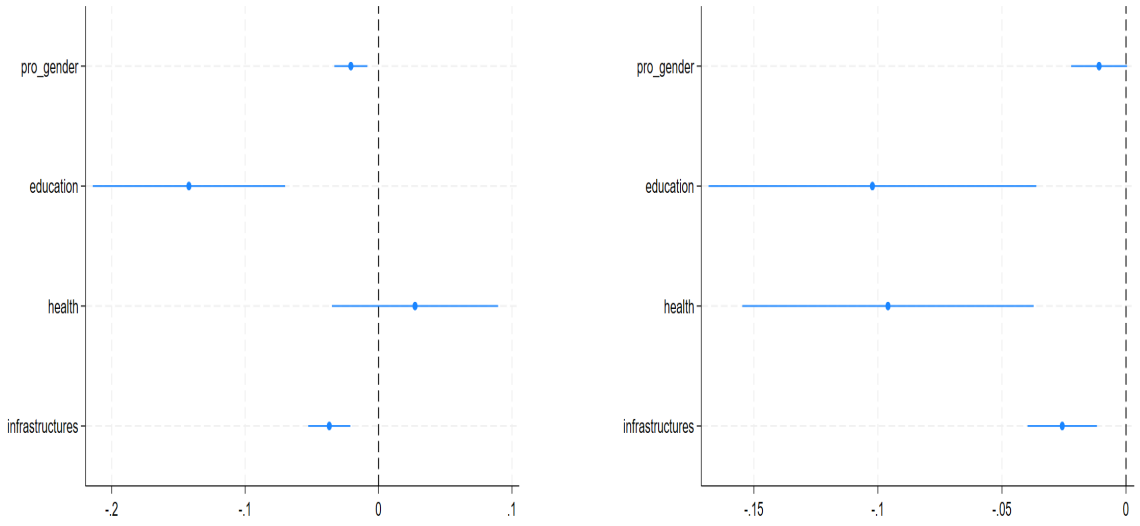
Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
Domestic violence against wife:					
unfaithful	0.248	0.432	0	1	38483
disrespect	0.357	0.479	0	1	38540
roof materials	37.065	18.292	11	97	38540
number of children	2.36	1.345	0	14	45467
backward class or casts	2.585	1.089	1	8	43729
religion	2.628	10.637	1	96	45467
log(gdp per capita)	11.354	0.474	10.278	12.728	37669
urbanization	34.182	13.18	9.83	71.400	35257
women in parliement	48.546	1.637	44.47	52.49	37657
log(population)	3.344	1.731	-0.635	5.476	35257
dose	4.76	5.421	0	15	45467
partner education	2.624	1.588	0	8	74021

The dependent variable is a binary variable coded as 1 (if the respondent considers as normal to beat a wife for specific reasons regardless of high or low intensity) and 0 (otherwise). The variable of interest is the time (in year) since the first implementation of gender budgeting (to measure the intensity of the treatment). Given the qualitative nature of the dependent variable, the preferred estimation method for estimating equation (1) is the probit model. Compared to the linear probability method and the logit model, the probit model is the most effective and efficient in estimating the qualitative model. For the variable of interest, we used the share of so called "pro-gender" spending and its components to ensure that this increase of the fiscal space dedicated to these items can effectively improve the women situation and help to their empowerment. Unlike the linear model, the coefficients from the Probit model estimations are not directly interpretable. They are interpreted in terms of marginal effects. The sign and significance of the parameters provide an indication of the impact of explanatory variables on the probability of observing the dependent variable's occurrence. The relevance of the identification strategy is verified through sensitivity analysis.

4.6.2 Results

The results suggest a negative effect of pro-gender and education public spending increase on the likelihood for a woman to consider as acceptable some Intimate Partner Violence (IPV) for unfaithful and disrespect. Women are also less likely to agree with the fact that their partners have sexual relationship with other women. The women who live in states that have implemented gender budgeting seem to be more aware of their rights. The results seem to be more important with the increase of public spending education spending.

The next graphs summarize the results for both outcomes.



(a) Marginal effect on IPV for unfaithful (b) Marginal effect on IPV for disrespect

Figure 7: Marginal effects of pro-gender public spending on IPV

The tables 15 and 16 available in appendix also show the results from a numerical point of view.

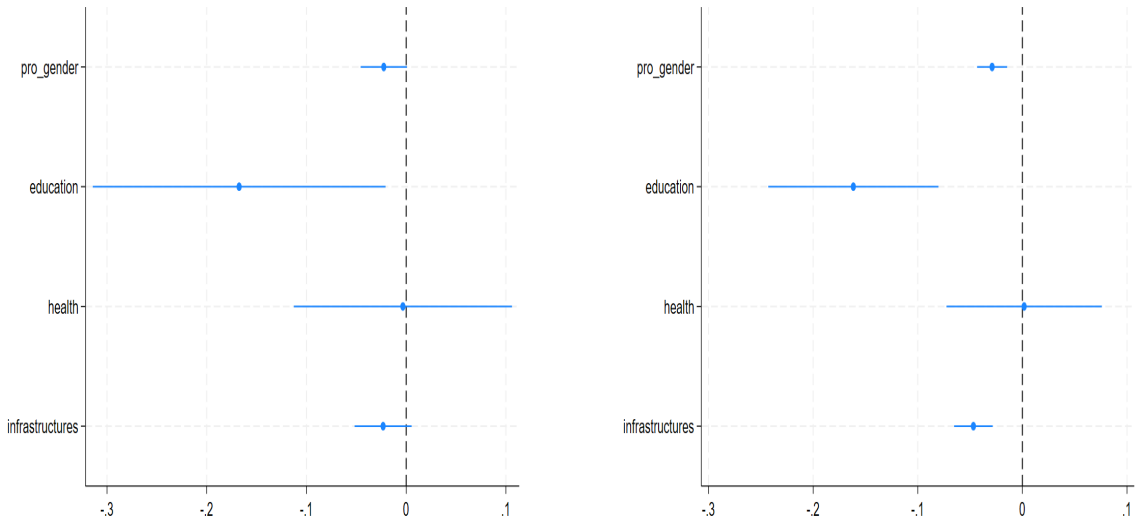
4.6.3 Sensitivity Analysis

To assess the potential factors that can affect women's empowerment, we conducted a sensitivity analysis to see if living areas or educational attainment could influence my results. Indeed, living areas could significantly impact the effectiveness of gender budgeting. In rural regions, implementing and monitoring gender budgeting can pose challenges due to limited infrastructure, lower administrative capacity, and potential lack of awareness or political will. Additionally, funds designated for gender-focused initiatives may disproportionately benefit urban areas where resources and administrative capabilities are more concentrated. This potential urban bias can lead to an unequal distribution of benefits, undermining efforts to address gender dispari-

ties in rural communities. Consequently, the intended outcomes of gender budgeting—such as improved access to education, healthcare, and economic opportunities for women—may not be fully realized in rural areas, exacerbating existing inequalities (Bhana (2010)). So, it could be interesting to check if this factor among others can affect my results.

To examine these effects, we recompute the same equation, first using only observations from urban areas and then from rural areas. This allows me to determine if the results remain significant in both contexts and to compare the magnitude of these effects between urban and rural areas. By isolating urban and rural observations, we can assess whether the implementation and impact of gender budgeting differ across these living areas, providing insight into any disparities and helping to tailor more effective gender-focused policies for each context.

The next graphs (8a and 8b) summarize the results for IPV because of unfaithful from women and show that the effects remain positive and significant in both areas and are mainly driven by education public spending increase.



(a) Marginal effect on IPV in urban areas (b) Marginal effect on IPV in rural areas

Figure 8: Marginal effects of pro-gender public spending on IPV because of unfaithful

The tables available in appendix also show the results from a numerical point of view.

The results indicate that both overall pro-gender spending and education significantly impact domestic violence rates. However, spending on infrastructure, particularly roads and bridges, is notably more significant and exerts a stronger effect in rural areas. This heightened impact can be attributed to several factors. Firstly, improved roads and bridges enhance accessibility to essential services, such as healthcare and

law enforcement, which are crucial in addressing and preventing domestic violence. Secondly, better transportation networks facilitate economic opportunities, reducing financial stress and associated violence. Lastly, enhanced infrastructure promotes social connectivity and support networks, which are vital in rural areas where isolation can exacerbate domestic violence situations. Therefore, infrastructure improvements in rural regions could play a critical role in mitigating domestic violence.

Education spending is also significant and exerts an important effect in rural areas. This heightened impact can be attributed to several factors. Firstly, improved education enhances awareness and understanding of domestic violence, equipping individuals with the knowledge to address and prevent it. Secondly, better educational opportunities lead to economic empowerment, reducing financial stress and associated violence. In urban areas, education fosters diverse social connectivity and support networks, while in rural areas, it mitigates isolation that can exacerbate domestic violence situations. Therefore, education improvements play a critical role in mitigating domestic violence across both urban and rural regions.

In the next section, we have tried to check the potential transmission channels that can explain my results

4.7 Transmission channels

To identify the potential transmission channel, we built a ratio of *Centrally Sponsored Schemes* (CSS) on the State revenues and State expenditures. This construction aims to check if the increase in health and education expenditures can be due to an increase in transfers received by each state. Indeed, *Centrally Sponsored Schemes* are some transfers decided by central ministries and spent for some specific purposes such as education and health (which is on a *Concurrent List* between States and Central government). We are not able to collect data about the different schemes and only keep those related to health and education. The variables are summarised just below.

Table 7: Transmission channel

	CSS(% of revenues)	CSS (% of expenditures)	Credibility
Before adoption	4.08	4.18	4.13
After adoption	5.82	6.05	6.51
Non Gender Budgeting	4.54	4.60	5.33

We try to estimate the potential transmission channels by using the same process as Neuenkirch and Neumeier (2016) We compute the means of the two variables

for (a) the treatment group during times when gender budgeting is in place, (b) the treatment group focusing only on years before gender budgeting implementation, and (c) our synthetic control group obtained via entropy balancing. The results are outlined in table 7 just above. The descriptive statistics indicate some differences between the control group obtained via entropy balancing and states which apply gender budgeting. When comparing the control group to the treatment group before gender budgeting was applied, however, we find that the latter is characterized by a notably greater share of CSS for both measures.

Indeed, before the treatment, the treated units received less CSS in the percentage of revenues (4.08% versus 4.54%) and expenditures (4.18% versus 4.60%) than the non-adopter ones, but the situation became different after the adoption for revenues (5.82 vs 4.54) and expenditures (6.05 vs 4.60).

However, we can't conclude from this statistical test that gender budgeting adoption reduces the state's autonomy. The increase of CSS received by the States can be due to the wish of the central government to fund some projects decided by State governments to reach their objectives, but it can also be an incentive to adopt gender budgeting and mean for the central government to influence the state's decisions. We can only conclude that an increase in CSS received by the States could be a potential transmission channel to explain the greater share of health and education expenditures for the adopter States.

We also compute a kind of credibility index. To do it, we compute the difference between the share of "pro-gender"expenditures expected in the budget announcement and the share of "pro-gender"expenditures in the States financial account. We have assumed that this bias index will allow us to apprehend the performance of subnational administration. The differences between forecast and realization are possible and usual, but a systematic and important difference may mean a lower level of performance in its administration. We compute it as an absolute value. *The absolute value refers to the fact that we multiply the negative value by -1 to get only positive values* to consider the distance (bias) between the forecast and the realization. We made it because a systematic underestimation of expenditures in the forecast could be good news in terms of available funding, but it's not good news from the credibility and local administration capacities point of view. The credibility index is computed as:

$$Bias_{it} = \left(\frac{Pro\_gender_{it}}{Total\_expenditure_{it}} - \frac{Pro\_gender\_expected_{it}}{Total\_expenditure\_expected_{it}}\right) * 100 \qquad (4.5)$$

Where $Pro\_gender\_expected$ represents the expenditures previously considered as "pro-gender"in the budget announcement. They are expressed as a percentage of To-

tal expenditures also expected in the budget announcement (*Total_ Expenditures_ expected*).

However, to make it easy to interpret and more intuitive, Itransform it under the form:

$$credibility_{it} = \frac{1}{Bias_{it}} \tag{4.6}$$

The results available in table 7 also suggest that Gender Budgeting adopters seem to become more credible than non-adopters.

As part of our analysis of potential transmission channels at microeconomic level, we conducted probit regressions to assess how the implementation of gender budgeting and the time since its adoption affect individuals' sources of information, particularly regarding family planning, which pertains to women's reproductive health. These sources of information are crucial as they enable women to make informed decisions and choices about their bodies. Given this context, examining these choices as an output is both relevant and necessary for understanding the broader impact of gender budgeting on women's autonomy in reproductive health decisions. The next graph (9) shows that individuals residing in states that have adopted gender budgeting are more likely to receive information about family planning through radio, newspapers, and television. This result may reflect a genuine commitment by these adopting states to implement measures that uphold their commitments and maintain credibility in their public announcements.

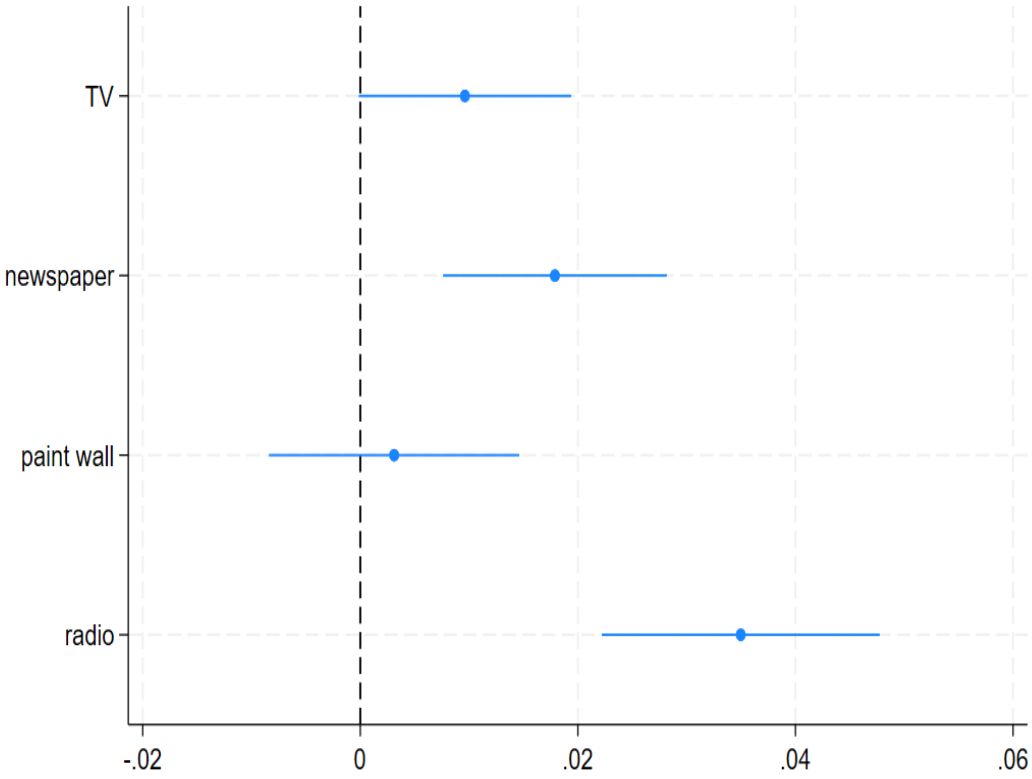


Figure 9: Marginal effects of gender budgeting adoption on information access

4.8 Conclusion

This paper has examined how the adoption of gender budgeting influences the composition of public spending in Indian states over the period 1991–2020, with particular attention to the share of resources allocated to so-called pro-gender sectors. The analysis started from the observation that while gender inequalities persist, the practical effectiveness of gender budgeting in reshaping budget priorities at the local level remains insufficiently studied. To address this, the paper combined a theoretical framework based on a principal-agent relationship and the role of transparency with an empirical strategy that uses multiple identification methods.

Using a range of Difference-in-Differences estimators adapted to staggered adoption, an entropy balancing approach to address possible selection bias and pre-trend concerns, and a Dose Response Model to capture the effects of treatment intensity over time. We provide robust evidence that states implementing gender budgeting tend, on average, to devote a greater share of their budgets to sectors such as education and infrastructure. The findings for health spending remain more modest, while spending on water appears less prioritized or even reduced in relative terms, suggesting that not all sectors are equally affected by this reallocation.

These results confirm that gender budgeting can translate into concrete shifts in fiscal policy, particularly when supported by clear reporting requirements and ongoing assessment mechanisms that enhance governments' credibility. The study also shows that these spending reallocations are not merely symbolic but can be linked to micro-level improvements, including changes in attitudes towards women's rights and a decline in the acceptance of domestic violence. This highlights the potential of fiscal policy tools, when combined with transparency, to influence not only budget structures but also social outcomes (Samarakoon and Parinduri (2015) and Polzer et al. (2021)).

From a research perspective, this paper contributes by documenting the concrete budgetary consequences of gender budgeting in a large federal setting where states have significant discretion over public spending. It demonstrates the value of using multiple complementary estimation strategies to test the robustness of results when policies are rolled out at different times and with varying degrees of intensity.

In terms of policy, the findings suggest that gender budgeting can help align declared gender equality goals with actual spending decisions, provided transparency mechanisms are credible and effectively implemented. However, the results remain limited to the sectors and channels examined, and broader questions about fiscal autonomy and intergovernmental relations in India merit further investigation.

Future work could deepen this analysis by exploring additional transmission mechanisms, such as the role of local political competition, administrative capacity, or citizen participation in budget monitoring. Examining how repeated use of gender budgeting reinforces institutional learning and affects longer-term development outcomes would also be valuable.

Overall, this paper shows that gender budgeting, when genuinely adopted and accompanied by credible transparency tools, can help redirect public spending toward sectors that advance gender equality and deliver tangible benefits for local populations.

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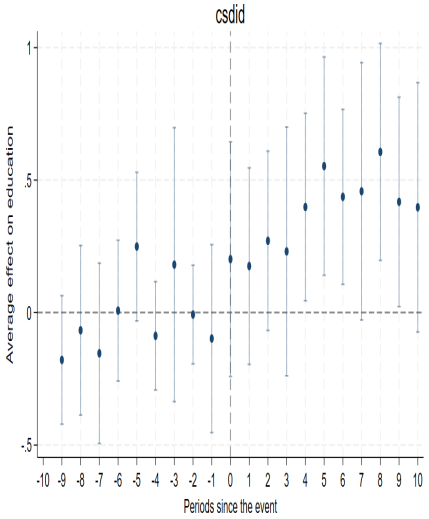
4.9 Appendix

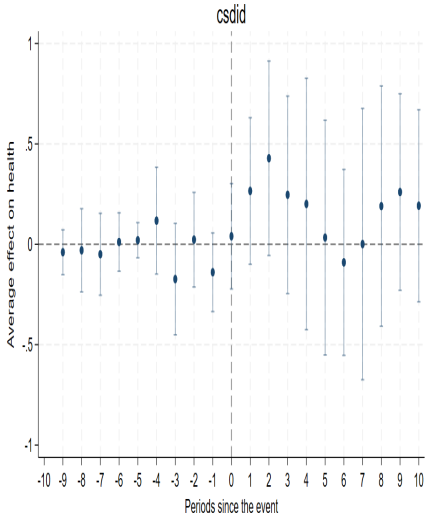
4.9.1 Staggered DiD

Callaway

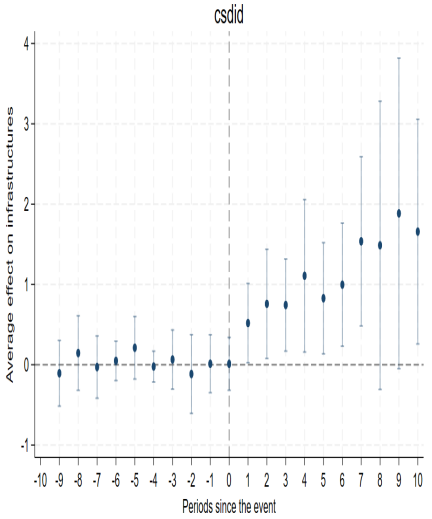
Figure 10: Visual results of Callaway and Sant'Anna



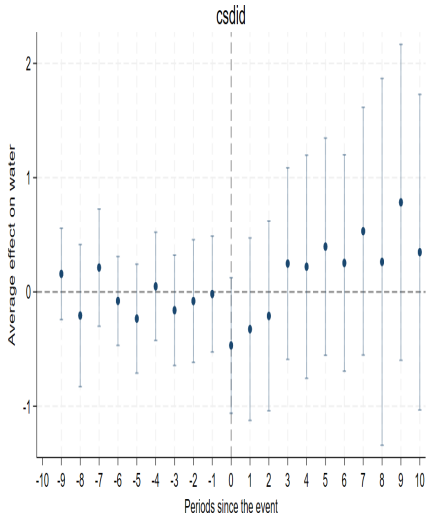
(a) Event study for education



(b) Event study health



(c) Event study infrastructures



(d) Event study water and sanitation

Figure 11: Event study for "pro-gender" components (Callaway and Sant'Anna (2021))

Wooldridge

Table 8: Wooldridge Diff in Diff results

	pro-gender	Education	Health	Infrastructures	Water
gender budgeting	1.151 *	0.387 ***	0.0921	0.912***	-0.229
	(1.68)	(5.02)	(0.51)	(3.47)	(-0.60)
Observations	668	668	668	668	668

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

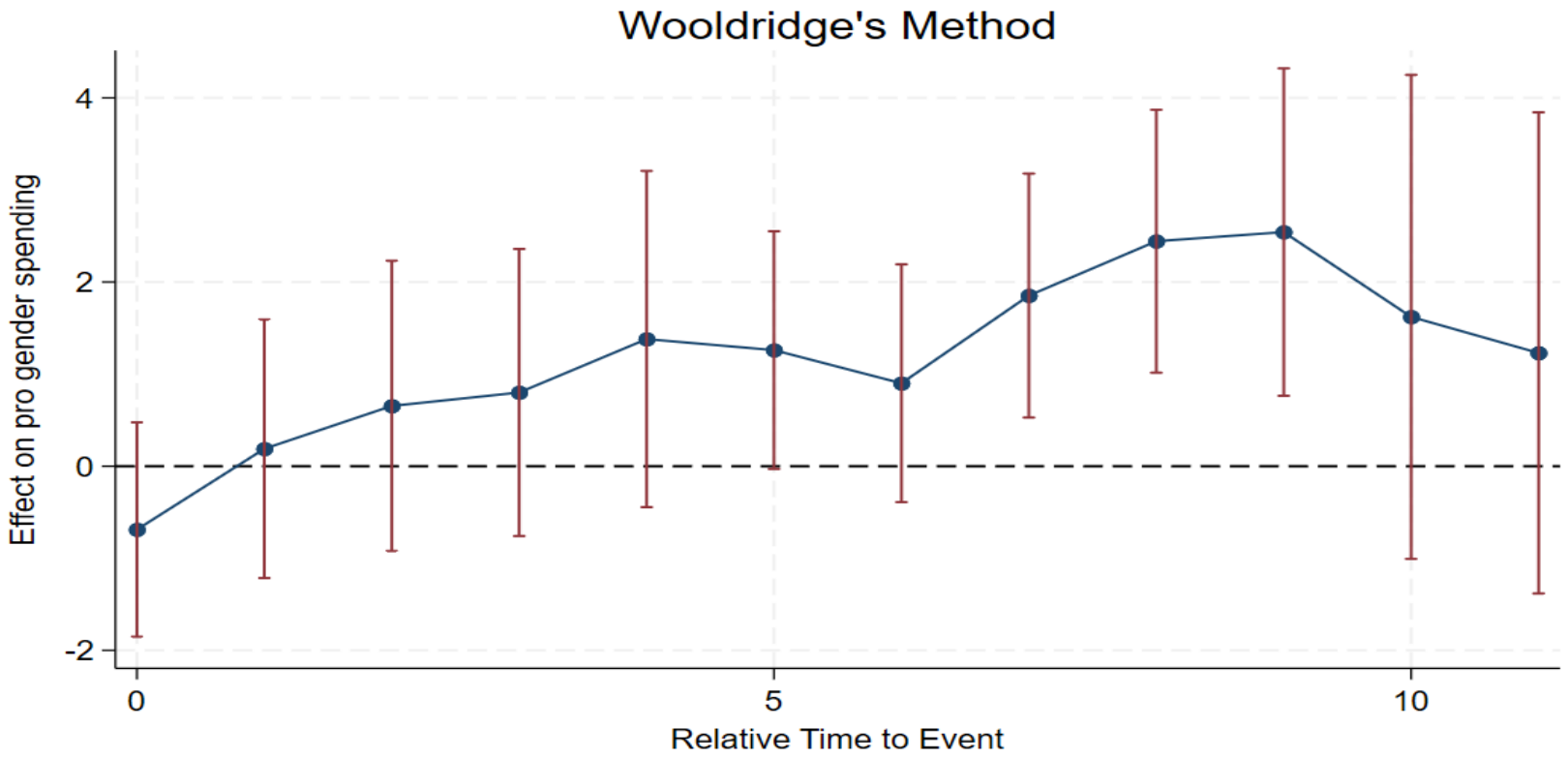


Figure 12: Results for Wooldridge estimator

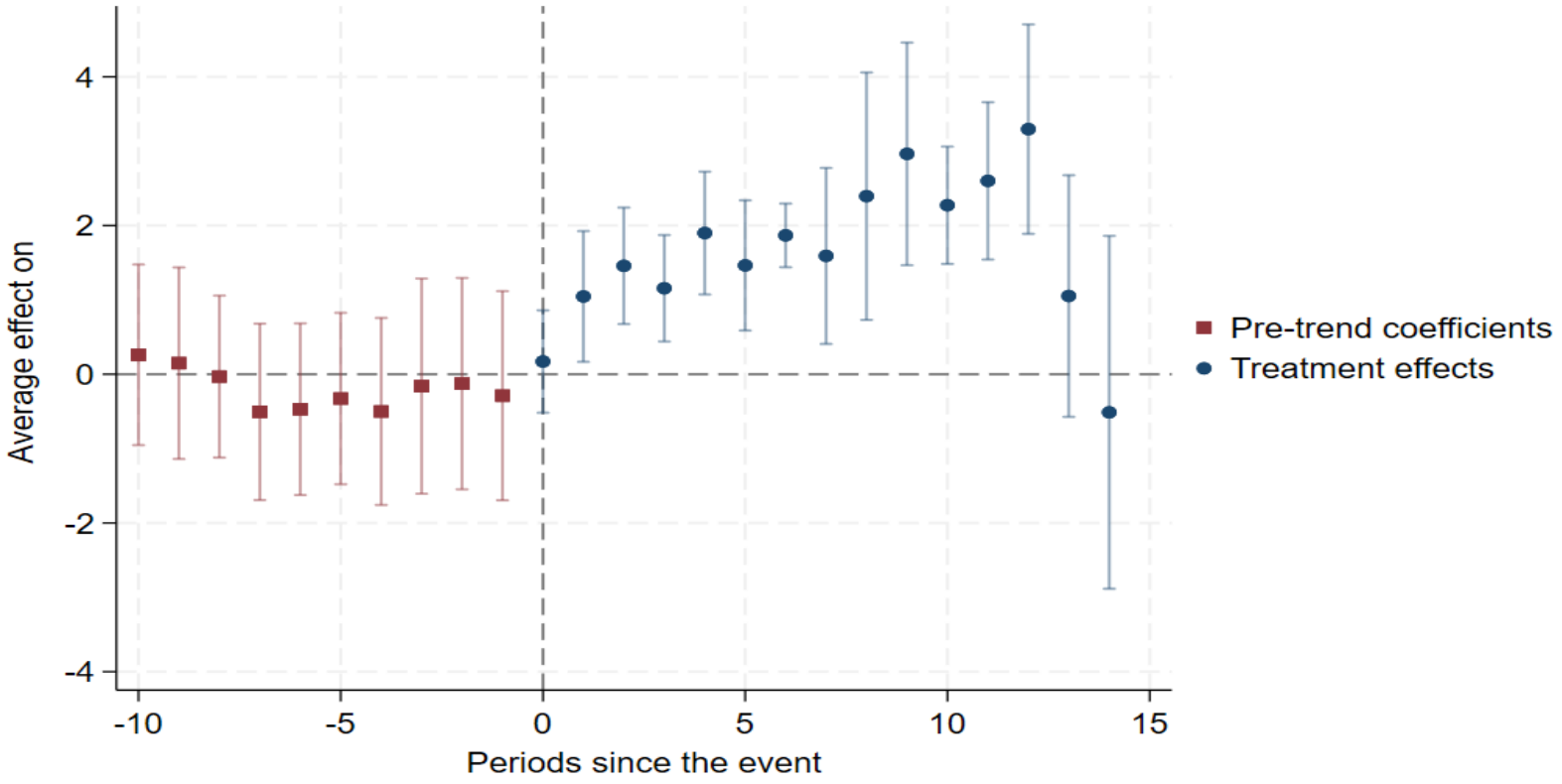


Figure 13: Event study results for "pro-gender"spending

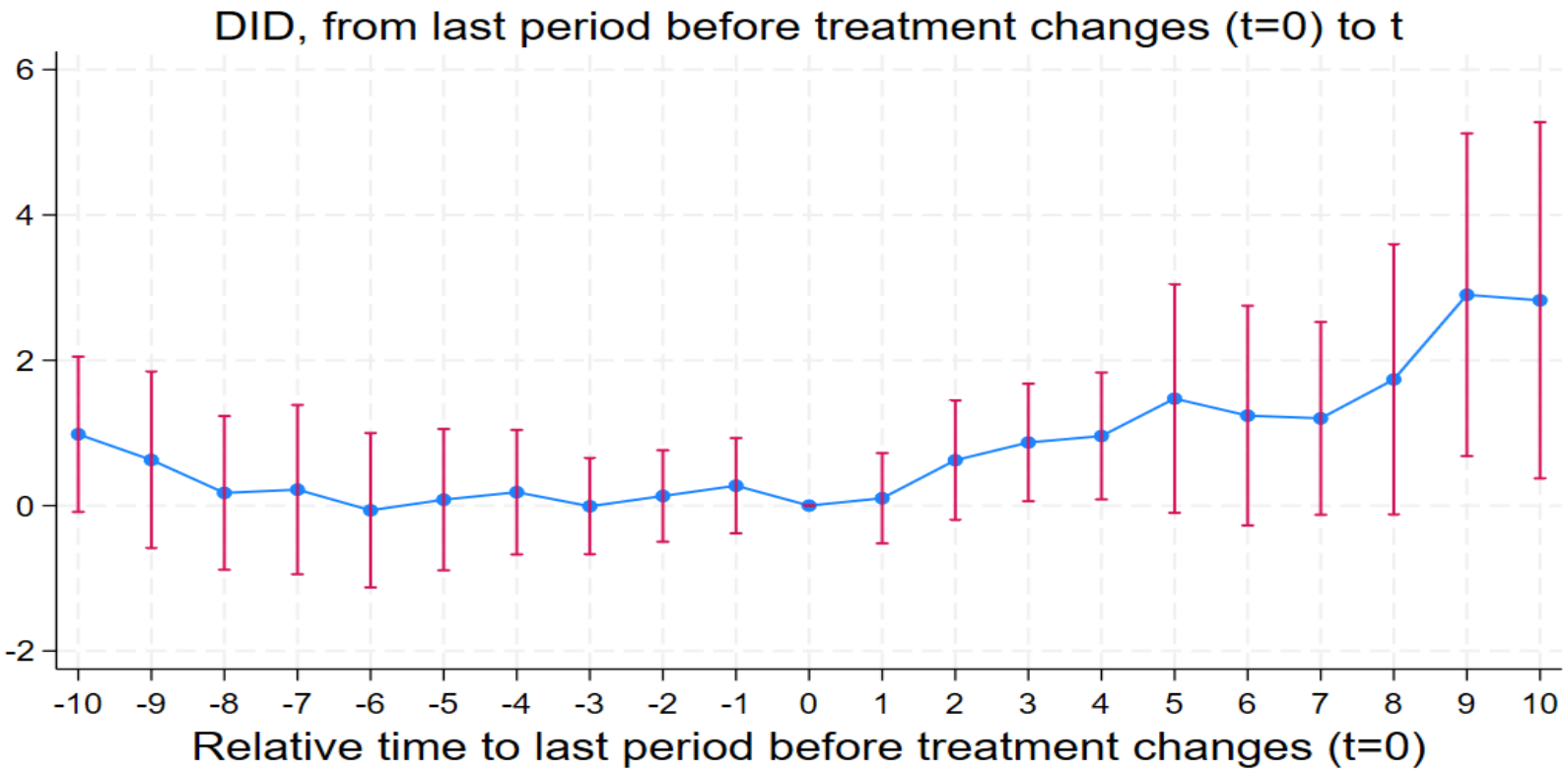


Figure 14: Event study results for "pro-gender"spending

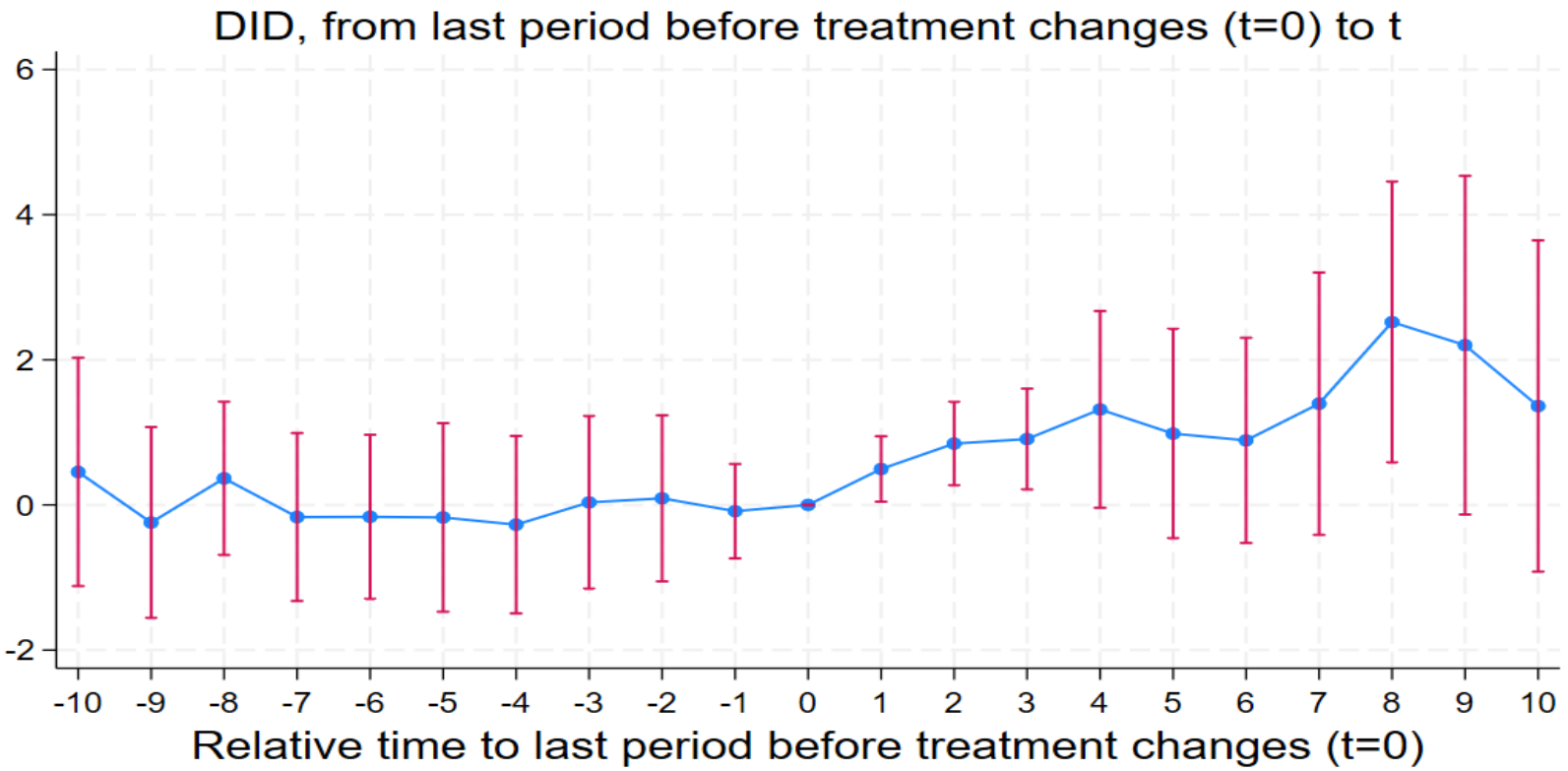


Figure 15: Event study results for "pro-gender"spending with continuous treatment

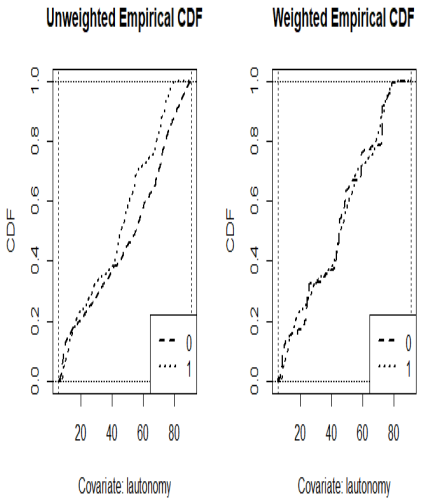
4.9.2 Entropy balancing

Correlation issue

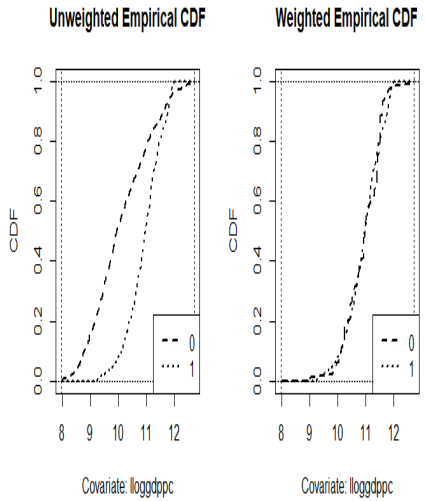
Table 9 shows a simple comparison of pre-weighting sample means of all matching covariates between treated (Column [2]) and control (Column [1]) states, which represent the potential synthetic group. Column [5] shows significant differences between the two groups for all pre-treatment variables, as some p-values are below the threshold of 5%. Such differences could bias the true treatment effect due to a potential selection problem. Therefore, in Panel B (Column [1]), we compute a synthetic control group by re-weighting the control units, using the pre-treatment covariates from the benchmark specification. This approach allows us to make the means of the pre-treatment covariates of the synthetic group as comparable as possible to those of the treated units. As can be seen in Column [5] of Panel B, the weighting eliminated any significant pre-treatment difference between the means of the treated and synthetic covariates. Thus, we can consider the synthetic group as a perfect counterfactual of the treated group.

Table 9: Balance statistics for covariates before and after matching

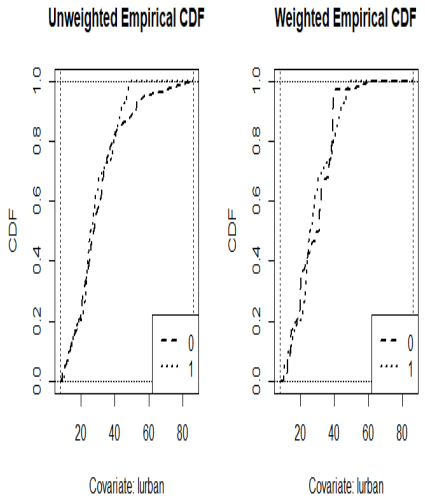
Variable	treated	untreated	Difference	t statistics	p-value
Unweighted Balance Statistics:					
	(1)	(2)	(3)	(4)	(5)
l.autonomy	43.81	49.79	-5.98	2.4375	0.0156
l.log(gdp per capita)	10.77	9.98	0.79	-11.2868	0.0000
l.urbanization	27.65	29.54	-1.89	1.6248	0.1054
trend	22.76	14.18	8.58	-18.3878	0.0000
l.local_women in parliament	48.46	48.67	-0.21	1.1481	0.2524
fiscal_rule	1.00	0.39	0.61	-26.46481	0.0000
l.agriculture (% GDP)	27.33	31.13	-3.80	2.4178	0.0162
l.log(population)	20.97	20.84	0.13	-19.3786	0.0000
Weighted Balance Statistics:					
	(1)	(2)	(3)	(4)	(5)
l.autonomy	43.81	43.80	0.01	0.003	0.9922
l.log(gdp per capita)	10.77	10.77	0.00	0.058	1.000
l.urbanization	27.65	27.65	0.00	0.015	0.9473
trend	22.76	22.72	0.04	0.080	1.000
l.local_women in parliament	48.46	48.46	0.00	0.776	0.8738
fiscal_rule	1.00	1.00	0.00	0.011	1.000
l.agriculture (% GDP)	27.33	27.33	0.00	0.096	0.9919
l.log(population)	20.97	20.96	0.01	-0.038	1.000



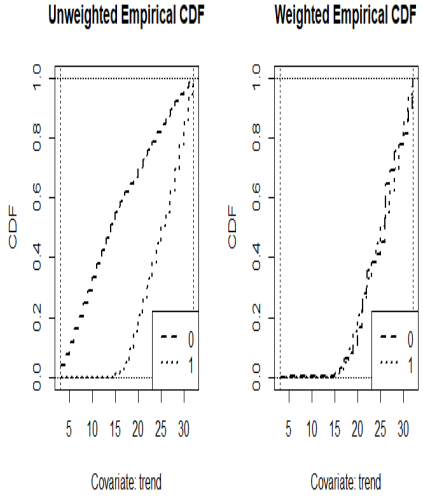
(a) Autonomy reweighted



(b) GDP per capita (log) reweighted



(c) Urbanization reweighted



(d) Trend reweighted

Figure 16: Entropy balancing results

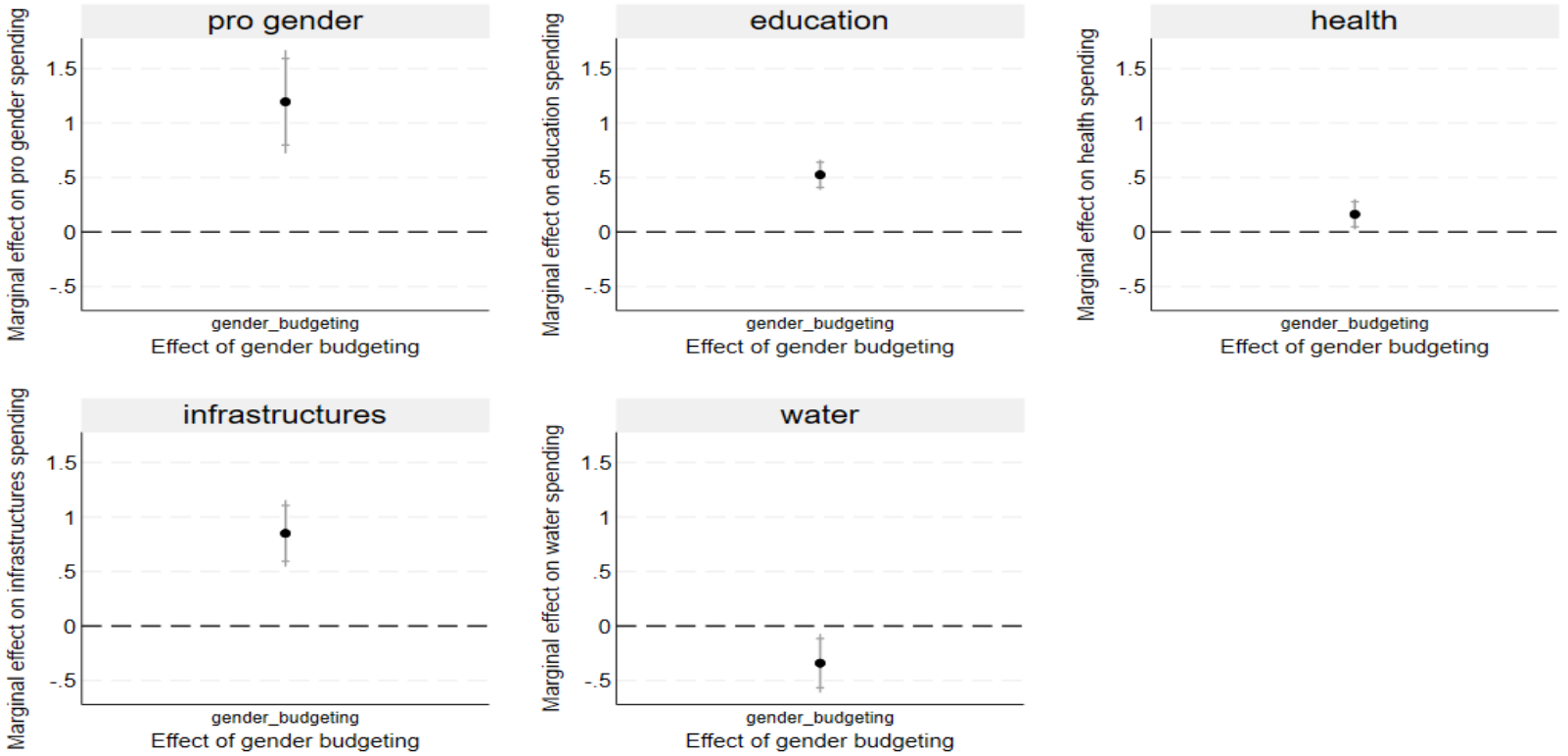


Figure 17: Entropy balancing Results

4.9.3 Dose response model

Table 10: Dose Response Model results

	(1)	(2)	(3)	(4)	(5)
	pro_gender	education	health	infrastructures	water
gender_budgeting	2.077***	0.612***	0.510**	0.731***	0.237
	(0.556)	(0.200)	(0.190)	(0.244)	(0.319)
N	668	668	668	668	668
R^2	0.245	0.148	0.279	0.225	0.139

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.9.4 Placebo Test

Table 11: Placebo test Results for components

	(1)	(2)	(3)	(4)	(5)
	pro_gender	education	health	infrastructures	water
placebo	0.106	0.0735	0.0224	0.0805	-0.0665
	(0.169)	(0.0553)	(0.0427)	(0.106)	(0.100)
N	668	668	668	668	668
R^2	0.435	0.242	0.242	0.242	0.207

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.9.5 Anticipation effects

Table 12: Anticipation effects results

	pro-gender	Education	Health	Infrastructures	Water
ATT	0.640	0.293*	-0.117	0.444	0.0239
	(0.94)	(1.91)	(-0.49)	(1.55)	(0.06)
Observations	668	668	668	668	668

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.9.6 Narrowing the control window

Table 13: Results for narrowing -3 ; +3

	pro-gender	Education	Health	Infrastructures	Water
gender_budgeting	1.456***	0.298***	0.184**	1.443***	-0.410
	(3.60)	(3.83)	(2.27)	(5.93)	(-1.32)
Observations	166	166	166	166	166

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Results for narrowing -5 ; +5

	pro-gender	Education	Health	Infrastructures	Water
gender_budgeting	1.551***	0.325***	0.153*	1.465***	-0.327
	(4.02)	(4.27)	(1.90)	(6.09)	(-1.13)
Observations	180	180	180	180	180

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

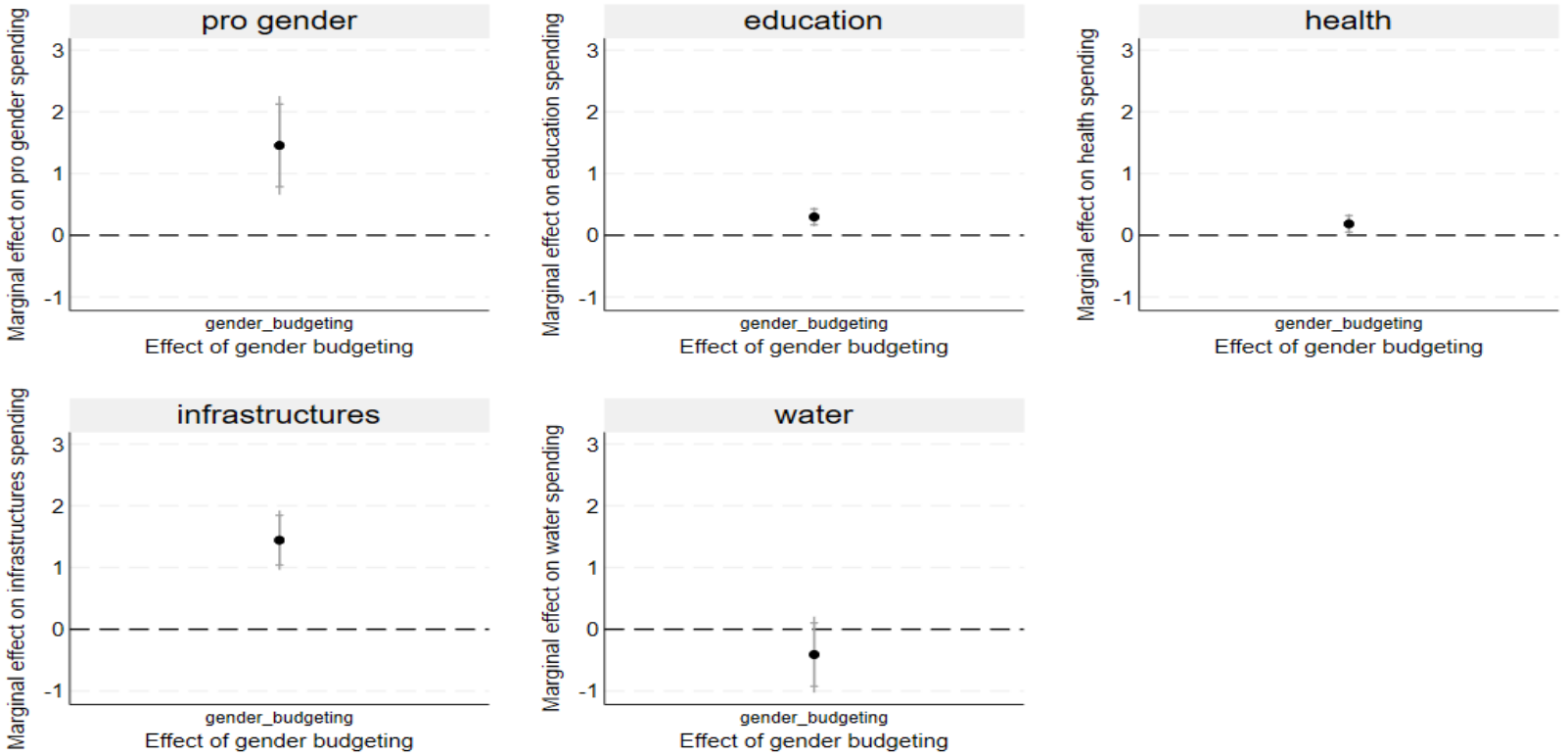


Figure 18: Results for a 3 years around period

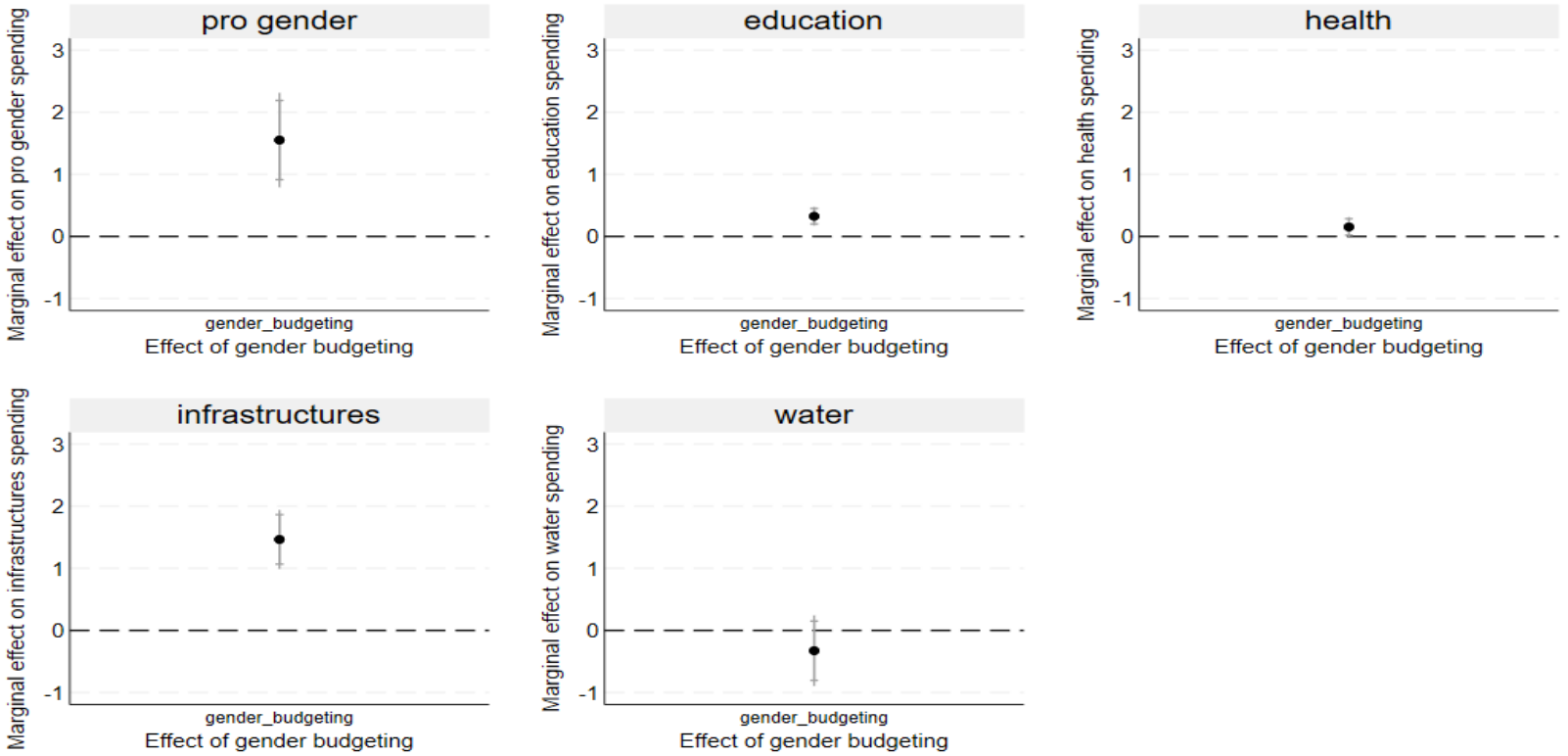


Figure 19: Results for 5 years around period

4.9.7 Microeconomic effects

Table 15: Marginal effect on IPV due to unfaithful

	pro-gender	education	health	infrastructure
justifies domestic violence: wife unfaithful				
pro_gender	-0.0208***			
	(-3.29)			
education		-0.142***		
		(-3.86)		
health			0.0273	
			(0.86)	
infrastructures				-0.0369***
				(-4.58)
N	49294	49294	49294	49294

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 16: Marginal effect on IPV due to disrespect

	pro-gender	education	health	infrastructure
justifies domestic violence: wife disrespect				
pro_gender	-0.0109*			
	(-1.89)			
education		-0.102***		
		(-3.03)		
health			-0.0959***	
			(-3.20)	
infrastructures				-0.0257***
				(-3.60)
N	49351	49351	49351	49351

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Marginal effect on IPV due to unfaithful in urban areas

	pro-gender	education	health	infrastructure
pro_gender	-0.0225*			
	(-1.89)			
education		-0.167**		
		(-2.24)		
health			-0.00329	
			(-0.06)	
infrastructures				-0.0231
				(-1.58)
N	11625	11625	11625	11625

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: Marginal effect on IPV due to unfaithful in rural areas

	pro-gender	education	health	infrastructure
pro_gender	-0.0289***			
	(-3.95)			
education		-0.162***		
		(-3.89)		
health			0.00167	
			(0.04)	
infrastructures				-0.0468***
				(-4.98)
N	38037	38037	38037	38037

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Chapter 5

When gender meets efficiency: Impact of GRB on health spending in India

Do gender lenses make public spending more effective? This paper assesses the impact of gender-responsive budgeting (GRB) on the efficiency of health spending in Indian states from 1997 to 2020. Using efficiency measures of budget allocation, it finds that states adopting GRB achieve higher spending efficiency by strengthening administrative capacity and improving the accuracy of fiscal forecasts. These gains translate into more credible and effective resource allocation. At the micro level, GRB is linked to lower pregnancy loss and broader access to formal health insurance. Overall, the results highlight GRB as a lever for fiscal discipline and social progress, demonstrating how embedding gender in budget processes enhances governance quality inclusive development.

5.1 Introduction

Gender inequalities continue to persist worldwide, prompting governments to adopt gender budgeting as a strategy to reduce these disparities. Beyond its direct goal of addressing gender gaps, Gender Budgeting (GB) also brings a crucial but often overlooked dimension: it requires greater transparency from governments. By publishing gender budgeting statements, governments make detailed information about spending priorities and gender impacts accessible to the public, which helps reduce the information asymmetry between citizens and policymakers. This transparency can strengthen public scrutiny, enhance trust, and ultimately improve the quality and effectiveness of public spending and policies (Chen et al. (2019); Chan and Karim (2012); De Simone et al. (2019); Montes et al. (2019) and Gavazza and Lizzeri (2009)). At the local level, where governments are closest to communities, gender budgeting plays an even more relevant role. Local authorities can tailor spending to better meet the specific needs of women and marginalized groups in their territories, while increased transparency ensures that citizens can hold these authorities accountable. In this way, gender budgeting not only promotes gender equality but also fosters better governance and more responsive local institutions.

Existing research on gender budgeting has mainly focused on the ideal conditions for its adoption, highlighting political commitment, institutional capacity, and the role of gender-sensitive policies in driving positive outcomes (Chakraborty (2016) and Stotsky and Zaman (2016)). Few or no studies examine how gender budgeting can lead to better resource allocation and increased funding for programs targeting gender equality. However, this literature rarely explores how the implementation phase translates into concrete improvements in the quality of public spending. There is a clear gap in understanding how gender budgeting affects the performance and efficiency of local governments beyond the question of budget reallocation or general effectiveness. Moreover, the interplay between macro-level strategies and micro-level outcomes is often neglected, leaving important questions unanswered about how national frameworks translate into local results. Crucially, no existing study has examined how the transparency embedded in gender budgeting frameworks can influence spending efficiency — that is, how governments can achieve better results with the same resources. Yet, transparency is a core element of gender budgeting: by publishing gender budgeting statements, governments can make their spending priorities and gender impacts visible, enabling citizens to hold them accountable and demand better performance. However, this transparency is not automatic nor guaranteed. In some countries, gender budgeting reports remain confidential and are not shared with the public, limiting the potential to reduce information asymmetries and enhance scrutiny. This incom-

plete transparency means that the positive effect on spending quality and efficiency cannot be assumed but must be empirically tested. Understanding whether and how transparency within gender budgeting frameworks improves the efficiency of local governments is therefore essential to fully grasp the transformative potential of this policy tool.

This research investigates how gender budgeting, by requiring greater transparency, can improve the efficiency of local health spending and translate into better service delivery and outcomes at the micro level. Health is one of the most decentralized sectors in India, with States playing a key role in financing, delivering, and regulating public health services. Given the persistent disparities in health outcomes across Indian States, evaluating how gender budgeting influences the efficiency of health spending offers critical insights into both fiscal performance and social impact. Moreover, improvements in health systems have direct implications for women's well-being, especially in maternal and child health, making this sector particularly relevant in a gender-sensitive fiscal analysis. At the macro level, it examines whether transparency helps local governments to be more efficient in their health related spending. At the micro level, it explores how this improved quality of spending results in better access to care and more targeted services for communities. It also considers how encouraging households to subscribe to health insurance can be an efficient way to complement public spending: by sharing costs and risks, insurance can relieve pressure on public budgets while expanding access to care and protecting households from health-related financial shocks.

We address a clear gap in literature by providing empirical evidence on the actual effects of gender budgeting, which most existing studies assume rather than measure. While previous work often takes for granted that gender budgeting reduces gender inequalities, few studies test this claim rigorously or examine its impact on the quality of public spending. We fill this gap by linking the adoption of gender budgeting to the efficiency of local health expenditures, showing how resources are used to achieve outcomes in the context of budget constraints. We highlight that higher spending or improved indicators alone do not guarantee efficient resource use. By focusing on how gender budgeting, through greater transparency, can translate into better-targeted services and improved health outcomes, we contribute new insights on the relationship between fiscal tools and spending quality, especially at the local level where resource scarcity is a critical challenge.

We find that the adoption of gender budgeting in Indian states between 1997 and 2020 has improved the efficiency of health spending through greater transparency and enhanced budget monitoring. The main channel behind this effect is the strengthening of local administrative capacities. At the micro level, exposure to gender budgeting

is associated with a reduction in pregnancy losses and an increase in health insurance subscriptions, although postnatal care remains insufficient. These results show that gender budgeting can simultaneously improve governance and strengthen households' financial protection.

The remainder of this paper is structured as follows. The next section presents the conceptual framework that underpins our analysis. This is followed by the empirical strategy, detailing the identification framework used to estimate the effects of gender budgeting. We then discuss the robustness checks implemented to ensure the validity of our results. The paper next examines the main transmission channels that link gender budgeting to spending efficiency. This is followed by microeconomic analysis, which focuses on household-level outcomes. Finally, we conclude with a discussion of the main findings and their policy relevance.

5.2 Conceptual framework

This section develops a theoretical model to analyze how gender budgeting transparency affects health spending efficiency, considering immediate impacts and long-term institutional effects. The framework builds on principal-agent theory (Meckling and Jensen (1976)), where state governments (agents) allocate health resources on behalf of citizens (principals). This allocation could potentially face inefficiencies due to information asymmetries and rent-seeking behavior (Brennan and Buchanan (1980)).

Gender budgeting transparency reduces information asymmetry through *ex ante* budget disclosures and *ex post* performance reports. In each period t, government G_t allocates health budget B_t with efficiency S_t determined by two factors: implementation effort e_t and transparency level $T_t \in [0, 1]$. The government's rent-seeking preference $\theta_t \in [0, 1]$ captures its propensity to divert resources, with higher values indicating greater corruption. Efficiency is modeled as an increasing function of both effort and transparency:

$$S_t = g(e_t, T_t), \quad \text{with } \frac{\partial g}{\partial e_t} > 0, \quad \frac{\partial g}{\partial T_t} > 0.$$

The government's utility incorporates three components: (1) political benefits from efficient service delivery (λS_t), (2) rents from resource diversion ($(1 - T_t)\theta_t B_t$), and (3) effort costs ($\frac{1}{2}ce_t^2$):

$$U_{G,t} = \lambda S_t + (1 - T_t)\theta_t B_t - \frac{1}{2}ce_t^2.$$

Optimizing effort yields the first-order condition:

$$\frac{\partial U_{G,t}}{\partial e_t} = \lambda \frac{\partial g}{\partial e_t} - ce_t = 0 \implies e_t^* = \frac{\lambda}{c} \frac{\partial g}{\partial e_t}.$$

Transparency can affect efficiency through three immediate channels:

1. **Direct Effect**: Higher transparency directly improves allocation decisions:

$$\frac{\partial S_t}{\partial T_t} > 0.$$

2. **Effort Channel**: Transparency increases optimal effort by raising the marginal return to efficiency:

$$\frac{de_t^*}{dT_t} = \frac{\lambda}{c} \frac{\partial^2 g}{\partial e_t \partial T_t} > 0.$$

3. **Rent-Seeking Deterrence**: Greater transparency reduces diversion incentives:

$$\frac{dS_t}{dT_t} = \frac{dS_t}{d\theta_t} \frac{d\theta_t}{dT_t} > 0 \quad (\text{assuming } \frac{d\theta_t}{dT_t} < 0).$$

The total short-term effect combines these channels:

$$\frac{dS_t}{dT_t} = \frac{\partial g}{\partial T_t} + \frac{\partial g}{\partial e_t} \frac{de_t^*}{dT_t} + \frac{dS_t}{d\theta_t} \frac{d\theta_t}{dT_t} > 0.$$

While the short-term analysis captures immediate efficiency gains, the most transformative effects of transparency emerge through dynamic institutional changes. We introduce institutional capital K_t that accumulates through sustained transparency and enhances long-run efficiency. The stock of institutional capital evolves according to:

$$K_{t+1} = (1 - \delta_K)K_t + \psi T_t,$$

where $\delta_K \in (0, 1)$ is the depreciation rate and $\psi > 0$ measures transparency's effectiveness in building institutional capacity. The steady-state capital level is:

$$K^* = \frac{\psi T}{\delta_K}.$$

Efficiency now depends on institutional capital:

$$S_t = g(e_t, T_t, K_t), \quad \text{with } \frac{\partial g}{\partial K_t} > 0.$$

The government's utility incorporates long-term institutional benefits ϕK_t:

$$U_{G,t} = \lambda g(e_t, T_t, K_t) + (1 - T_t)\theta_t B_t - \frac{1}{2}ce_t^2 + \phi K_t.$$

Transparency's long-run effects operate through additional reinforcing mechanisms:

1. **Institutional Quality**: Standardized reporting and monitoring systems improve governance:
$$\frac{dS_t}{dT_t} = \frac{\partial g}{\partial I_t}\frac{dI_t}{dT_t} > 0.$$

2. **Capital Accumulation**: Sustained transparency builds institutional capacity:
$$\frac{dS_t}{dT_t} = \frac{\partial g}{\partial K_t}\frac{dK_t}{dT_t} = \frac{\partial g}{\partial K_t}\frac{\psi}{\delta_K} > 0.$$

3. **Electoral Accountability**: Public information enhances political competition:
$$\frac{dS_t}{dT_t} = \frac{\partial g}{\partial C_t}\frac{dC_t}{dT_t} > 0.$$

The total long-run effect incorporates all channels:

$$\frac{dS_t}{dT_t} = \frac{\partial g}{\partial T_t} + \frac{\partial g}{\partial e_t}\frac{de_t^*}{dT_t} + \frac{dS_t}{d\theta_t}\frac{d\theta_t}{dT_t} + \frac{\partial g}{\partial K_t}\frac{dK_t}{dT_t} + \frac{\partial g}{\partial I_t}\frac{dI_t}{dT_t} + \frac{\partial g}{\partial C_t}\frac{dC_t}{dT_t}.$$

In the long run, as K_t converges to K^*, efficiency reaches:

$$S^* = g\left(e^*, T, \frac{\psi T}{\delta_K}\right),$$

where $e^* = \frac{\lambda}{c}\frac{\partial g}{\partial e_t}$ is the steady-state effort level. This demonstrates how sustained transparency can create persistent efficiency gains through institutional development.

The model reveals important differences between short-term and long-term effects:

1. **Short-term**: Efficiency gains come primarily from reduced information asymmetries and immediate behavioral responses (effort and rent-seeking).

2. **Long-term**: Institutional capital accumulation creates self-reinforcing efficiency improvements that persist even if transparency levels fluctuate.

3. **Policy implication**: While short-term impacts may be reversible, long-term institutional changes create path dependence in efficiency outcomes.

The framework suggests that transparency initiatives are most effective when implemented consistently over time, allowing institutional capital to accumulate. The next section will empirically test these theoretical predictions using panel data on gender budgeting adoption and health spending efficiency across Indian states.

5.3 Methodology

5.3.1 Data

Efficiency Score and Control Variables

This study relies on an original combination of various datasets that provide detailed and complementary information about economic, political and fiscal variables at state level. The core economic and fiscal data are sourced from the Reserve Bank of India (RBI), which offers a uniquely detailed and reliable account of the fiscal position and economic performance of each Indian State and Union Territory. The RBI's disaggregated statistics on revenues and expenditures allow for precise measurement of both revenue autonomy and expenditure autonomy, which are central to this analysis of fiscal federalism. The RBI's dataset also provides information on infant mortality ratio at state level for the period 1997-2020. Political variables are drawn from official electoral data provided by the Election Commission of India, ensuring accurate and consistent information on the political context at the state level.

The efficiency frontier approach estimates the maximum achievable output for a given level of inputs, defining the technical efficiency frontier. In this framework, each Decision-Making Unit (DMU) that lies on the frontier is considered fully technically efficient, while the distance from the frontier indicates the degree of inefficiency. The frontier can be estimated using parametric or non-parametric methods.

In this paper, we measure the efficiency of public health spending using a Stochastic Frontier Analysis (SFA). Unlike non-parametric approaches such as Data Envelopment Analysis (DEA), the SFA framework accounts for random shocks and measurement errors that can distort observed outcomes. This distinction is crucial in the context of public health spending, where unforeseen events (such as epidemics, supply chain disruptions, or political instability) may affect health outcomes independently of how well public funds are managed.

In such cases, for the same level of health spending, State A facing an unexpected health crisis may exhibit worse health outcomes than State B, despite equivalent management effort. A purely deterministic method would mistakenly attribute these deviations entirely to inefficiency. SFA overcomes this by disentangling inefficiency

from random noise, thus providing a more credible measure of spending efficiency. Moreover, SFA is less sensitive to outliers and heterogeneity across units, an important feature given the wide variation in demographic, economic, and institutional characteristics across Indian states.

Following Kumbhakar et al. (February 2015.), as implemented by Bamba (2020), Shen and Chen (2017), Adom et al. (2021), and Kang et al. (2022), we apply an estimator that controls for unobserved heterogeneity and separates it from inefficiency. This is particularly appropriate in a panel context covering Indian states, where differences in development levels, governance quality, and exposure to shocks could bias efficiency scores if left uncontrolled.

We adopt the two-step estimation strategy proposed by Nguyen et al. (2022), which refines the Kumbhakar et al. (February 2015.) approach by decomposing the composite error term ϵ into pure noise, short-run inefficiency, and long-run (persistent) inefficiency:

$$Y_{it} = \alpha + \beta X_{it} + \epsilon_{it} \tag{5.1}$$

where Y_{it} represents the output (here, a proxy for the effectiveness of health spending) and X_{it} is the vector of inputs for state i in year t. The composite error term is re-specified as:

$$Y_{it} = \alpha + \beta X_{it} + v_{it} - u_{it} - \eta_{it} \tag{5.2}$$

In this specification, v_{it} denotes random noise, u_{it} captures transient inefficiency, and η_{it} reflects persistent inefficiency.

As in Bamba (2020), we first estimate:

$$Y_{it} = \alpha_0^* + \beta X_{it} + \theta_i + \gamma_{it} \tag{5.3}$$

with

$$\alpha_0^* = \alpha_0 - E(\eta_{it}) - E(u_{it}), \tag{5.4}$$

$$\theta_i = \alpha_i - \eta_i + E(\eta_i), \tag{5.5}$$

$$\gamma_{it} = v_{it} - u_{it} + E(u_{it}). \tag{5.6}$$

In the second step, we use the residuals from this estimation to identify persistent and time-varying inefficiency through the stochastic frontier. This provides state-

specific, time-varying efficiency scores for public health spending.

To operationalize the output variable, we use the infant mortality ratio as a performance proxy for state health spending. This indicator reflects the effectiveness of maternal and child health services, a core responsibility of Indian state governments. Reducing infant mortality is a priority aligned with Sustainable Development Goals and is widely used in the literature (Jafarov and Gunnarsson (2008); Verhoeven et al. (2007) and Bernet et al. (2018)) to assess the quality of public health provision. Given the close link between gender budgeting priorities and maternal and child health, this measure is both relevant and policy meaningful for examining the efficiency impacts of GRB in India.

The control variables are a set of covariates used in the literature on public spending efficiency which can also affect the likelihood of adopting gender budgeting.

As explained by Boetti et al. (2012), the subnational government's fiscal autonomy leads to some less inefficient behaviour. These states are also less dependent on central government transfers and are more autonomous in their political choices. The fiscal autonomy variable (labeled as *autonomy*) is a ratio between states' own local revenues and their total revenues (transfers and grants included). Taxation influences public spending efficiency as explained by Afonso et al. (2021). So, the subnational autonomy appears to be a good control variable for the estimation process. The most urbanized states can generate some scale economies, or sometimes some congestion effects which make less effective and less efficient public spending and policies related to health issues. This variable is labeled as *Urbanization*. Sibiano and Agasisti (2013) and Rayp and Van De Sijpe (2007) highlight a link between GDP per capita (labeled as *log(GDPpc)* and public sector efficiency. Gross domestic product per capita appears as the key determinant of efficiency in Italian regions. At the same time, GDP per capita affects the accountability of rulers and their decisions to adopt or not gender budgeting process. The share of seats held by women in local parliament influences the composition of public spending at the subnational level (Svaleryd (2009)). The presence of women in local parliament (labeled as *Women in parliament*) also affects the political decisions and the choice of gender budgeting adoption. All the variables have a year lag to tackle or reduce the endogeneity.

The following table summarizes the main variables used in the estimation process.

The treatment and stylized facts

The treatment variable is a dummy that takes 1 if gender budgeting is implemented in a state and 0 otherwise. It comes from the paper of Stotsky and Zaman (2016) and has been updated with further research from the literature and the state governments'

Table 1: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
efficiency score	4.682	2.037	1.474	16.689	585
gender_budgeting	0.22	0.414	0	1	930
state autonomy	48.938	25.713	5.466	100	857
log(GDP per capita)	10.287	1.061	7.886	12.832	866
Urbanization (%)	33.568	19.098	7.98	99.900	736
trend	16.815	9.352	1	33	1023
women in parliement (%)	48.53	1.878	42.39	54.87	902
fiscal rule	0.381	0.486	0	1	930
log(population size)	20.847	0.125	20.608	21.025	787

disclaimers.

Table 2: Repartition of treatment

Treated	223
Untreated	707

The graph 1 illustrates the staggered adoption of gender budgeting in various states in India. It highlights the timeline and sequence in which different states implemented gender budgeting practices, showcasing the varying pace of adoption. The data underscore how some states embraced the initiative earlier, while others followed more gradually, reflecting the diverse policy responses throughout the country.

Missing data often arises because some states did not exist prior to a certain point in time. Consequently, these states could not have been subject to any "treatment" immediately upon their creation. This situation ensures that there are "not yet treated" observations for all states, as newly formed states naturally fall into this category until they eventually receive treatment. This allows for a clearer comparison between the treated and untreated states over time.

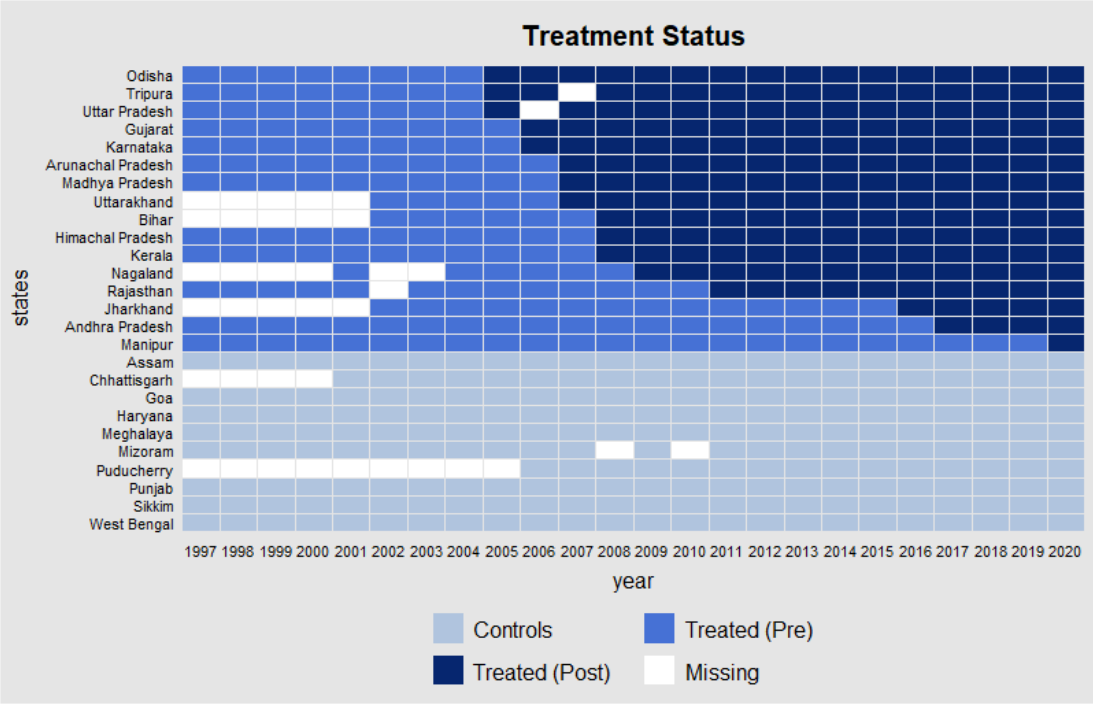


Figure 1: Treatment adoption by States

The graph 2 highlights a comparison between the average inefficiency score for treated (1) and untreated units (0). The efficiency score is very close to the sample, so it is difficult to understand the difference between treated and untreated units. It seems to suggest that states that have adopted gender budgeting are more efficient than those that have not adopted it. However, this correlation does not occur because a correlation does not necessarily imply causality. This result seems to confirm intuition and provide avenues for further analysis.

Figure 2: Efficiency score for adopters (1) and non-adopters(0)

5.3.2 Identification strategy

The identification method used is a Difference-in-Differences (DiD) strategy, using a comprehensive panel dataset. We focus on the efficiency score for each state and each year during the period 1997–2020. The decision to adopt gender budgeting in each state is not random. Therefore, the main challenge is to correct for selection into the reform, i.e., to account for differences between adopter and non-adopter jurisdictions that could have influenced the outcome. The DiD identification strategy makes it possible to correct for the initial difference in public expenditures and thus estimate the differential changes in these outcomes across states before and after each wave of adoption.

However, using several years of data makes our approach closer to a two-way fixed effects (TWFE) linear regression. Recent methodological papers characterize the potential issues surrounding TWFE with multiple periods and multiple treatments (Callaway and Sant'Anna (2021), Borusyak et al. (2024), Goodman-Bacon (2021), and De Chaisemartin and d'Haultfoeuille (2020)). An issue addressed in this literature is the cross-unit heterogeneity of treatment. Other issues include the time heterogeneity of treatment and the use of units that eventually become treated as control groups. When extending to 1991–2020, we try to capture longer-term effects and check whether there is an increasing advantage of early adoption. We also acknowledge a group of states that have adopted gender budgeting after the first wave, which might slightly perturb the control group as some units become treated. To address this, we suggest additional estimations in which we explicitly account for the two

types of treatment. In technical terms, we estimate the following equation in which Y_{it} is the outcome variable, i.e., public expenditures for state i in year $t = 1, ..., T$:

$$Y_{it} = \alpha + \beta^W D_{it}^W + \rho X_{it} + \theta_i + \gamma_t + \epsilon_{it} \tag{5.7}$$

with the dummy treatment variable equal to 1 if state i belongs to the group of states that have adopted gender budgeting in year k and are observed after that year.

To slightly enhance the DiD setup, we use the Callaway and Sant'Anna (2021) DiD approach. The Callaway and Sant'Anna (2021) DiD estimator allows us to use the inverse probability weighting as in Abadie (2005). As in Abadie (2005), we must estimate the propensity score. However, because we have multiple treatment dates for multiple groups, there is a unique propensity score for every group. However, we do not have a large reservoir of untreated units in many applications with multiple periods and differential timing. To create implicit pairings of units in the treatment and comparison groups, Callaway and Sant'Anna (2021) allows two options. We will use a pool of units as our comparison group that are never treated during the duration of the panel. Alternatively, we may use a pool of units that have simply not been treated at the time of treatment. Another key concept in Callaway and Sant'Anna (2021) is the group-time ATT. The group-time ATT is a unique ATT for a cohort of units treated at the same point in time.

The *csdid* package used for this estimation allows us to estimate with Callaway and Sant'Anna (2021) methods an estimator like Abadie (2005), but by considering the staggered adoption and heterogeneous effects. This type of approach usually brings flexibility to traditional DiD setups. Most importantly, it is used here to try to reduce unobserved time-varying differences between early- and late-gender budgeting adopting states that could confound our results. For this, we mobilize a set of variables X_{it} that are assumed to be correlated to some extent with time-varying confounders and that allow for comparing subgroups of treated and control states that are more alike.

For example, if states with the greatest GDP per capita are the ones that adopted gender budgeting first and, at the same time, are the ones that have greater efficiency score (internal validity issue) or stand to benefit most from gender budgeting because of their higher GDP per capita. If the unobservable advantages (e.g., economic and cultural dynamics, political leverage, or interest) are correlated with observable characteristics (e.g., population size, autonomy, GDP per capita), we could reduce the bias by comparing treated and control states that are most similar along a relevant set of observed characteristics of that sort. Rather than using matching on many different characteristics, which brings a curse of dimensionality issue, we rely on a

propensity score (PS) that concentrates all the useful information from these characteristics. The propensity score, denoted p hereafter, is obtained as the prediction of a first-stage estimation of a gender budgeting dummy on the set of relevant variables including key demographic dimensions such as urbanization ratio, GDP per capita, autonomy ratio (share of own revenues in total state revenues), and proportion of seats held by women in state parliament. To consider treated and untreated states that are more alike according to these different criteria simultaneously, we reweight observations using the inverse propensity score, as suggested by Abadie (2005) for the DiD approach. In this way, the modified estimation gives more weight to the late (early) gender budgeting adopters that are most similar to the early (late) gender budgeting adopters. We will also explore the heterogeneous impact of the reform by explicitly zooming in on groups with similar characteristics (e.g., treated and control states with high wealth). All estimations are clustered at the state level to account for autocorrelation.

5.3.3 Parallel trend assumption

We compute a *t-test* to compare the mean of our outcome variable for both groups (adopters and non-adopters) before the first year of implementation. The results available in Table 3 show that the mean difference in the outcome variable is not statistically significant between adopters and non-adopters before the treatment was applied.

To compare treated and control states that are most similar, we also suggest DiD estimations adjusted by a quasi-matching strategy. Assuming that the matching variables are highly related to unobserved confounders, this approach should reduce potential bias affecting trend differences between the groups of states that adopted gender budgeting at different points in time.

Before adoption			
Outcomes	Non-adopters	Adopters	Difference
Efficiency score	90.17	92.09	
After adoption			
Outcomes	Non-adopters	Adopters	Difference
Efficiency score	91.34	93.38	***

Table 3: Outcome means before the treatment (by status)

5.3.4 Results

The results are presented in the following table (Table 4). They suggest a positive effect of gender budgeting on efficiency scores. Analyzing budgets from a gender perspective is integral to gender mainstreaming. When gender considerations are embedded in policy and project design, they should be reflected in resource allocation; if not, outcomes are unlikely to deliver substantive equality for women. Budgets thus serve as a critical tool for gender mainstreaming. Such practices enhance transparency, information disclosure, and citizen participation in economic governance. Several studies (Chan and Karim (2012), Chen et al. (2019), De Simone et al. (2019), and Montes et al. (2019)) have shown a clear link between transparency and spending efficiency. Therefore, by increasing transparency and strengthening local administrative capacity, gender budgeting improves the efficiency of public spending in Indian states that have adopted it.

Table 4: Diff-in-Diff results

	Efficiency score
ATT	1.4874***
	(0.576)
Observations	668

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This effect remains positive over time, as illustrated in Graph 3 in the appendix, although the benefits take time to materialize. The delay may reflect a learning process within public administration. While governments may initially increase spending on health or other social sectors (e.g., education or infrastructure), it takes time to improve the quality and effectiveness of such spending through better budgetary processes and public expenditure planning (including *ex ante* evaluations).

Additionally, we analyze the effects of gender-responsive budgeting by cohorts. The results suggest heterogeneity across cohorts. The treatment effects appear to be stronger among early adopters, who seem to drive the overall effect. For later adopters, the effects are more modest, as shown in table 11 in the appendix. The non-significant effects observed for the cohorts adopting between 2006 and 2009 may be due to missing data and should be interpreted with caution.

The next section presents robustness checks for our results.

5.4 Robustness checks

5.4.1 Entropy Balancing

For the robustness check, we also use the entropy balancing method of Hainmueller (2012), as in Baccini et al. (2018) on fiscal decentralization and tax competition. Macroeconomic shocks can change expectations among citizens, state rulers, or local administrations. The announcement of gender budgeting adoption could raise citizens' expectations for better public services. At the same time, state rulers might try to improve spending quality to gain favor, even without adopting gender budgeting. This competition effect can bias pre-trends and distort results.

Matching estimators aim to mimic random treatment assignment by pairing treated units with untreated units that are as similar as possible in all relevant pre-treatment characteristics. Entropy balancing is a preprocessing technique that reweights observations to ensure covariate balance before estimating treatment effects. It assigns weights to sample units so that reweighted groups exactly match on specified covariate moments. These weights can then be used in any standard model for outcome estimation, just like survey weights or propensity score weights. By orthogonalizing the treatment with respect to the covariates, entropy balancing reduces model dependence in the second step.

Entropy balancing works in two steps. First, weights are computed for untreated units to ensure covariate means match across treated and control groups while staying close to uniform base weights. This ensures that the control group, on average, closely resembles the treatment group. Second, the weights are used in a regression with the treatment indicator to estimate the Average Treatment Effect on the Treated (ATT). Unlike other methods, entropy balancing does not require a parametric model for either the outcome or treatment, reducing risks of misspecification.

In conventional matching, untreated units often receive weights of 0 or 1 depending on whether they match a treated unit. When the untreated pool is small and covariates are many, this can lead to poor balance. Entropy balancing avoids this by allowing flexible non-negative weights to achieve better balance.

Combining reweighting with regression, entropy balancing accommodates the panel structure of our data. It controls both state-fixed and time-fixed effects in the regression step, addressing unobserved heterogeneity across states. The ATT is estimated as:

$$\pi ATT(x) = E[Y(1)|T = 1, X = x] - E[Y(0)|T = 0, X = x] \tag{5.8}$$

where Y is the outcome, X is the vector of pre-treatment characteristics, $E[Y(1)|T =$

$1, X = x]$ is the expected outcome for treated units, and $E[Y(0)|T = 0, X = x]$ is the counterfactual for comparable untreated units.

As shown by Neuenkirch and Neumeier (2016), entropy balancing has advantages over traditional matching: it is non-parametric, avoids functional form assumptions, and achieves strong covariate balance even with small samples. This makes it possible to build a valid counterfactual for treated units. The second step exploits the panel structure to include unit and time effects, controlling for unobserved heterogeneity and time trends unrelated to treatment. Tübbicke (2022) and Zhao and Percival (2017) show that entropy balancing is doubly robust and reaches the semiparametric efficiency bound if both outcome and treatment models are correctly specified.

The empirical model estimated is:

$$Y_{it} = \beta_1 GB_{it} + \alpha_1 \log(GDP\_pc)_{it} + \alpha_2 \log(density)_{it} + \alpha_3 X_{it} + \mu_i + \psi_t + \epsilon_{it} \quad (5.9)$$

where Y is the efficiency score of state i in period t, GB is the treatment indicator for gender budgeting, X_{it} is a vector of time-varying controls, μ_i and ψ_t are state and time-fixed effects, and ϵ_{it} is the idiosyncratic error term.

Results

The results suggest a positive and significative impact of gender budgeting adoption on health public spending quality. The results available in appendix (table 14) seem to confirm the previous results got from DiD setup.

5.4.2 Placebo Test

We now examine whether there are confounding factors that could affect our results on health spending efficiency, which have remained stable so far. The empirical literature shows that the adoption of an economic policy is often accompanied by parallel reforms, making the adoption of gender budgeting a non-random decision. Unobservable factors correlated with both policy adoption and efficiency outcomes could therefore bias the baseline estimates.

While we use an empirical strategy designed to address such concerns, we strengthen our findings by conducting a placebo test. Following Apeti (2023) and Apeti and Edoh (2023), we generate placebo or arbitrary adoption dates by randomly assigning gender budgeting adoption years to states in our sample, excluding the actual adoption years. The purpose of this placebo test is to verify whether any unobserved factors systematically drive the estimated effects: if this were the case, the placebo test would likely show significant results.

Our placebo estimates show that random treatment assignments do not affect health spending efficiency (see Table 15 in the Appendix). This supports the validity of our identification strategy by confirming that our main results are not driven by unobserved confounding factors, making this placebo test a relevant robustness check in our context.

5.4.3 Anticipation effects

To further test the robustness of our results and ensure that the observed effects are truly driven by the actual adoption of the reform, we check for possible anticipation effects. One source of anticipation could be that the reform was discussed in the media or political circles years before its formal adoption, giving rulers incentives to adjust policies or improve spending practices in advance. Such anticipation could influence health spending efficiency and bias the estimated treatment effects (Mertens and Ravn (2012) and Metiu (2021)).

To test this, we shift the adoption date by assuming that the treatment started two years before the actual adoption year. This helps us detect whether any significant effects emerge before the reform was implemented. The results of this test are presented in the appendix in Table 16.

The estimates show no significant effect when using the alternative adoption dates. We conclude that there is no evidence of anticipation effects on health spending efficiency related to gender budgeting adoption.

5.4.4 Political fragmentation effects

To ensure that our results on health spending efficiency are not driven by the possibility that a single party can unilaterally control all spending decisions due to political centralization, we compute a Herfindahl-Hirschman Index (HHI) to measure the fragmentation of votes in local parliaments. Political fragmentation refers to the dispersion of political power among multiple parties, which can lead to more inclusive decision-making and potentially increase spending efficiency. Conversely, when one party dominates, spending decisions may be more centralized and less efficient. By generating an interaction term between this political fragmentation variable and the gender budgeting variable, we account for the potential joint effects of gender-responsive policies and political decentralization on health spending efficiency. The Herfindahl-Hirschman Index is calculated as:

$$HHI = \sum_{i=1}^{N} s_i^2$$

where s_i represents the share of seats held by party i in the local parliament. A

higher HHI indicates lower fragmentation (i.e., more political centralization), while a lower HHI signals greater fragmentation. The normalized formula is:

$$HHI_{\text{norm}} = \frac{HHI - \frac{1}{N}}{1 - \frac{1}{N}}$$

where N is the total number of parties.

The summary statistics are shown below:

Table 5: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
HHI	0.422	0.177	0.151	1	730

The results in Table 17 in the appendix show that political fragmentation can influence health spending efficiency. The regression results highlight a nonlinear relationship between gender budgeting (GRB) and political concentration, measured by the HHI, in shaping efficiency outcomes. In models controlling for state and year fixed effects, the interaction term GRB × HHI is positive and significant, while the squared term (GRB × HHI)^2 is negative and marginally significant, indicating an inverted U-shaped effect. This suggests that GRB has the strongest impact on efficiency when the political environment shows moderate concentration. In highly concentrated systems—where one party or a dominant coalition controls the legislature—the incentive to promote transparency and improve efficiency is weaker due to limited competition and lower accountability. Conversely, in highly fragmented systems, where power is dispersed across many small parties, unstable coalitions can struggle to coordinate and sustain effective reforms, undermining the implementation of GRB. The turning point estimates range between 0.27 and 0.42 across models, with a consistent pattern around 0.40, suggesting that optimal conditions for efficiency gains from gender budgeting occur when political concentration is balanced—neither too high nor too low. The magnitude of the coefficients should be interpreted in light of the fact that the HHI is normalized between 0 and 1; even small coefficient values imply substantial marginal effects across the range of political concentration.

5.5 Transmission channels

For this exercise, we construct a "bias" index that measures the difference between a state's actual health spending in state i at period t and the share of health spending reported in the same state's budget forecast for that period. The bias index is defined as:

$$bias\_index_{i_t} = |(health\_spending_{i_t}/Total\_expenditures_{i_t}) * 100 - (health\_spending\_forecasted_{i_t}/Total\_expenditures\_forecasted_{i_t}) * 100| \quad (5.10)$$

Table 6: Summary statistics for the bias index

Variable	Mean	Std. Dev.	Min.	Max.	N
Bias index	0.129	0.108	0.002	0.539	497

We assume that this bias index reflects the performance of subnational administrations. While differences between forecasts and realizations are normal, systematic and large gaps can indicate weaker administrative capacity and lower fiscal credibility. We compute the absolute value of this difference to measure the distance (bias) between forecasted and actual health spending. A systematic underestimation of spending might appear positive for funding availability but signals poor credibility and weaker local administrative capacity.

To assess how gender budgeting can affect health spending efficiency through fiscal credibility, we estimate potential transmission channels using the same approach as Neuenkirch and Neumeier (2016). We calculate the means of the bias index for (a) the treatment group during periods when gender budgeting is in place, (b) the treatment group before gender budgeting adoption, and (c) the synthetic control group generated via entropy balancing. The results are shown in Table 7.

The descriptive statistics show differences between the control group and the states implementing gender budgeting. Before adoption, treated states show a higher bias (0.13) than untreated states (0.12), suggesting lower credibility. After adoption, the bias decreases to 0.10 for treated states, indicating improved credibility.

Table 7: Transmission channel

	Bias index
Before adoption	0.13***
After adoption	0.10***
Non-Gender Budgeting	0.12***

These findings align with previous evidence that sound public financial management, strong fiscal credibility, and robust tax administration[1] can improve spending

[1]Each Indian state has its own finance ministry.

efficiency. To test whether this channel holds, we run a pairwise correlation between the bias index and the health spending efficiency score.

Table 8: Pairwise correlation

	Bias index
Efficiency score (GB)	-0.1585***
Efficiency score (Non-GB)	-0.1242

The results in Table 8 confirm the expected negative correlation between the bias index and the health spending efficiency score. This suggests that reducing the bias (i.e., improving credibility and administrative accuracy) is associated with higher efficiency.

To strengthen this result, we use a simultaneous equations model following Ekoula et al. (2023) and French and McKillop (2016). Table 9 summarizes the main estimates. The results are significant and support our interpretation that stronger budget forecast credibility and local administrative performance act as transmission channels through which gender budgeting improves health spending efficiency.

Table 9: Simultaneous equations results

	(1)	(2)
VARIABLES	Efficiency score	Bias index
Lagged bias index	-1.048***	
	(0.359)	
Gender budgeting		-0.017**
		(0.008)
Observations	541	541
R-squared	0.470	0.546

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.6 Microeconomic effects

Beyond the effects that gender budgeting adoption can have on fiscal policy strategies and the resulting increase in the efficiency of public spending dedicated to health, we also examine how it can impact individuals' daily lives, particularly by enhancing

their protection against health-related risks. Improved quality of health expenditures can strengthen effective health coverage by ensuring better access to care, increased prevention efforts, and reduced exposure to financial hardship due to illness (Erlangga et al. (2019)). In this context, expanding health insurance coverage plays a key role, as it facilitates access to healthcare services and reinforces the protective function of public health systems. For example, Clots-Figueras (2011) find that politicians' gender affects policy, but that their social position, i.e., their caste, should also be considered. Female legislators in seats reserved for lower castes and disadvantaged tribes invest more in health and early education and favor "women-friendly" laws, such as amendments to the Hindu Succession Act, which was designed to give women the same inheritance rights as men. They also promote redistributive policies, such as land reforms. In contrast, female legislators from higher castes do not have any significant impact on "women-friendly" laws.

In addition, India is a vast country with very large and diverse states. Some Indian states, such as Rajasthan, are larger and more populous than entire countries like Finland, Norway, or Côte d'Ivoire. It is therefore relevant to examine potential effects at the local and individual levels. It is also important to note that gender budgeting is increasingly viewed as a bottom-up approach. This means that it is not only the allocation of resources at the national or state level that matters, but also how these resources flow to and are available for women in villages, towns, and cities across the country (Sharma and Garg (2014)).

To assess the microeconomic effects of gender budgeting on health-related outcomes, we adopt a twofold approach.

First, we focus on maternal and child health by examining the quality of care and nutrition provided to children after birth. These indicators reflect not only household investment in child well-being but also broader access to basic health services. To capture aspects of reproductive health, we include pregnancy outcomes (specifically, whether the pregnancy resulted in a loss) as a proxy for the quality of maternal health services and access to prenatal care. These dimensions are critical for understanding how gender-responsive fiscal policies can improve women's health trajectories and reduce early-life vulnerability.

Second, we analyze access to health insurance schemes, whether public or community-based, as an indicator of individual protection against health-related financial risks. Health insurance coverage provides a concrete measure of how well individuals are shielded from the economic consequences of illness or injury. By linking coverage to health status and vulnerability (as in Pan et al. (2016)), we aim to evaluate whether gender budgeting contributes to broader and more equitable health protection systems.

Together, these micro-level outcomes help us assess whether gender budgeting adoption delivers real improvements in health protection and quality of life, especially for women.

5.6.1 Data and empirical strategy

Data at the individual level come from the *Demographic and Health Survey* (DHS), which has been conducted in Indian states since the 1990s. The DHS household surveys typically interview a representative sample of between 10,000 and 20,000 women (aged 15–49) and men (aged 15–59).

To assess the microeconomic effects of gender budgeting (GB) adoption, we use the three most recent waves of the *Demographic and Health Survey*. This choice is based on data availability for respondents. We merge the DHS repeated cross-sectional dataset with our macroeconomic dataset containing state-level indicators. This process provides us with a combined dataset of macro and micro indicators for a sample of around 75,000 women in 31 Indian states and union territories. Using multiple survey waves allows us to capture potential time effects across states and examine how the effect evolves with time since the first GB adoption wave.

The next table summarizes the main variables used in our probit regression analysis on the microeconomic effects of GB adoption.

Table 10: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Outcomes :					
Postnatal check-up	0.398	0.568	0	1	3,363,153
Fortified food (baby)	0.111	0.370	0	1	254,719
Got insurance scheme from:					
State	0.088	0.283	0	1	454,067
Community	0.001	0.026	0	1	454,067
National	0.198	0.399	0	1	454,067
Roof materials	37.065	18.292	11	97	38,540
Number of children	2.360	1.345	0	14	45,467
Backward class or caste	2.585	1.089	1	8	43,729
Religion	2.628	10.637	1	96	45,467
Log(nightlights)	11.354	0.474	10.278	12.728	37,669
Urbanization	34.182	13.180	9.830	71.400	35,257
Women in parliament	48.546	1.637	44.470	52.490	37,657
Log(population)	3.344	1.731	-0.635	5.476	35,257
Dose	4.760	5.421	0	15	45,467
Partner education	2.624	1.588	0	8	74,021

The dependent variables are binary, coded as 1 if the respondent answers “yes” (regardless of intensity) and 0 otherwise. The main variable of interest is the time in years since the first implementation of GB, which we use to measure the treatment intensity. We refer to this variable as "dose."

Given the qualitative nature of the dependent variable, the preferred estimation method is the probit model. To address the lack of reliable state-level GDP data disaggregated at local levels, we construct a measure of nightlights intensity at the district level. This proxy captures local economic activity with finer spatial detail. Nightlights data provide a consistent and comparable measure of economic intensity across districts, helping to overcome limitations in official statistics.

Compared to the linear probability model and the logit model, the probit model is more appropriate and efficient for estimating binary outcomes. Unlike the linear model, probit coefficients are not directly interpretable in level terms but are interpreted through marginal effects. The sign and significance of the coefficients indicate the impact of each explanatory variable on the probability of observing the outcome.

The probit estimation equation is as follows:

$$\Pr(Y_i = 1 \mid X_i) = \Phi(X_i'\beta)$$

$$Y_i^* = X_i'\beta + \varepsilon_i, \quad \varepsilon_i \sim \mathcal{N}(0,1)$$

$$Y_i = \begin{cases} 1 & \text{if } Y_i^* > 0 \\ 0 & \text{otherwise.} \end{cases}$$

5.6.2 Microeconomic results

The results show that greater exposure to the gender budgeting (GB) program is associated with a lower probability of pregnancy loss but no significant change in access to fortified food. However, exposure is linked to a decrease in the likelihood of receiving postnatal check-ups.

On the insurance side, GB exposure significantly increases the probability of being covered by state and national insurance schemes, while it has no clear effect on community-based insurance. In our analysis, we distinguish three levels of health insurance coverage: *State-level schemes* are funded and managed by individual states to cover specific groups such as low-income households or informal workers. *national insurance programs* are broader schemes financed by the central government to provide basic health protection across all states. and *community-based insurance* includes locally organized or NGO-run schemes that operate outside formal government budgets.

These patterns suggest that GB may influence maternal health and financial protection through different institutional and behavioral channels. The reduction in pregnancy loss could result from targeted investments in antenatal care, better monitoring, or more effective outreach supported by gender-sensitive budget allocations. The lack of impact on fortified food may reflect supply constraints or lower prioritization of nutrition-specific programs within GB frameworks. The negative link with postnatal care could point to a gap in funding continuity across the maternal care cycle or persistent barriers—such as mobility, time, or lack of follow-up—that limit post-delivery service use.

The increase in state and national insurance coverage highlights the important role of formal institutions in extending financial protection. These effects likely result from gender-responsive reforms that simplify administrative procedures, better target women as beneficiaries, or earmark funds to subsidize enrollment. In this context, insurance coverage should be seen as part of broader financial inclusion. Financial inclusion means more than simply having a bank account; it includes reliable financial

services—credit, savings, and especially insurance—that help households manage risk and avoid economic hardship (van Hees et al. (2019)). By expanding access to formal insurance, GB strengthens women's financial resilience (Habib et al. (2016)) and autonomy, helping them cope with health shocks and reducing their reliance on informal safety nets. The absence of clear effects on community-based insurance may reflect the limited reach of GB measures in informal or decentralized schemes that operate outside state or national budget channels. Together, these findings underline the institutional nature of GB's impact: it strengthens financial protection through formal state systems while leaving room for better links with community-level solutions.

The detailed results tables are provided in the appendix (Tables 19 and 20), with Table 20 summarizing the expected effects.

5.7 Conclusion

Through this study, we have evaluated the effects of gender budgeting (GB) adoption on the efficiency of public health spending in Indian states between 1997 and 2020. Using a difference-in-differences estimator combined with entropy balancing (a method that adjusts for selection bias by combining matching with linear regression) we find that states implementing GB achieve higher health spending efficiency scores than those that do not. One main transmission channel identified is the strengthening of local administrative capacities, as shown in Table 7. At the macro level, GB creates a framework of ongoing evaluation and accountability in budget processes. This institutionalization of monitoring and clear goal setting improves the fiscal architecture and strengthens the coherence of policy design and implementation. In this sense, GB functions not only as a tool to reduce gender disparities but also as a lever for better governance. Improving spending efficiency is especially relevant in a context of tight budget constraints, as it allows subnational governments to make better use of limited resources and deliver higher-quality services.

At the micro level, complementary analyses using household and individual data reveal that exposure to GB is associated with concrete changes in social outcomes. We find evidence of reduced pregnancy loss and increased insurance coverage through state and national schemes, although postnatal care remains insufficiently addressed. These results highlight that gender-sensitive fiscal practices can generate broader benefits, including improved engagement with health systems and stronger financial protection for women (through insurance coverage). In particular, expanded access to formal insurance illustrates how GB can shape financial inclusion by supporting state-led enrollment and coverage mechanisms.

Our findings contribute to the literature by linking GB to the quality and effi-

ciency of public spending—an aspect that is often overlooked. We show that GB can improve not only the allocation of spending but also its effectiveness and governance, bridging macro-level fiscal design with micro-level outcomes. This connection opens new avenues for empirical work that could test similar mechanisms in other policy areas.

These results suggest that embedding clear objectives, designing targeted measures, and systematically evaluating them (key principles of GB) can enhance the quality of public spending in sectors beyond gender equality. In contexts like India, where central institutions can enforce compliance, the monitoring function reinforces GB's legitimacy and effectiveness. This research is also relevant for other countries, whether federal or not, that aim to improve the efficiency of public spending and reduce gender inequality. It shows that clear rules, strong monitoring, and capable local administration can make gender budgeting deliver real improvements in governance.

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5.8 Appendix

5.8.1 Diff-in-Diff

Table 11: Diff in Diff results by cohorts

Cohorts	eff score	eff score	eff score	eff score	eff score	eff score
2005	2.1241 ***					
	(0.7330)					
2006		0.2637				
		(0.5678)				
2007			2.7257			
			(1.7532)			
2009				1.5613		
				(0.7953)		
2014					0.4753***	
					(0.0419)	
2016						0.3527***
						(0.0672)
Observations	668	668	668	668	668	668

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

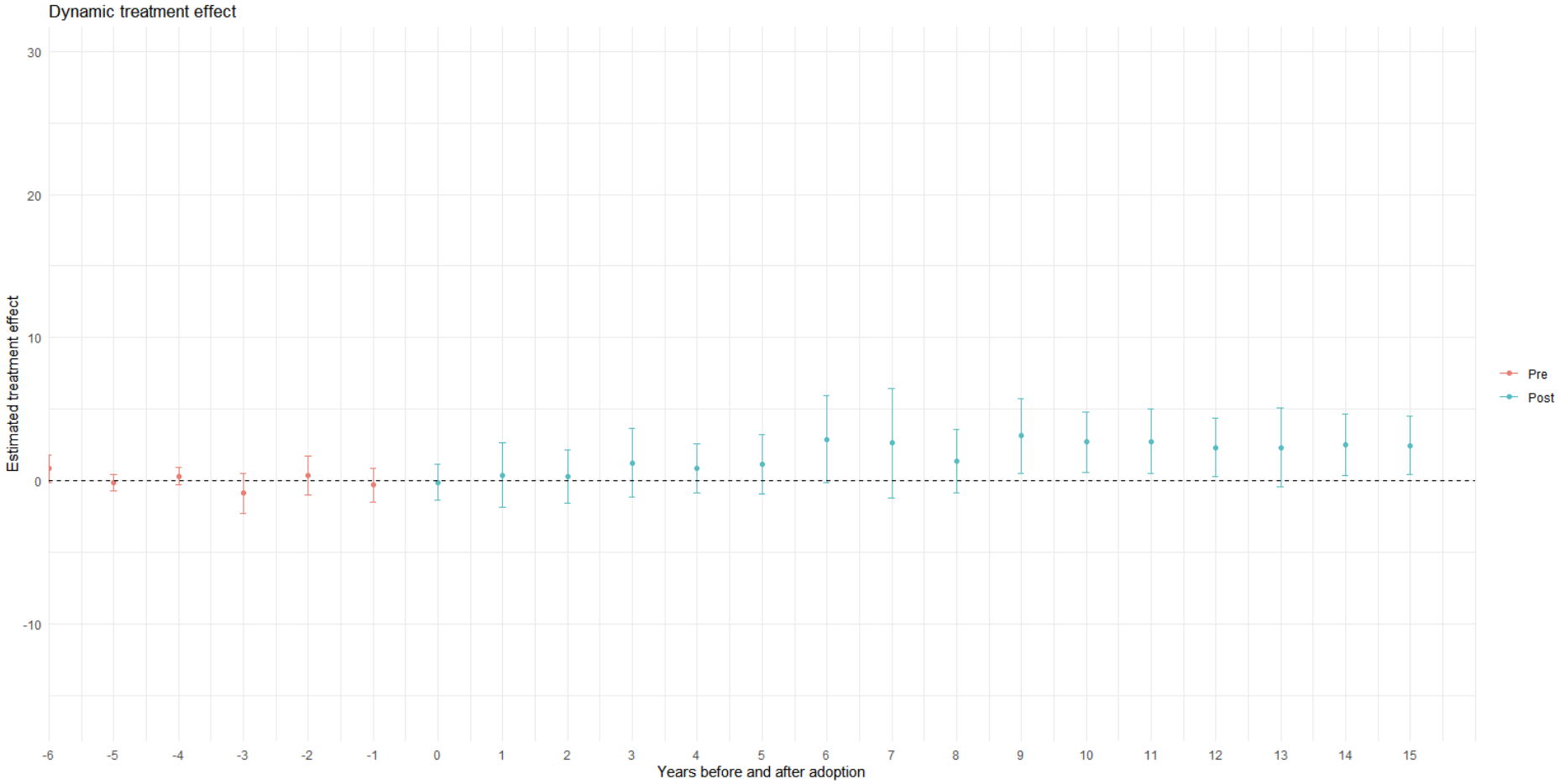


Figure 3: Diff-in-Diff event stduy

5.8.2 Entropy balancing

Correlation issue

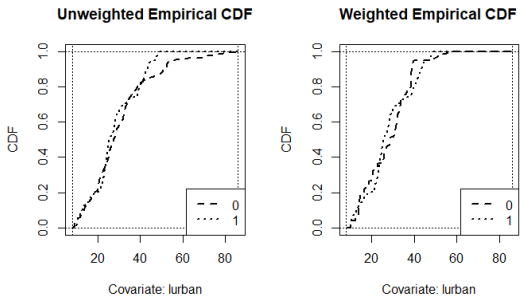
Table 12 shows a simple comparison of pre-weighting sample means of all matching covariates between treated (Column [2]) and control (Column [1]) states, which represent the potential synthetic group. Column [5] shows significant differences between the two groups for all pre-treatment variables, as some p-values are below the threshold of 5%. Such differences could bias the true treatment effect due to a potential selection problem. Therefore, in Panel B (Column [1]), we compute a synthetic control group by re-weighting the control units, using the pre-treatment covariates from the benchmark specification. This approach allows us to make the means of the pre-treatment covariates of the synthetic group as comparable as possible to those of the treated units. As can be seen in Column [5] of Panel B, the weighting eliminated any significant pre-treatment difference between the means of the treated and synthetic covariates. Thus, we can consider the synthetic group as a perfect counterfactual of the treated group.

Table 12: Unweighted Balance Statistics

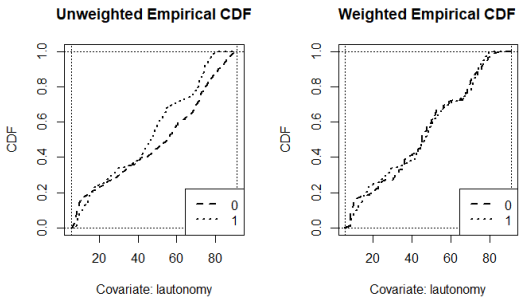
Variable	Mean [GB=1]	Mean [GB=0]	Difference ([GB=1]-[GB=0])
L.autonomy	43.99	48.92	-4.93
L.log(GDP per capita)	10.82	10.00	0.82
L.urbanization	27.84	30.15	-2.31
trend	23.39	14.41	8.98
L.women in parliement	48.49	48.71	-0.22
fiscal_rule	1.00	0.39	0.61
L.log(population)	20.96	20.83	0.13

Table 13: Weighted Balance Statistics

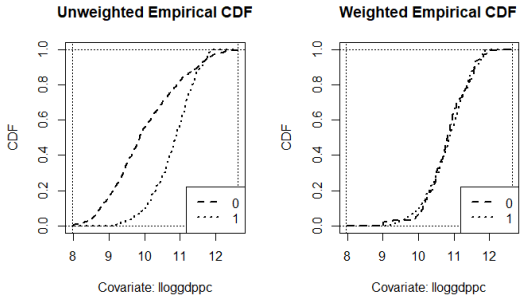
Variable	Mean [GB=1]	Mean [GB=0]	Difference ([GB=1]-[GB=0])
L.autonomy	43.99	43.99	0.00
L.log(GDP per capita)	10.82	10.82	0.00
L.urbanization	27.84	27.83	0.01
trend	23.39	23.39	0.00
L. women in parliement	48.49	48.49	0.00
fiscal_rule	1.00	1.00	0.00
L.log(population)	20.96	20.96	0.00



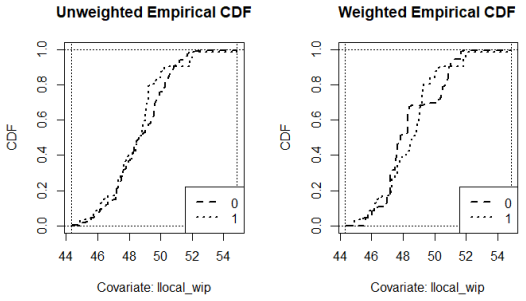
(a) Urbanization balance



(b) Autonomy balance



(c) GDP per capita (log) balance



(d) Women in Parliament Balance

Figure 4: Entropy banlancing graphs

Entropy balancing

Table 14: Entropy balancing results

Variables	efficiency score			
gender budgeting	1.21 **	1.02***	1.45 ***	1.03 ***
	(2.03)	(3.71)	(3.06)	(3.33)
States FE	No	No	Yes	Yes
years FE	No	Yes	No	Yes
Covariates	Yes	Yes	Yes	Yes
Observations	541			

5.8.3 Placebo test

Table 15: Results for the placebo test

	Dependent variable:
	efficiency score
placebo	0.122
	(0.436)
Observations	541
Note:t statistics in parentheses	*p<0.1; **p<0.05; ***p<0.01

5.8.4 Anticipation effects

Table 16: Results for the anticipation test

	Dependent variable:
	efficiency score
anticipation	−0.871
	(-1.122)
Observations	541
Note:t statistics in parentheses	*p<0.1; **p<0.05; ***p<0.01

5.8.5 Political fragmentation

Table 17: Entropy balancing results

Variables	efficiency score			
GRB*HHI	6.54	7.26**	10.00***	5.50*
	(1.20)	(2.33)	(2.85)	(1.83)
(GRB × HHI) ^{2}	-8.23	-11.6*	-12.00*	-10.3*
	(-0.848)	(-1.94)	(-1.95)	(-1.88)
States FE	No	No	Yes	Yes
years FE	No	Yes	No	Yes
Covariates	Yes	Yes	Yes	Yes
Turning point	0.397	0.313	0.417	0.267
Observations	537			

t statistics in parentheses *p<0.1; **p<0.05; ***p<0.01

5.8.6 Microeconomic effects

Dependent variable:	`fortified food`	`pregnancy loss`	`post natal check-up`
	(1)	(2)	(3)
dose	0.006	-0.009**	-0.018***
	(0.004)	(0.004)	(0.003)
Observations	12,959	12,959	12,959

Table 18: Regression results (Standard errors in parentheses).

`Insurance from:`	`States`	`Community`	`Country`
dose	0.019***	0.065	0.034***
	(0.006)	(0.059)	(0.004)
Observations	12,959	12,959	12,959

Table 19: Results for insurance subscription

Note: *p<0.1; **p<0.05; ***p<0.01

Outcome	**Effect of Gender Budgeting Duration**
Postnatal check within 2 months	Negative
Pregnancy loss	Negative (fewer losses)
Fortified food access	No significant effect
Insurance subscription (state level)	Positive
Insurance subscription (community)	No significant effect
Insurance subscription (national)	Positive

Table 20: Summary of effects of time since gender budgeting adoption

Chapter 6

General conclusions

This thesis has explored the intersection of fiscal federalism and gender budgeting in India, analyzing how institutional design and gender-sensitive fiscal reforms jointly shape public policy outcomes. Combining theoretical modeling and empirical analysis, the study provides a multidimensional perspective on how federalism and gender-responsive budgeting (GRB) interact to promote transparency, inclusion, and efficiency. The first part of the thesis examined federalism as a foundational structure for governance. Chapter 2 analyzed the impact of fiscal and administrative autonomy on conflict dynamics, showing that greater subnational autonomy reduces secessionist and resource-based violence—particularly in ethnically diverse regions where local control over assets and institutions is critical. Chapter 3 extended this analysis to gender inequality, demonstrating that fiscal autonomy is associated with improvements in women's human development indicators. However, these benefits depend on intra-household dynamics and political incentives, indicating that autonomy alone is insufficient to achieve equitable outcomes. The second part of the thesis turned to gender budgeting as a policy instrument for enhancing fiscal inclusiveness and performance. Chapter 4 showed that the adoption of GRB led to a reallocation of resources toward socially inclusive sectors, with centrally sponsored schemes playing a crucial role in promoting state-level commitment. Chapter 5 assessed the efficiency of public health spending, revealing that GRB not only improves spending efficiency but also leads to tangible gains in women's health outcomes and insurance coverage. These results underscore the dual benefits of GRB: improving fiscal discipline while delivering measurable social returns. Collectively, the findings suggest that institutional design and fiscal instruments are complementary. While decentralization creates space for

responsiveness, tools like GRB guide how that space is used. When paired with mechanisms that enhance accountability, federal structures can serve as powerful vectors of social innovation. The thesis highlights the importance of embedding both equity and credibility into decentralized governance systems. Several limitations should be acknowledged. Gender-disaggregated fiscal data remain inconsistently available across states, limiting the analysis of spending composition. Moreover, the long-term social effects of GRB—particularly in terms of shifting norms and behaviors—are difficult to assess within the study's timeframe. Lastly, intergovernmental dynamics and spatial spillovers merit more in-depth investigation. These limitations open promising avenues for further research. Comparative studies across federations could help identify generalizable mechanisms. Including finer-grained political variables—such as electoral competitiveness or coalition dynamics—would deepen the understanding of subnational commitment to equity. Additionally, qualitative case studies could illuminate how GRB is interpreted and implemented by local actors. From a policy perspective, the thesis provides several key insights. First, decentralization reforms must be accompanied by targeted instruments that promote equity and accountability. The findings show that while fiscal autonomy can help reduce the intensity of conflict by enabling states to address local grievances, it does not automatically yield inclusive development. Without mechanisms that explicitly account for equity, decentralization may reinforce existing inequalities—including gender-based ones. Second, gender budgeting should be institutionalized and linked to intergovernmental fiscal transfers to ensure robust implementation. The thesis shows that GRB plays a compensatory role in contexts with weaker administrative capacity or limited political will, successfully redirecting public spending toward inclusive sectors like health and education. GRB affects not only the level of spending but also its structure, encouraging more balanced allocations across historically neglected sectors. Third, greater transparency and citizen participation—especially when tied to GRB—can enhance the credibility and social impact of fiscal reforms. The results confirm that GRB, when implemented transparently and with participatory mechanisms, improves the efficiency of public spending, particularly in health. States that adopt GRB demonstrate better performance and superior outcomes in maternal health and insurance coverage, illustrating the transformative potential of transparent and inclusive fiscal tools. In sum, integrating GRB into the architecture of federal governance enhances both the distributive fairness and the operational efficiency of public finances. In conclusion, gender budgeting is more than a technical innovation in public finance—it is a tool for renegotiating the social contract in federal systems. By making public spending more transparent, equitable, and responsive, it transforms how governments engage with citizens. In a country like India, marked by deep diversity, persistent

inequality, and complex institutional arrangements, aligning federal autonomy with gender-responsive budgeting offers a credible pathway toward more inclusive and accountable governance.

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