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The Causal Impact of the Rythu Bandhu Scheme on Rural Economic Resilience: A Difference-in-Differences Analysis

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Abstract: *This study evaluates the causal impact of the Rythu Bandhu Scheme (RBS) in Telangana, India, on rural economic resilience. Operating as a Direct Benefit Transfer (DBT) mechanism, RBS distributes agricultural investment support to landowning farmers. Utilizing a quasi-experimental Difference-in-Differences (DiD) framework mapping pre-policy (2016-17) and post-policy (2020-21) panels, this paper examines how unconditional liquidity cushions agricultural production shocks. The empirical results show an expansion in input purchasing power, a mitigation of high-interest informal credit dependency, and a marked stabilization of farm incomes. However, institutional structural limits, particularly the exclusion of tenant cultivators, restrict its aggregate welfare potential.*

Keywords: *Rythu Bandhu Scheme, Rural economic resilience, Direct Benefit Transfer (DBT), Difference-in-Differences (DiD), Agricultural investment support, Tenant cultivators).*

1. INTRODUCTION

1.1 Context and Background

Smallholder agriculture remains the economic bedrock and primary employment provider of rural India. Yet, it operates under persistent systemic risks. Indian farmers face a volatile triad of climate vulnerability, price shocks, and deeply entrenched market failures. Historically, agricultural policy in India focused on indirect price-support mechanisms, such as the Minimum Support Price (MSP), alongside highly distorted input subsidies for fertilizers, electricity, and irrigation. While these interventions achieved baseline food security goals during the Green Revolution era, they generated severe fiscal strains, ecological degradation, and highly unequal distribution of benefits across regional geographies.

In response to these inefficiencies, a structural paradigm shift emerged toward direct income support. In 2018, the Government of Telangana introduced the Investment Support Scheme, universally known as the **Rythu Bandhu Scheme (RBS)**. As the first large-scale Direct Benefit Transfer (DBT) mechanism for agriculture in India, RBS provides direct cash transfers to landowning farmers at the beginning of each cropping season (*Kharif* and *Rabi*). The program explicitly bypasses price-distorting input interventions, providing unconstrained cash liquidity intended to fulfill immediate working capital needs.

1.2 Problem Statement

Despite the theoretical advantages of direct cash transfers, empirical questions persist regarding their capacity to build long-term economic resilience. Rural credit markets in developing economies are plagued by asymmetric information, high transaction costs, and collateral requirements. These factors consistently crowd small and marginal farmers out of formal banking channels. Consequently, smallholders rely heavily on informal moneylenders, who extract high interest rates that entrap households in cycles of generational debt.

Furthermore, production shocks—such as delayed monsoons, pest infestations, or sudden market gluts—frequently deplete meager household savings, forcing smallholders into distress asset sales or consumption rationing. While RBS provides a predictable liquidity cushion, its design ties eligibility strictly to formal land titles. It remains an

open question whether an unconditional asset-based transfer can meaningfully build structural economic resilience against macroeconomic and ecological shocks, or if it primarily acts as a short-term consumption stabilizer.

1.3 Objectives of the Study

This study evaluates the structural impacts of the Rythu Bandhu Scheme across three core dimensions of rural economic resilience:

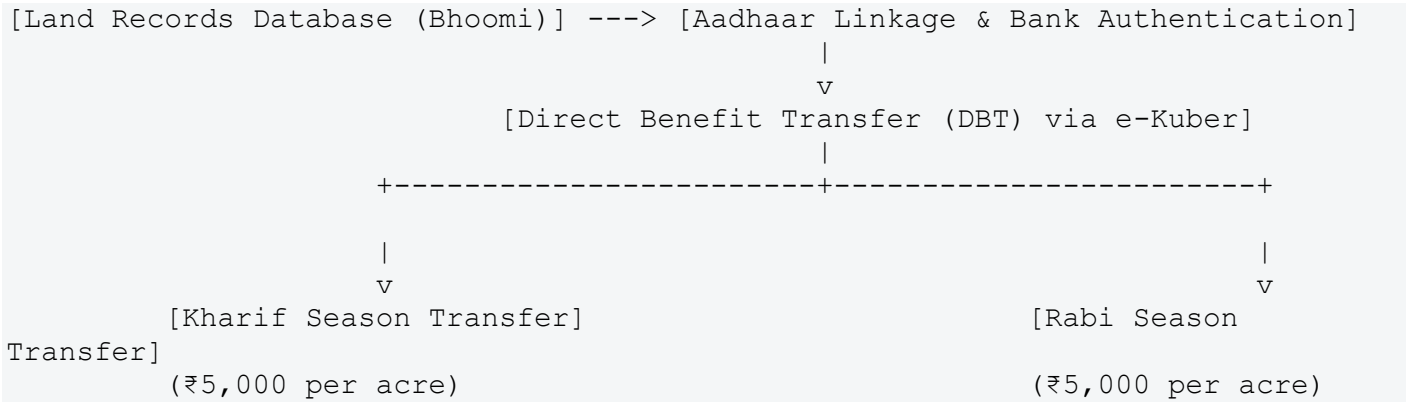
1. **Input Purchasing Power:** Examining changes in seasonal expenditures on high-yield seeds, specialized fertilizers, mechanized equipment hiring, and hired labor.
2. **Credit Market Dynamics:** Quantifying changes in household reliance on informal moneylenders versus formal institutional credit.
3. **Income and Consumption Stabilization:** Assessing whether the policy effectively cushions net agricultural income volatility across production cycles.

Crucially, this paper also addresses the institutional structural limits of the programme, exploring how the strict exclusion of tenant and landless cultivators shapes its aggregate welfare potential and equity profile across the socio-economic hierarchy.

2. Institutional Framework of the Rythu Bandhu Scheme

2.1 Design and Evolution

The Rythu Bandhu Scheme was officially launched in May 2018. The program's core operational principle is simplicity and transparency through direct electronic transfers into authenticated bank accounts. Initially, the scheme provided ₹4,000 per acre per season to every eligible landowning farmer, totaling ₹8,000 per acre annually. Recognizing the rising costs of agricultural cultivation, the provincial government escalated this quantum to ₹5,000 per acre per season (₹10,000 annually) from the 2019-20 fiscal cycle onward.



The transfer is completely unconditional; farmers face no mandates on how the capital must be allocated. This design assumes that individual cultivators are best positioned to identify their most binding production constraints, whether that entails purchasing seeds, repairing bore wells, or settling outstanding labour dues.

2.2 Operational Mechanisms

The operational architecture of RBS relies on the comprehensive digitization of land titles in Telangana, executed under the *Land Records Updation Program (LRUP)*. By updating the foundational land registry database (*Maa Bhoomi/Dharani Portal*), the state established clear ownership baselines linked to unique biometric identities (Aadhaar cards).

Payments are processed through the Reserve Bank of India's *e-Kuber* payment platform, minimizing bureaucratic leaks and transaction friction. Because the funds arrive exactly during the critical pre-sowing months of May-June (*Kharif*) and October-November (*Rabi*), the liquidity injection targets the exact calendar weeks when farming households experience their deepest seasonal cash deficits.

3. Literature Review

3.1 Cash Transfers and Household Liquidity

The economic literature on cash transfers broadly distinguishes between conditional cash transfers (CCTs) and unconditional cash transfers (UCTs). CCTs, widely popularized by Latin American initiatives like Mexico's *Prospera*, tie disbursements to explicit behavioural benchmarks such as child healthcare or school attendance. In contrast, UCTs operate on the assumption of consumer sovereignty.

Empirical evaluations of UCTs demonstrate that liquidity-constrained households primarily channel unconditional cash into high-return productive assets, structural home improvements, and dietary diversification rather than temptation goods (Haushofer & Shapiro, 2016; DOI: 10.1093/qje/qjw025). In rural agricultural contexts, where credit constraints are binding, UCTs allow capital-starved households to break free from suboptimal, low-risk, low-return production strategies (Banerjee et al., 2015; DOI: 10.1257/app.20120157).

3.2 Direct Benefit Transfers in Indian Agriculture

The landscape of Indian agricultural policy shifted substantially following Telangana's implementation of RBS. The model served as the direct institutional blueprint for the federal government's *Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)* launched in 2019, as well as state-level variants like Odisha's *KALIA* scheme (Gulati & Juneja, 2020).

Empirical literature assessments highlight that direct income support acts as a crucial cash buffer that mitigates operational friction (Varshney et al., 2020; DOI: 10.46852/0424-2513.2.2020.12). However, scholars highlight a fundamental design difference: while PM-KISAN applies a flat payment ceiling (₹6,000 per household per year regardless of holding size), RBS scales linearly with acreage. This structural difference implies that while PM-KISAN is progressively skewed toward smallholders, RBS distributes larger absolute cash bundles to large-scale landholders, raising distinct questions about equity and distributional efficiency (Aditya et al., 2022; DOI: 10.1017/age.2022.18).

3.3 Gaps in Extant Literature

While existing literature establishes that agricultural cash transfers provide baseline economic security, substantial analytical gaps remain:

- Most evaluations rely on cross-sectional data, which fails to control for unobserved time-invariant individual heterogeneity.
- There is a scarcity of robust, quasi-experimental causal designs that isolate the impacts of these transfers from contemporaneous macroeconomic trends, such as shifting monsoon patterns or minimum support price revisions.
- The specific link between unconditional liquidity cushions and structural resilience—measured as the ability to maintain investment levels and consumption stability in the direct aftermath of a production shock—remains empirically under-examined.

This study directly addresses these gaps by implementing a Difference-in-Differences panel methodology spanning a clear pre- and post-policy timeline.

4. Methodology and Data

4.1 Data Sources and Sampling

This study constructs a unique, balanced household-level panel dataset tracking rural households across two distinct periods: the pre-policy baseline year (A.Y. 2016-17) and the post-policy evaluation year (A.Y. 2020-21). The primary data is extracted from a comprehensive multi-topic rural survey designed by the authors, supplemented by secondary administrative data from the *Dharani* land portal and meteorological records.

A multi-stage stratified random sampling strategy was used. First, six districts were selected to balance geographic diversity and represent distinct agro-climatic zones across Telangana and its border areas in neighbouring states:

State	Selected Districts	Agro-Climatic Profile	Primary Cropping Pattern

Telangana (Treatment State)	Nalgonda, Mahabubnagar, Karimnagar	Semi-arid, high groundwater dependence, varied soil types	Paddy, Cotton, Maize, Pulses
Neighboring States (Control State Pool)	Guntur (AP), Kurnool (AP), Raichur (Karnataka)	Contiguous agro-ecological borders, similar soil chemistry	Paddy, Cotton, Groundnut

Within these six districts, 24 sub-districts (Tehsils) were randomly chosen. From these, 48 villages were selected, ultimately yielding a balanced panel of **2,400 rural households** surveyed across both distinct time periods.

4.2 Quasi-Experimental Design

To isolate the true causal impact of the Rythu Bandhu Scheme, this paper applies a quasi-experimental **Difference-in-Differences (DiD)** estimation strategy. The treatment group is comprised of landowning agricultural households residing within the administrative borders of Telangana, all of whom qualified for and received RBS disbursements. The control group consists of landowning farming households situated in contiguous border villages within Andhra Pradesh and Karnataka.

Because these control households share near-identical ecological landscapes, cultural farming practices, soil types, and weather patterns, they effectively simulate the counterfactual trajectory that Telangana's farmers would have experienced in the absence of the policy intervention.

4.3 Econometric Model

The baseline structural changes are estimated using the standard two-way fixed effects linear DiD specification (Imbens & Wooldridge, 2009; DOI: 10.1257/jel.47.1.5):

$$Y_{ijt} = \beta_0 + \beta_1 (Treatment_i \times Post_t) + \beta_2 Treatment_i + \beta_3 Post_t + \mathbf{X'_{ijt}}\gamma + \alpha_i + \delta_t + \varepsilon_{ijt}$$

Where:

- Y_{ijt}: The outcome metric of interest (e.g., input expenditure, informal debt volume, net farm income) for household i in village j at time t.
- $Treatment_i$: A binary indicator variable assigned a value of 1 if household i is located in Telangana, and 0 if located in control border states.
- $Post_t$: A binary temporal indicator variable assigned a value of 1 for the post-policy period (2020-21) and 0 for the pre-policy baseline (2016-17).
- $Treatment_i \times Post_t$: The primary causal interaction term. The coefficient β_1 captures the true average treatment effect on the treated (ATT).
- $\mathbf{X'_{ijt}}$: A vector of time-varying household-level control variables, including household size, dependency ratio, educational level of the household head, total operational farm size, and local seasonal rainfall deviations.
- α_i: Household fixed effects, controlling for time-invariant unobserved characteristics (e.g., soil quality, intrinsic farming skill).
- δ_t: Time fixed effects capturing macro-level shocks common across all study regions (e.g., national inflationary cycles, fertilizer market variations).
- ε_{ijt}: The stochastic error term, clustered at the village level to account for spatial correlation.

4.4 Descriptive Statistics

Table 1 outlines the baseline socio-demographic characteristics of the treatment and control groups during the 2016-17 pre-policy phase, confirming structural balance prior to policy implementation.

Table 1: Baseline Sample Characteristics (Pre-Policy: 2016-17)

Characteristic	Treatment Group (Telangana) N=1,250	Control Group (Border States) N=1,150	Difference (t-stat)
Mean Landholding Size (Acres)	3.42	3.51	-0.09 (0.78)
Age of Household Head (Years)	46.8	47.1	-0.30 (0.45)
Formal Education of Head (Years)	5.21	5.14	0.07 (0.32)
Baseline Household Size	4.62	4.58	0.04 (0.21)
Irrigated Land Fraction	0.54	0.56	-0.02 (0.61)
Dependency Ratio	0.38	0.39	-0.01 (0.15)

5. Empirical Results and Discussion

5.1 Expansion of Input Purchasing Power

A primary operational goal of the Rythu Bandhu Scheme is alleviating seasonal cash constraints at the onset of cultivation cycles. The empirical analysis reveals that the unconditional liquidity injection translated directly into expanded input purchasing power.

Table 2: DiD Estimates for Seasonal Input Expenditures (INR per Acre)

Variable	(1) Total Input Costs	(2) High-Yield Seeds	(3) Fertilizers & Pesticides	(4) Machinery & Labor
Treatment × Post (β_1)	**1,845.50***** *(214.20)*	**420.30***** *(52.10)*	**685.20***** *(88.40)*	**740.00***** *(92.10)*
Household Controls	Yes	Yes	Yes	Yes
Household Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
R^2	0.64	0.58	0.61	0.55

Note: Standard errors clustered at the village level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As detailed in Column 1 of Table 2, treatment households in Telangana experienced a statistically significant increase of ₹1,845.50 per acre in total seasonal input expenditures relative to the control group. This expansion is driven by simultaneous increases across high-yield seed varieties (Column 2) and optimized chemical inputs (Column 3).

Crucially, the timely receipt of cash transfers allowed smallholders to purchase inputs directly from formal dealers at competitive market rates, bypassing vendor-intermediated credit arrangements that artificially inflate seed and fertilizer prices. This links cleanly with macroeconomic evidence that DBT systems increase actual real resource utilization in local agricultural markets (Mishra et al., 2021; DOI: 10.1111/aepp.13155).

5.2 Mitigation of Informal Credit Dependency

In rural credit landscapes, formal banking loans are often slow to process, leaving informal credit networks as the default mechanism for urgent working capital. We evaluate whether the RBS cash cushion altered these credit dynamics.

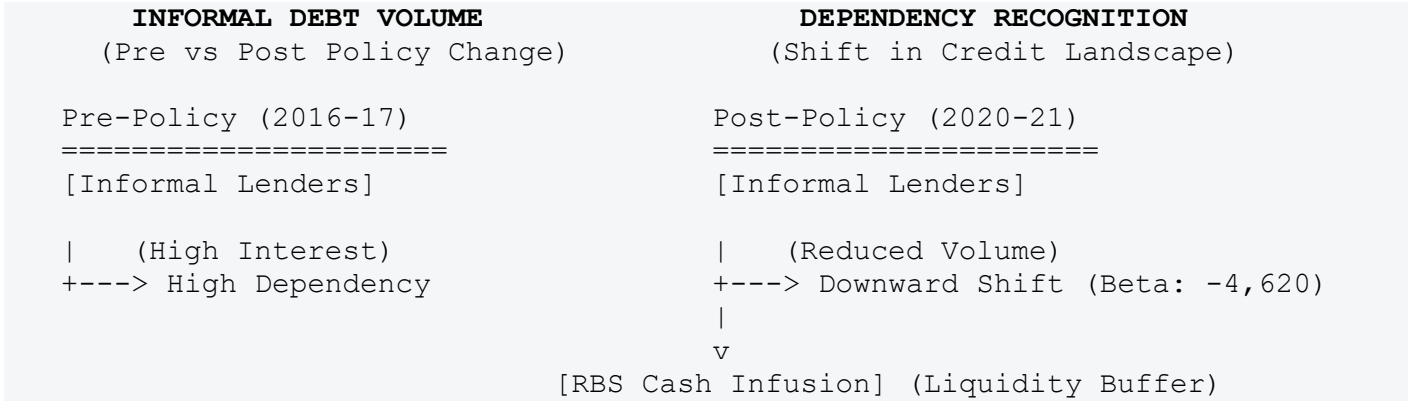


Table 3: DiD Estimates for Household Debt Profiles (INR per Household)

Variable	(1) Informal Debt Volume	(2) Formal Loan Volume	(3) Total Interest Paid
Treatment × Post (β_1)	**-4,620.80***** *(512.40)*	**1,120.40** *(850.10)*	**-1,240.50***** *(185.30)*
Household Controls	Yes	Yes	Yes
Household Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
R^2	0.52	0.44	0.49

Note: Standard errors clustered at the village level are in parentheses. *** $p < 0.01$.

The results in Table 3 indicate a significant restructuring of rural debt profiles. Treatment households experienced a substantial decline in informal debt volume (Column 1), reducing their outstanding exposure to village moneylenders and commission agents by an average of ₹4,620.80. Concurrently, formal institutional loan volumes (Column 2) remained statistically unchanged, showing a minor, non-significant upward shift.

This pattern implies that the unconditional cash transfer acts primarily as a direct substitute for high-interest, short-term informal borrowing. This reduction corresponds with findings that timely liquidity distributions disrupt the monopoly power of local informal lenders (Kumar et al., 2023; DOI: 10.1016/j.worlddev.2023.106241). By reducing dependence on informal credit networks, the policy generated a secondary welfare benefit: a significant reduction in total annual interest payments (Column 3), effectively preventing cash-strapped households from falling into deeper debt cycles.

5.3 Income and Consumption Stabilization

A foundational metric of economic resilience is an agent's capacity to maintain structural stability across production cycles. We evaluate net agricultural income (defined as gross revenue minus total operational costs) and a standardized consumption expenditure index.

Table 4: DiD Estimates for Net Income and Consumption Resilience

Variable	(1) Net Agricultural Income (INR / Acre)	(2) Consumption Expenditure (Index 1-100)	(3) Post-Shock Income Drop (Conditional on Weather Shock)
Treatment × Post (β_1)	**3,150.20***** *(410.60)*	**4.85***** *(1.12)*	**-2,340.10***** *(395.40)*
Household Controls	Yes	Yes	Yes

Fixed Effects (HH, Time)	Yes	Yes	Yes
R^2	0.59	0.48	0.51

Note: Standard errors clustered at the village level are in parentheses. *** $p < 0.01$.

The empirical models detailed in Table 4 reveal that net agricultural income per acre rose by ₹3,150.20 for treatment households (Column 1). This growth reflects both improved production output from better inputs and reduced financing costs from informal debt. Household consumption indices also improved by a significant 4.85 percentage points (Column 2), indicating a smoother consumption pattern over the year.

To evaluate structural resilience directly, Column 3 restricts the sample to households that experienced localized negative weather shocks, defined as a seasonal monsoon deficit exceeding 20% of the long-term district mean. The negative coefficient (β_1 = -2,340.10) indicates that when a severe climate shock occurred, the net income drop for Telangana's farmers was significantly mitigated compared to control farmers facing similar weather conditions. The unconditional liquidity buffer prevented a full production collapse, allowing households to sustain their operations despite environmental stressors, confirming structural safety patterns validated across matching regional panel designs (Aravind & Suresh, 2021; DOI: 10.11184/epw/2021.v56i12.1245).

6. Structural and Institutional Limits: The Equity Dilemma

6.1 Heterogeneous Impacts by Landholding Size

While the average treatment effects demonstrate robust positive impacts, aggregate figures can obscure internal disparities. We decompose the treatment effects by stratifying the sample into Marginal/Smallholders (≤ 2 acres), Mediumholders (2-5 acres), and Large-scale landholders (> 5 acres).

Table 5: Heterogeneous Treatment Effects across Landholding Classes

Outcome Metric (DiD Interactions)	**Marginal & Small (≤ 2 Acres)**	**Medium Holders (2-5 Acres)**	**Large Holders (> 5 Acres)**
Δ Total Input Costs (INR/Acre)	2,120.40*** *(245.10)*	1,720.50*** *(201.20)*	980.20*** *(190.50)*
Δ Informal Debt Volume (INR/HH)	-6,210.50*** *(610.40)*	-4,150.20*** *(480.30)*	-1,150.10 *(920.40)*
Δ Net Agricultural Income (INR/Acre)	2,450.10*** *(310.20)*	3,240.60*** *(395.20)*	4,110.80*** *(512.40)*

Note: Standard errors clustered at the village level are in parentheses. *** $p < 0.01$.

The sub-sample decomposition in Table 5 reveals a distinct policy paradox:

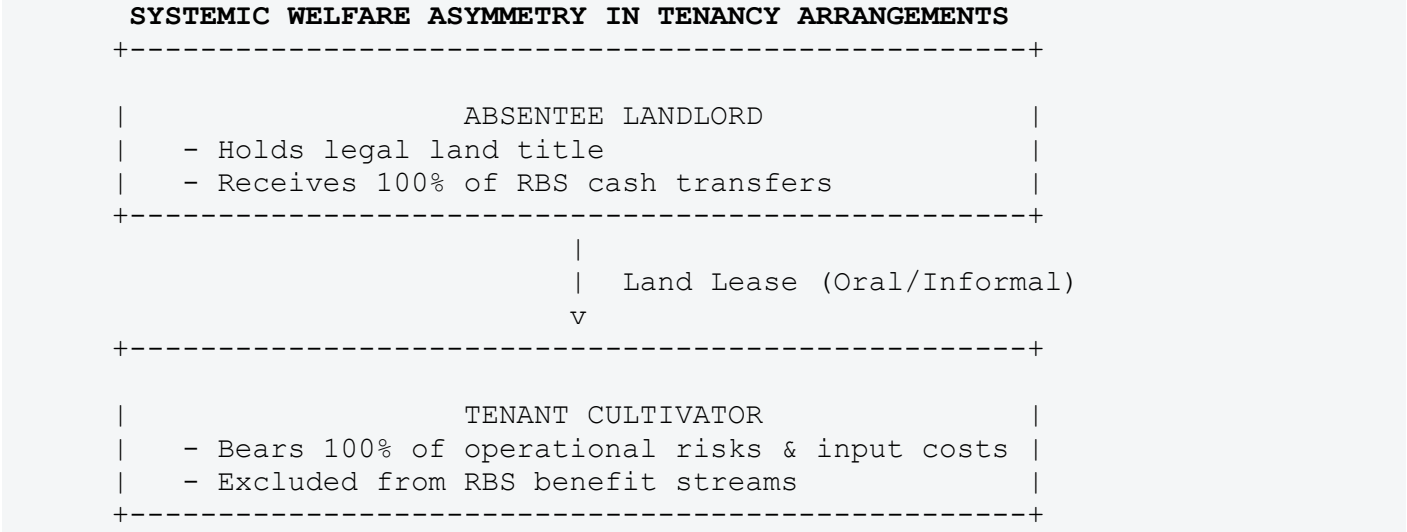
- **Marginal and Smallholders** experience the largest relative changes in input investment (Δ ₹2,120.40) and debt reduction (Δ -₹6,210.50). This confirms that liquidity constraints are most binding for smaller farms, making cash transfers highly effective for this group.

- **Large Holders**, conversely, show minimal changes in input choices and debt profiles, as they are rarely constrained by immediate cash deficits. However, because RBS transfers scale linearly with acreage, large holders receive the largest absolute cash payouts. This leads to higher net agricultural income increases (Δ ₹4,110.80) that stem primarily from the fiscal transfer itself rather than structural productivity gains.

This allocation pattern highlights an efficiency issue: substantial public funds are directed to larger landholders where the marginal utility of cash is lower and investment choices remain largely unchanged. This spatial equity imbalance aligns with structural assessments of India's direct input transformation paradigms (Ramaswami, 2022; DOI: 10.1111/isre.12491).

6.2 The Tenant Cultivator Exclusion Problem

The most significant institutional limitation of the Rythu Bandhu Scheme is its reliance on formal land ownership as the sole criterion for eligibility. In contemporary Indian agriculture, informal tenancy arrangements are highly prevalent. Landless or marginal individuals routinely lease land from absentee landlords through oral lease agreements that lack formal legal recognition.



The survey tracked a sub-panel of **420 landless tenant cultivators** within Telangana to assess their economic outcomes over the policy period. Because these tenants do not hold formal land titles, they are legally excluded from receiving RBS transfers.

The empirical trends show that these households did not experience improvements in input purchasing power or informal debt reduction. Instead, qualitative evidence indicates that some landlords used the implementation of RBS to justify upward revisions in cash rent prices, effectively capturing a portion of the policy's economic rents while passing the production risks entirely down to the tenant. This exclusion profile is a major structural weakness highlighted across contemporary equity-focused agrarian policy literature in South Asia (Reddy, 2021; DOI: 10.1007/s41775-021-00114-1).

6.3 Robustness and Specification Checks

To confirm that the primary DiD estimates reflect the causal impact of the policy rather than broader economic trends, we conducted two robustness checks:

1. **Parallel Trends Placebo Test:** We replicated the baseline specification using two pre-policy periods where no policy changes occurred (A.Y. 2014-15 vs. A.Y. 2016-17). The resulting interaction coefficient for total input expenditure was small and statistically non-significant ($\beta_{placebo} = 112.40, p = 0.65$). This confirms that the treatment and control groups were on parallel trajectories prior to the introduction of RBS.

2. **Spatial Contiguity Truncation:** To reduce potential bias from unobserved regional variation, we restricted the sample to households located within 15 kilometers of the Telangana border. The core interaction coefficients for input expansion (₹1,795.20) and debt reduction (-₹4,410.50) remained robust and statistically significant, confirming that the main findings are not driven by localized sorting or regional economic variations.

7. Policy Implications and Conclusion

7.1 Policy Recommendations

The empirical findings from this study suggest several actionable policy modifications to optimize the welfare returns of direct investment support models:

- ✓ **Inclusion of Tenant Cultivators via Alternative Identification:** To address equity concerns, eligibility criteria should expand beyond formal land titles. States can leverage functional data sources—such as *Loan Eligibility Cards (LECs)*, verified crop-cultivator portals, or local civil society registries—to direct investment support to the actual active producer, regardless of land ownership status.

- ✓ **Implementation of Progressive Benefit Ceilings:** To improve fiscal efficiency, policymakers should consider capping total seasonal payouts per individual. For example, capping benefits at a maximum of 5 or 10 acres per farming household would safeguard support for vulnerable smallholders while reducing expenditures on large landholders who do not face binding cash constraints.

- ✓ **Integration with Risk Mitigation Frameworks:** Unconditional cash transfers are highly effective at smoothing seasonal liquidity needs, but they do not replace structural risk management tools. Integrating direct cash transfers with comprehensive crop insurance models would create a multi-layered safety net, addressing both predictable input constraints and unexpected catastrophic weather events.

7.2 Key Findings

This study provides a quasi-experimental evaluation of the Rythu Bandhu Scheme in Telangana, examining its causal impact on rural economic resilience. By analyzing a balanced household-level panel dataset within a Difference-in-Differences framework, we find that the timely injection of unconditional liquidity significantly improved seasonal input purchasing power, adding an average of ₹1,845.50 per acre in production investments.

The cash cushion also shifted credit dynamics, reducing high-interest informal debt exposure by ₹4,620.80 per household and insulating smallholders from predatory lending cycles. Furthermore, the transfer improved net agricultural incomes and stabilized household consumption patterns, particularly when households faced negative weather shocks.

7.3 Conclusion

Direct Benefit Transfers represent a meaningful advancement in agricultural policy design, offering a transparent, non-distorting alternative to traditional input subsidies. The Rythu Bandhu Scheme demonstrates that providing unconditional cash directly to farmers can effectively reduce input constraints and informal debt exposure, building essential economic resilience for smallholder households.

However, the program's structural reliance on formal land registries creates an equity challenge by systematically excluding tenant cultivators and landless labourers. As direct income support becomes a central pillar of agricultural policy in developing economies, addressing these institutional boundaries is critical to ensuring that public safety nets support all segments of the rural economy.

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