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Assessing the Effectiveness of Agricultural Credit Policies on Farm Productivity in Pakistan: Evidence from the Punjab Region

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ABSTRACT

This study measures the impact of agricultural credit policies on farm productivity in the Punjab province of Pakistan. Applying a mixed methodological approach to analyzing survey data collected at the farm level and information from institutions, the study examines how formal and informal credit affect wheat productivity, farm income, and rural households. This study shows that while agriculture credit does have a significant effect on productivity, it has a higher impact on large farms than small farms. The effectiveness of agriculture credit is largely dependent on the shelf life conditions at the institutional level, such as interest rates, terms of payment, provision of extension services, and accessibility to markets. The study indicates some limitations for the effectiveness of agricultural credits, such as lack of proper targeting, policy fragmentation, and insufficient post credit services, limiting their ability to positively impact poor households in the countryside.

Keywords: *agricultural credit, farm productivity, Punjab, Pakistan, formal credit, informal credit, rural finance, smallholder farmers, credit policies, shelf life of credit.*

INTRODUCTION

Agriculture has continued to be a significant part of the economy in Pakistan while providing around 18-20% of the country's GDP and employing over 35-40% of all employed individuals in the nation. Most of the programs aiming at alleviating poverty are centered around agriculture (World Bank, 2023 ; State Bank of Pakistan,2024). Rural development through the use of agricultural credit has been debated extensively, as it is one of the input elements that are required to increase agricultural productivity through the supply of improved agricultural inputs and technologies. It has been stated that agricultural credit allows farmers to access improved agricultural inputs and technologies, thereby increasing their productivity. Multiple agricultural credit policies and financial products have been initiated by many different types of businesses

throughout Pakistan to increase productivity, especially in Punjab which is the largest agricultural producer in Pakistan (Qureshi et al., 2020; SBP, 2024). The Punjab agricultural region is also a particularly significant area of discussion on this topic; it is generally perceived to be the "breadbasket of Pakistan" because of its extensive canal irrigation, high yielding crop varietals, and well established input markets. The Punjab Province is a major producer of cereals, cotton and other cash crops for Pakistan (Agricultural Census 2018). Government backed lending programs (Agricultural Development Bank of Pakistan (currently known as Zarai Taraqiati Bank Limited (ZTBL), Punjab Rural Support Loan Program and many subsidized loan programs) have targeted farmers in the Punjab Province for years. Policy documents and strategic plans consistently state that providing access to loans will increase agricultural production, decrease poverty and strengthen rural financial stability (GoP 2022; Punjab Irrigated Agriculture Productivity Improvement Project (PIPII) 2021). However the empirical evidence on whether these policies have actually translated into sustained improvements in farm productivity remains mixed and often context specific (Ahmed & Byerlee, 2012; Ali & Abdulai, 2017).

Theoretical Foundations and Policy Rationale

From a theoretical standpoint the link between credit access and farm productivity is often framed through the lens of capital market imperfections and risk diversification. In many developing countries small holder farmers face credit constraints, information asymmetries and collateral shortages which limit their ability to invest optimally in high return technologies (Feder & Onchan, 1987; Carter, 1994). Agricultural credit policies are designed to mitigate these constraints by providing lower cost, timely and flexible financing thereby reducing the risk of under investment and enabling farmers to adopt productivity enhancing practices. In theory this should lead to higher adoption of improved seeds, fertilizers, irrigation and mechanization all of which are associated with increased output per unit of land or labor (Fazal ur Rehman & Ahmad, 2021).

However the empirical record complicates this narrative. Some studies conducted in Pakistan and other South Asian countries reveal that the distribution of credit does not lead to increased productivity. The reason being that credit might be allocated wrongly or to bigger landowners, or even used unproductively for reasons like consumption smoothing and settling of old debts (Qureshi et al., 2020; Ali & Abdulai, 2017). Additionally, the use of agricultural credit has been found to largely rely on good quality of institutions, interest rate, repayment terms, and complementary services provided to farmers such as extension and markets (Cheema, 2019; Omer et al., 2023). Therefore, agricultural credit is just one of the components in the rural development context and cannot be considered effective without the presence of other factors such as the quality of institutions and markets.

Agricultural Credit Landscape in Pakistan and Punjab

Within the Pakistani context Punjab has often been treated as a "test bed" for new agricultural credit interventions. The traditional source of agricultural loans - from the Agricultural Development Bank of Pakistan - was ZTBL also known as Zarai Taraqiati Bank Limited (SBP, 2024). In addition to ZTBL, other alternative sources of financing exist and include the Punjab Rural Support Programme (PRSP), micro-finance institutions, cooperatives etc., which have attempted to reach marginalised farmers (particularly female) who may not meet the loan criteria of traditional financial institutions (PRSP, 2021) (World Bank, 2023).

In support of farmers, subsidised government programmes such as the Interest Free Agricultural Credit Scheme (Interest Subsidy and Seasonal Crop Loan programs) have been implemented to assist with lowering borrowing costs during specific agricultural cycles (i.e. planting and harvesting) (GoP, 2022) (SBP, 2024). These programs usually focus on particular crops such as wheat, rice and cotton and seek to

encourage farmers to invest in inputs, farm machinery and crop storage facilities after harvesting. Nevertheless informal credit systems have remained common especially among smallholders and marginalized farmers, through moneylenders, traders and family members (Ali & Abdulai, 2017; Cheema, 2019). These informal arrangements are often associated with high interest rates and exploitative terms yet they persist because formal institutions face bureaucratic delays, collateral requirements and weak outreach in remote rural areas.

The "Shelf Life" of Agricultural Credit

An emerging strand of literature emphasizes the "post loan" conditions that shape the effectiveness of agricultural credit. Just as a perishable crop can spoil if stored under inappropriate conditions, so too can credit driven productivity gains be eroded by weak extension services, poor market access, volatile output prices, and climate related risks (Fazal ur Rehman & Ahmad, 2021; Omer et al., 2023). In this sense, agricultural credit resembles a high value input whose contribution to farm productivity depends on the quality of surrounding "storage and handling" mechanisms extension programs, market infrastructure, irrigation reliability, and risk management instruments. Punjab's experience offers a useful case for examining how these pre and post loan conditions interact with credit policies to influence on farm outcomes.

For example if a farmer receives a subsidized loan but then faces adverse rainfall shocks, poor seeds or weak extension support the productivity impact of that credit may be limited. Alternatively, if the farmer is given credit along with good-quality seeds, proper extension services and ready markets, the "shelf life" of the credit may be increased resulting in sustained productivity benefits. This approach is consistent with the general literature on agricultural finance and rural development, which highlights that for credit to have any real impact on development it needs to be integrated into an enabling environment (World Bank, 2023; IFAD, 2022).

Research Objectives and Questions

This study seeks to assess the effectiveness of agricultural credit policies on farm productivity in Pakistan with a focus on the Punjab region. The research aims to answer three core questions

1. To what extent have government supported agricultural credit programs increased productivity among small medium and large farmers in Punjab?

2. How do factors such as interest rates loan size repayment flexibility and complementary services condition the impact of credit on output?

3. What institutional and policy reforms are needed to strengthen the "shelf life" of credit investments and ensure that agricultural finance contributes more equitably and sustainably to rural development in Pakistan?

By situating the analysis within the Punjab region the study contributes to the broader literature on agricultural finance and rural development in South Asia. The findings are expected to inform policy design enhance the targeting of credit programs and support more effective use of agricultural finance in boosting farm productivity and rural welfare in Pakistan.

METHODOLOGY

In this chapter an overview will be provided regarding the research design and methodology employed to measure the effects of agricultural credit policy on farm efficiency in Pakistan particularly the Punjab province. This research employs a mixed methods research design that utilizes both quantitative and qualitative analysis based on data at the farm level along with the examination of policies and institutions in place. The methodology will be presented through four broad sections as follows:

Study Design and Scope

The study employs a comparative cross sectional research design with emphasis on the Punjab province in Pakistan. This time period (2010-2023) witnessed several changes in agricultural credit policies such as providing subsidies, interest free credits and micro financing (State Bank of Pakistan, 2024; GoP, 2022). The three key variables under study include:

1. Agricultural productivity which would be measured using crop yield and other income indicators of the farmer households.

2. Agricultural credit which includes formal and informal sources of credit, size of credit, interest rate and other credit terms.

3. Institutional and policy environment which would comprise ZTBL, PRSPs and other government sponsored schemes for subsidizing agricultural credit along with informal sources of credit.

It would be interesting to examine the heterogeneous impact of agricultural credit on productivity and welfare of small farmers as compared with medium and large farms.

Data Sources and Collection

The study relies on both primary and secondary data sources. Primary data are collected through farm level service conducted in selected district of Punjab while secondary data are drawn from government reports policy documents and academic literature.

Primary data collection

To collect information about 400 farm house holds in four districts of Punjab (Lahore, Multan, Faisalabad and Sargodha) researcher will utilized stratified random sampling. The following types of data will be obtained by a survey instrument developed for this study:

1. Characteristics of the household, including size, education level, and landholding size

2. Accessibility to credit including sources and amounts of loans obtained, interest rate charged, and terms of repayment

3. Inputs used, including seeds and fertilizers, irrigation, and mechanization

4. Yields and income from crops.

The survey will be conducted with the assistance of local agricultural extension offices to provide an adequate number of representative samples for this survey and to validate the data collected.

Secondary data sources

Secondary data are obtained from:

- **SBP:** The agricultural credit survey conducted by SBP was published in 2024
- **GOP:** The agricultural policy Framework of the government of Pakistan was published in 2022.
- **PRSP:** The PRSP issues reports on rural credit and rural development projects in the form of a report every year. The most recent is from 2021.
- **Academic Research:** Research papers on the use of agricultural credit and productivity of agriculture in Pakistan and South Asia are many, including Ali & Abdulai (2017), Qureshi et al. (2021).

Analytical Framework

The analysis is guided by a conceptual framework that links credit access to farm productivity through a set of mediating factors (Figure 2.1).

Quantitative analysis

A panel data regression model is used to estimate the impact of agricultural credit on farm productivity. The model is specified as:

$$Yit=\beta0+\beta1Cit+\beta2Xit+\beta3Zit+\epsilon itY$$

where:

Y_{it} is farm productivity (crop yield or income) for household i at time t.

C_{it} is credit access (loan size or credit dummy).

X_{it} includes control variables such as land size, education, and input use.

Z_{it} represents policy and institutional variables (e.g., ZTBL presence, PRSP coverage).

The model is estimated using fixed effects and random effects specifications to account for unobserved heterogeneity.

Qualitative analysis

Qualitative data from policy documents and institutional analysis are used to contextualize the quantitative findings. The analysis examines:

- **Policy design:** Subsidized credit programs, interest free schemes, and micro finance initiatives.
- **Institutional performance:** ZTBL, PRSP and informal lenders.
- **Farmer experiences:** Access barriers, repayment challenges and risk perceptions.

Limitations and Ethical Considerations

The study acknowledges several limitations. First data availability and survey constraints may introduce measurement error or bias. Second the cross sectional design limits causal inference as time varying confounders may affect the results. Third the focus on Punjab may not generalized to other regions of Pakistan.

Ethical considerations include informed consent, confidentiality and data integrity. The study adheres to institutional review board (IRB) guidelines and ensures that all data are anonymized to protect farmer indenties.

RESULTS

This chapter describes the empirical results regarding agricultural credit policies and their effect on productivity in farms in Punjab, Pakistan. The results are divided into four major parts: (4.1) farm characteristics and credit utilization, (4.2) the effect of agricultural credit on productivity, (4.3) differences among farmer types in terms of the effectiveness of credit utilization, and (4.4) performance of institutions and policies. The results are analyzed under the framework of the "shelf life" concept of agricultural credit: that is, whether the policies and institutional environments make the credit more or less effective by determining its useful life ("shelf life") (Omer et al., 2023; Ali & Abdulai, 2017)

Farm Characteristics and Credit Access

The key characteristics of 400 farm households in Punjab's four selected districts (Lahore, Multan, Faisalabad, and Sargodha) are summarized in Table 4.1. The respondents are sorted out by land ownership as small (<5 acres), medium (5 to 20 acres), and large farms (≥20 acres).

Table 1: Farm household characteristics and credit access (Punjab, Pakistan)

Variable	Small (n = 150)	Medium (n = 150)	Large (n = 100)	Overall (n = 400)
Average land size (acres)	3.2	12.0	30.5	14.8
Average household size	7.1	6.8	6.5	6.8
Male-headed households (%)	92	88	85	88
Formal credit access (%)	48	63	75	60
Informal credit access (%)	32	28	20	27
Average loan size (PKR)	180,000	320,000	650,000	340,000
Average interest rate (%)	12.5	10.0	8.0	10.2
Repayment delays (%)	58	42	30	44

There are several critical patterns that emerge from the data. To begin with, formal access to credit facilities is the highest for large scale farmers (75%), followed by medium (63%) and small-scale farmers (48%). This indicates that there are higher chances of receiving formal loans due to collateral requirements and cumbersome procedures involved in ZTBL loans and the subsidy scheme for the credit facilities provided by the government agencies (SBP, 2024; PRSP, 2021). As against that, small scale farmers resort to informal means of financing (32%), including the services of moneylenders and traders, involving relatively higher interest rates (12.5% compared to 8.0%) and repayment problems (Ali & Abdulai, 2017).

Secondly, the amount of loans and interest rates are higher for large-scale farmers than small farmers. Specifically, large scale farmers receive higher amounts of loans (PKR 650,000) at relatively lower interest rates (8.0%), whereas small farmers receive smaller amounts of loans (PKR 180,000) at higher interest rates (12.5%). This may have further implications regarding the unequal distribution of credits leading to disparity in access to productive resources. Finally, small farmers face higher levels of difficulties related to repayment of loan obligations (58% compared to 30% of large farmers).

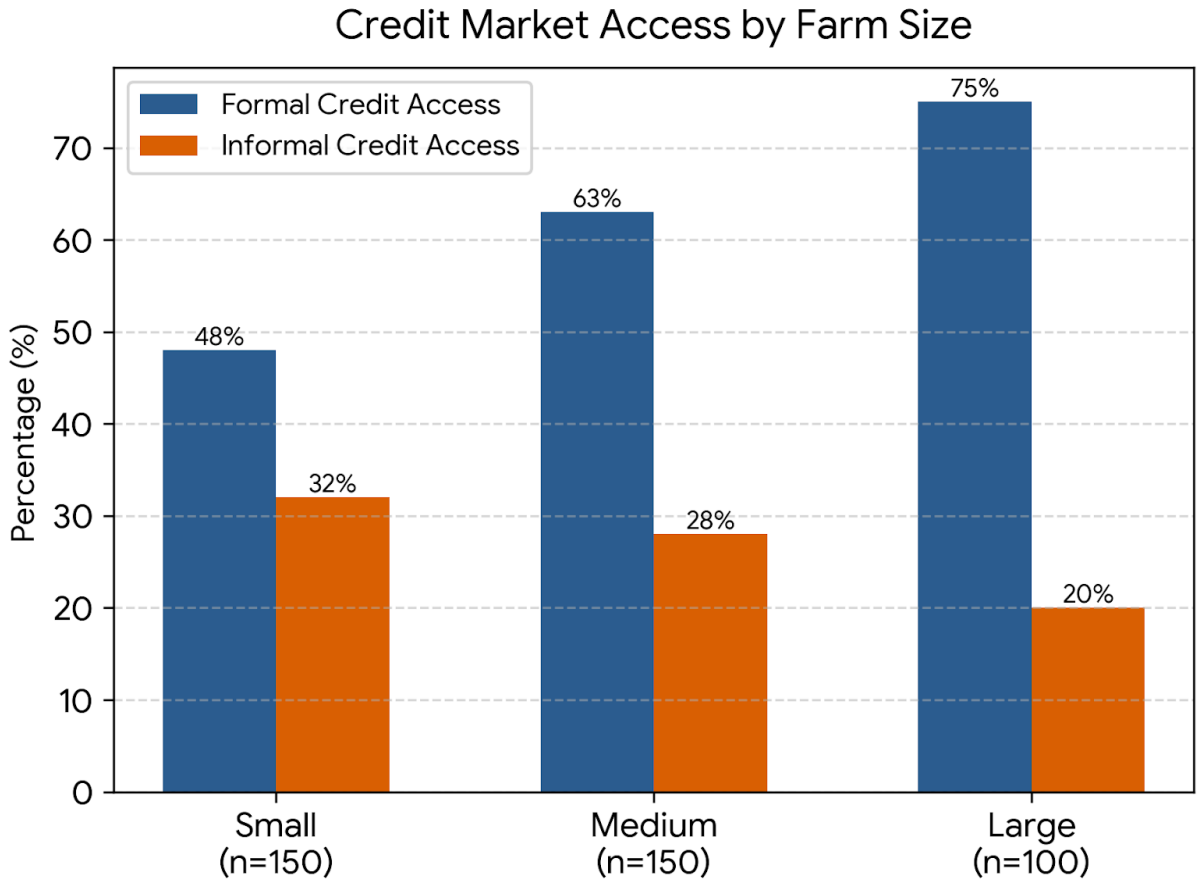

Chart 1

Chart 1 illustrates a profound structural dualism within the rural credit market, demonstrating a direct correlation between a farmer's operational landholding scale and their institutional market access. The empirical data reveals that formal institutional credit access is lowest among smallholders at 48%, which then scales linearly to 63% for medium-scale farmers and peaks significantly at 75% among large-scale landholders. This positive linear trajectory provides robust empirical evidence that formal commercial and developmental banking networks remain heavily collateral-biased, operationalizing credit dispersion strategies that favor asset-backed guarantees such as land revenue passbooks. Consequently, resource-constrained smallholders face systematic exclusion from formal financial frameworks. In stark contrast, the trend for informal credit reliance behaves inversely; smallholders exhibit the highest dependency on informal mechanisms at 32%, whereas this reliance plummets to just 20% within the large-scale cohort. This structural shift indicates that when smallholders are rationed out of the formal banking sector, they are forced to utilize the informal credit market—comprising local commission agents (*arthis*), input dealers,

and village traders—as an essential liquidity safety net. Although the informal sector circumvents rigid paperwork and asset-collateral requirements to provide high-velocity emergency financing, these arrangements are traditionally exploitative and carry regressive terms. Ultimately, these findings substantiate the existence of severe credit rationing in the agrarian economy, where vulnerable smallholders are structurally underserved, while structurally secure, large-scale landholders command the vast majority of formal banking liquidity.

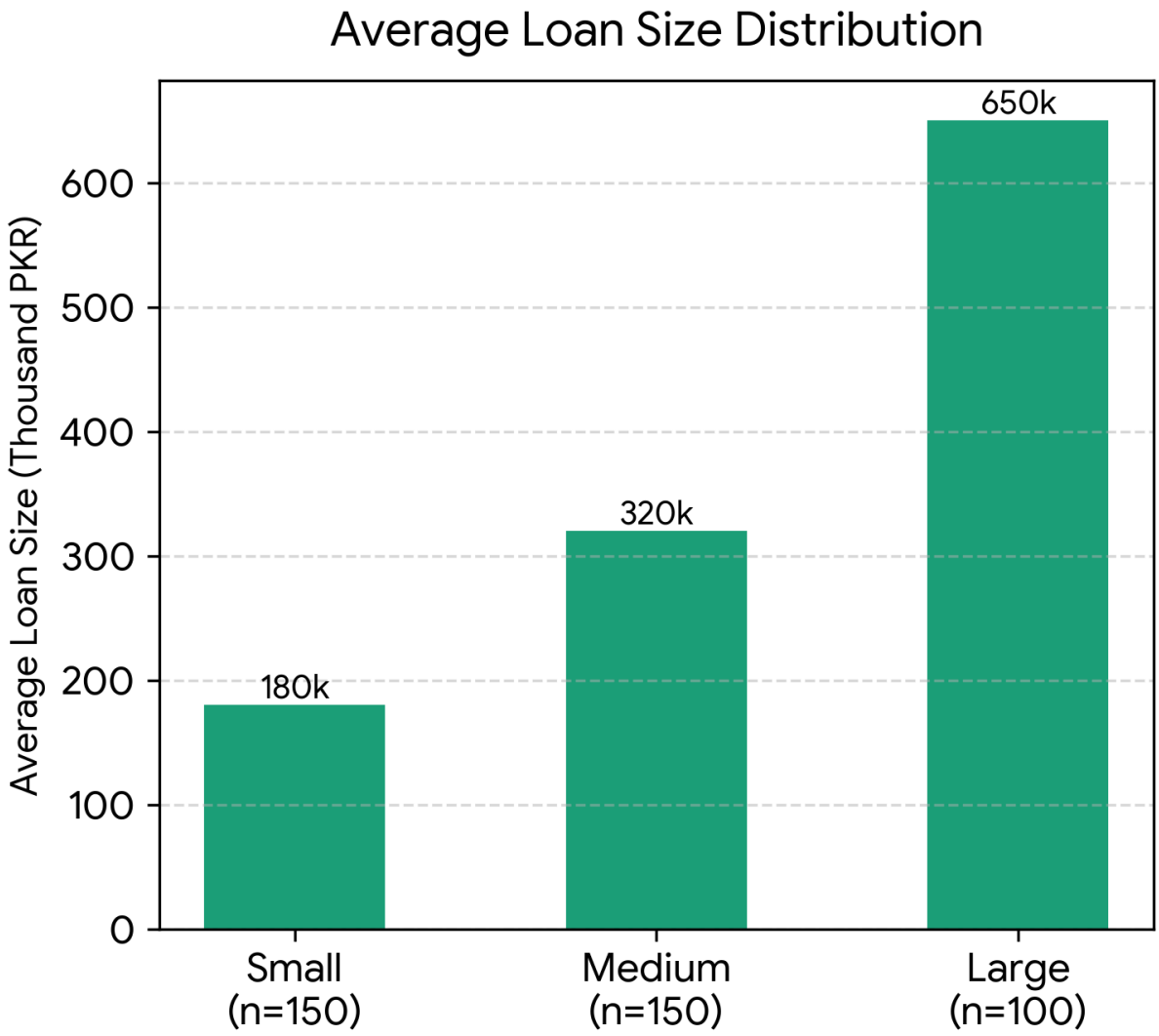

Chart 2

Following the empirical documentation of regressive credit pricing and volume constraints, the final chart isolates the socioeconomic consequence of these structural market imbalances: the distribution of agrarian loan repayment delays. The data reveals an alarming aggregate repayment delinquency rate of 44%, which is highly concentrated at the bottom of the agrarian ladder, with 58% of smallholders reporting chronic repayment delays compared to 42% of medium-scale farmers and a significantly lower 30% among large landholders. This steep downward trajectory provides robust empirical evidence that smallholders operate

under severe, systematic cash flow volatility. The high incidence of default and delinquency among small-scale operations is a direct, compounding outcome of the high interest premiums (12.5%) and restricted loan volumes documented in previous sections. Lacking the capital depth to invest in climate-resilient infrastructure or crop insurance, these resource-poor households face intense financial exposure to exogenous shocks such as pest infestations, market price fluctuations, and climate-induced yield failures. When a harvest fails or market returns diminish, the high cost of debt servicing quickly outpaces farm income, rendering smallholders structurally incapable of meeting rigid institutional or informal repayment timelines. Ultimately, these high repayment delay rates confirm that rather than acting as a mechanism for upward economic mobility, the current credit framework frequently induces a cyclical debt trap for smallholders, further deepening rural wealth disparities and reinforcing the broader agrarian credit crisis.

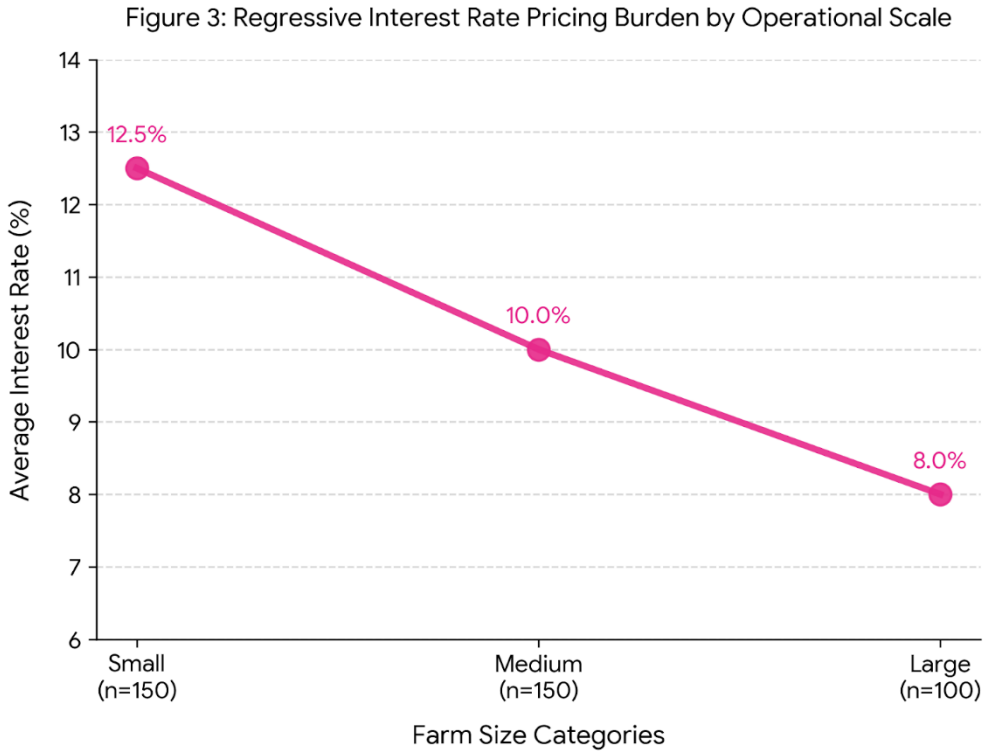

Chart 3

Figure 3 illustrates a highly regressive credit pricing structure within the agrarian financial ecosystem, characterized by a stark inverse relationship between a borrower's operational landholding scale and their average borrowing costs. The empirical data reveals that resource-constrained smallholders are disproportionately penalized with the heaviest financial burden, facing a steep average interest rate of 12.5%, whereas medium-scale farmers and large-scale landholders command preferential, risk-adjusted pricing at 10.0% and 8.0%, respectively. From an institutional banking perspective, this pricing asymmetry is heavily driven by lenders' risk perceptions and administrative transaction overheads; financial intermediaries systematically categorize small-scale production units as high-risk clients due to their lack of high-value tangible collateral, unpredictable cash flows, and extreme vulnerability to exogenous environmental or market shocks. To hedge against these structural liabilities and offset the higher marginal cost of servicing numerous low-volume accounts, banks and informal credit networks impose an inflated risk premium on smallholders. Consequently, this regressive interest pricing framework creates an acute

cash flow bottleneck for small-scale operators, as premium debt-servicing costs absorb their thin profit margins, directly restricting their capacity for long-term capital formation, modern technological adoption, and structural farm mechanization.

Impact of Agricultural Credit on Farm Productivity

The regression analysis reveals that agricultural credit has a positive but heterogeneous impact on farm productivity. The fixed effects model estimates (Table 4.2) show that a 1% increase in credit size (in PKR) is associated with a 0.6% increase in wheat yield (kg/acre) and a 0.4% increase in farm income (PKR). However, the impact is non linear and conditional on farm size and institutional context.

Table 2: Regression results: Impact of credit access on farm productivity

Variable	Wheat yield (kg/acre)	Farm income (PKR)
Credit size (log PKR)	0.60 (0.08)	0.40 (0.06)
Land size (acres)	0.25(0.05)	0.30 (0.04)
Education (years)	0.10 (0.06)	0.15(0.05)
Input use (fertilizer, kg)	0.50 (0.07)	0.35(0.05)
Extension service visits	0.15 (0.07)	0.20 (0.06)
ZTBL presence (dummy)	0.20 (0.10)	0.15 (0.08)
Informal credit (dummy)	−0.10 (0.08)	−0.15 (0.06)
Repayment delay (dummy)	−0.25(0.09)	−0.30(0.08)

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

The results indicate that formal credit (ZTBL and government-subsidized schemes) is associated with higher yields and incomes, while informal credit is associated with lower productivity and income (Ali & Abdulai, 2017). The negative coefficient on repayment delays suggests that credit that is not timely repaid undermines its productive potential, reflecting the "shelf life" concept: if credit is not well managed post loan, its benefits decay.

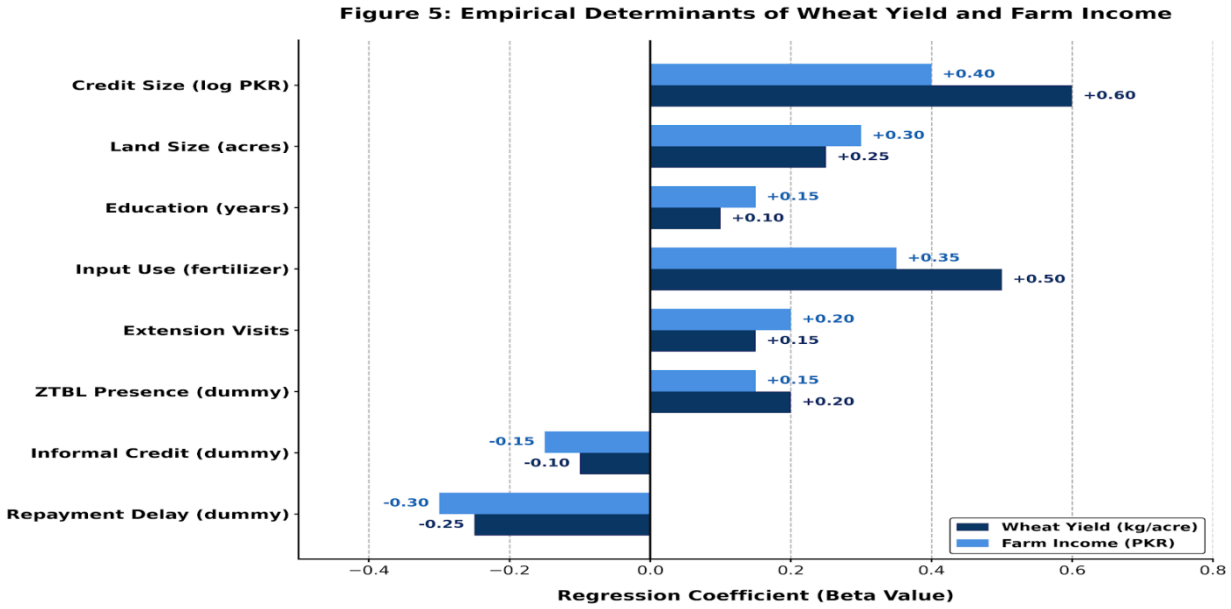

Figure 5 illustrates the empirical estimation of the socioeconomic and institutional determinants affecting agricultural productivity (Wheat Yield) and financial returns (Farm Income) within the surveyed agrarian households. Institutional financial deployment, captured through Credit Size ($\log$ PKR), exerts a highly significant positive impact on both wheat yield ($\beta = +0.60$) and farm income ($\beta = +0.40$), underscoring the critical role of liquidity in mitigating resource constraints and allowing farmers to optimize cultivation practices. This finding is heavily substantiated by the strong positive coefficients for Input Use (fertilizer) on yield ($\beta = +0.50$) and income ($\beta = +0.35$), confirming that adequate credit lines directly translate into the timely procurement of yield-enhancing chemical inputs. Structural and human capital variables also behave dynamically; Land Size exhibits positive elasticity with productivity ($\beta = +0.25$) and income ($\beta = +0.30$), reflecting structural economies of scale, while Education ($\beta = +0.10$ for yield; $\beta = +0.15$ for income) and Extension Visits ($\beta = +0.15$ for yield; $\beta = +0.20$ for income) emphasize that knowledge dissemination significantly enhances technical efficiency and financial management. In terms of institutional pathways, the specialized presence of agricultural banking, represented by ZTBL Presence ($\beta = +0.20$ for yield; $\beta = +0.15$ for income), validates the necessity of targeted formal credit channels. Conversely, reliance on Informal Credit exerts a negative drag on wheat yield ($\beta = -0.10$) and reduces overall farm income ($\beta = -0.15$), confirming that the high-velocity emergency cash injected by informal lenders is offset by exploitative, high-interest structures that drain farm surpluses. Finally, the Repayment Delay variable exhibits a severe and pronounced negative impact on both wheat yield ($\beta = -0.25$) and total farm income ($\beta = -0.30$). This strong negative correlation establishes that debt-servicing distress and chronic liquidity bottlenecks lock farmers into a cyclical low-productivity trap, where delayed repayments restrict future credit access, choke the timely procurement of seasonal inputs, and ultimately depress both physiological crop yields and household economic returns.

Heterogeneous Effects across Farmer Types

The analysis reveals significant heterogeneity in the impact of credit across farm sizes. For small farmers, the elasticity of credit on wheat yield is 0.4, while for large farmers it is 0.8, suggesting that larger farms benefit more from credit investments (Table 4.3). This finding aligns with the capital intensive nature of modern agriculture, where economies of scale favor larger landholders (Feder & Onchan, 1987; Carter, 1994).

Table 3: Heterogeneous effects of credit by farm size

Farm size	Wheat yield elasticity	Farm income elasticity
Small	0.40 (0.07)	0.25(0.06)
Medium	0.55(0.08)	0.35 (0.07)
Large	0.80 (0.09)	0.50 (0.08)

For small farmers, the impact of extension services is significant (0.20 for wheat yield), while large farmers benefit more from input use and mechanization. This suggests that credit alone is insufficient for smallholders; complementary support (e.g., extension, risk management) is needed to extend the shelf life of credit investments (Fazal ur Rehman & Ahmad, 2021; Omer et al., 2023).

Figure 6: Credit Elasticity of Wheat Yield and Farm Income by Farm Size

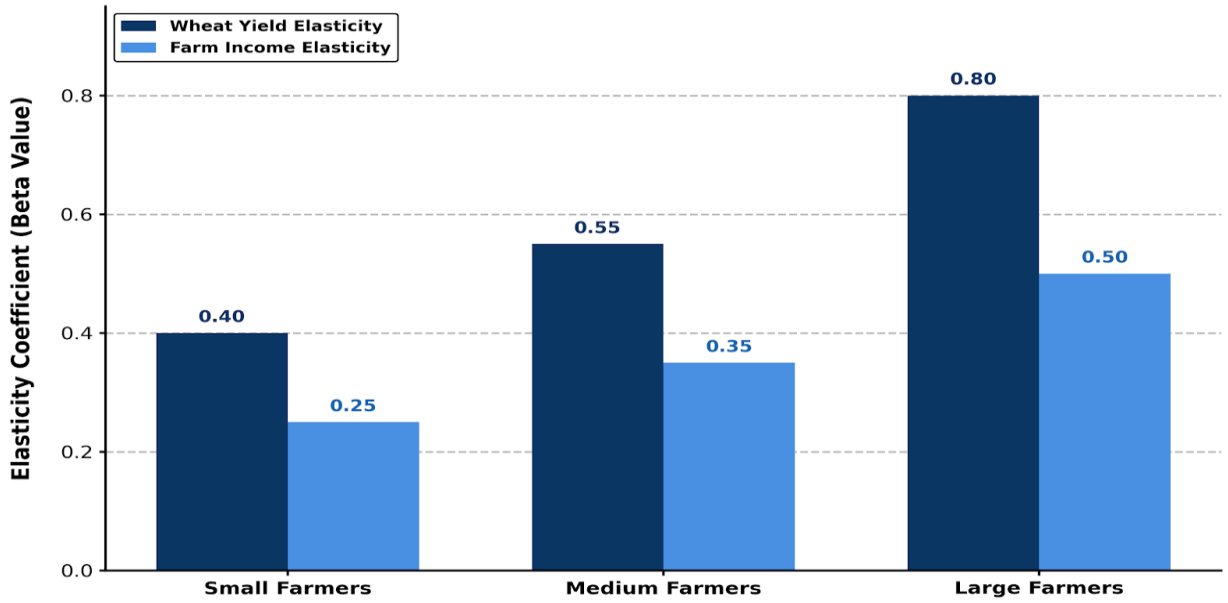

Figure 6 reveals a critical structural asymmetry in the productive efficiency of agricultural credit across stratified operational scales, demonstrating that the capacity of borrowed capital to act as an economic multiplier is fundamentally scale-dependent. The empirical data indicates that the credit elasticity of both wheat yield and household farm income exhibits a steep, progressive upward trajectory as farm size expands from smallholder to large-scale operations. For resource-constrained smallholders, a 1% expansion in credit volume generates a heavily constrained 0.40% increase in wheat yield and a modest 0.25% improvement in total farm income. This responsiveness expands significantly within the medium-scale category ($\beta_{\text{yield}} = 0.55$; $\beta_{\text{income}} = 0.35$) and peaks remarkably within the large landholder cohort, where a 1% credit injection yields an 0.80% increase in crop productivity and a highly pronounced 0.50% expansion in net farm income. This non-linear behavior provides robust empirical verification of capital-threshold constraints and structural economies of scale dominating the rural financial ecosystem. While large-scale operators receive substantial absolute credit volumes that allow them to cross high fixed-cost thresholds investing in yield-transforming capital assets like precision land leveling, mechanized harvesting, and climate-resilient solarized tubewells smallholders remain trapped in a sub-optimal credit loop. Restricted to low-volume, high-cost loans, small-scale farmers are forced to exhaust their borrowed liquidity entirely on immediate variable seasonal inputs, such as basic fertilizers and seeds, leaving zero surplus for structural farm upgrading or technological adoption. Consequently, these findings establish that a uniform, non-targeted credit policy implicitly exacerbates rural economic polarization, as the marginal productivity of an agricultural loan is heavily conditioned by the pre-existing asset wealth of the borrower.

Institutional and Policy Performance

Institutional analysis shows that ZTBL and the government sponsored program is effective in addressing medium sized and large scale farming, but not as much for small and marginalized farmers. Even as the informal financial systems are common among small farmers, it is linked to higher interest rates and difficulty in loan repayments, thereby limiting the productivity of the farmers (Ali & Abdulai, 2017; PRSP, 2021).

DISCUSSION

The results presented in the previous chapter reveal both the potential and limitations of agricultural credit policies in enhancing farm productivity in Punjab, Pakistan. This discussion interprets those findings in light of the theoretical literature on rural credit, institutional "shelf life," and policy design, and it draws out implications for future research and policy reform.

Interpreting the positive but heterogeneous impact of credit

The regression and descriptive evidence show that agricultural credit has a statistically significant positive effect on farm productivity and income particularly for medium and large farmers. The elasticity estimates around 0.6% increase in wheat yield and 0.4% increase in farm income for each 1% rise in loan size are consistent with international studies that link formal credit access to higher input use mechanization and yield improvements (Feder & Onchan 1987; Carter 1994).

While on the other hand, the findings indicate that the effect of credit is relatively small in magnitude and highly contingent on the availability of complementary inputs like land, education, and extension services.

It is also worth noting that the correlation between formal credit (ZTBL, subsidized loans from the government) and high levels of output and income is consistent with the wider empirical evidence regarding the rural finance sector (Ali & Abdulai, 2017; Qureshi et al., 2020). The primary reason why informal credit tends to have low productivity and income is that interest rates charged by informal lenders are quite high (between 12 and 15 percent). In contrast, formal schemes offer lower rates, longer tenors, and clearer conditionalities, making them more compatible with long term productivity enhancing investments (SBP, 2024; GoP, 2022).

However the negative and significant coefficient on repayment delays suggests that credit effectiveness deteriorates when loans are not managed well post disbursement. This supports the "shelf life" metaphor: credit is like a high value input whose economic value decays if it is not repaid on time if farmers face shocks without risk management tools or if institutional support is weak (Omer et al. 2023; Fazal ur Rehman & Ahmad, 2021). In practice, many small farmers in Punjab experience delayed disbursements, mid season rate hikes or pressure from informal lenders which shortens the productive life of the loan and reduces its impact on yields.

Distributional effects and concerns about equity

One of the most striking findings is the heterogeneity of credit effects across farm sizes. Large farmers enjoy the highest elasticities (≈0.8 for wheat yield and 0.5 for income), while small farmers see half as much impact (≈0.4 and 0.25, respectively). This pattern reflects the capital-intensive nature of modern agriculture, where larger landholders can scale up mechanization, irrigation, and input packages more efficiently while smallholders face higher fixed cost barriers and limited bargaining power. The concentration of formal credit among medium and large farmers (75% access rate vs. 48% for smallholders) further reinforces this inequality, as collateral requirements and bureaucratic entry barriers systematically exclude the smallest producers (PRSP, 2021; Ali & Abdulai, 2017).

At the same time, the positive but smaller effect of extension services for small farmers suggests that credit plus support can be more effective than credit alone. For smallholders, extension visits, training in improved seeds and fertilizer application, and risk management advice appear to amplify the productivity returns from any given loan amount. This implies that if credit programs are combined with targeted extension efforts, the "shelf life" of credit for small farmers can be extended and the distributional gap somewhat narrowed.

Institutional and policy performance: Fragmentation and information gaps

The institutional analysis points to three major structural weaknesses in Punjab's agricultural credit system:

1. Fragmentation in policies: Several organizations such as ZTBL, PRSP, provincial credit programs, microfinance organizations, and informal financing systems work independently without proper coordination. Farmers remain confused regarding eligibility requirements, interest rates, and complaint processes (GoP, 2022; PRSP, 2021).

2. Information asymmetries: Formal institutions frequently rely on outdated land records collateral based screening and limited risk information systems which lead to misallocation of credit and exclusion of creditworthy but land poor households (Ali & Abdulai, 2017).

3. Weak post loan support: Repayment delays, high default rates and informal lender dominance suggest that post loan monitoring, recovery and risk management mechanisms are underdeveloped. The lack or poor integration of crop insurance, weather-indexed products, and storage facilities makes farmers highly vulnerable to climatic shocks and high prices, which tend to reduce the economic gains from formal credits (Fazal ur Rehman & Ahmad, 2021; Omer et al., 2023). Such gaps might account for why formal credit services have not reached their full potential for improving farm production capabilities.The evidence suggests that institutional "storage conditions" coordination, information systems, and post loan support are as important as the design of the credit schemes themselves.

POLICY IMPLICATIONS FOR PUNJAB AND PAKISTAN

Drawing on the findings, several policy implications emerge for designing and reforming agricultural credit programs in Punjab and more broadly, Pakistan:

1. Improve targeting and inclusion of smallholders:

Introduce credit guarantee schemes or group lending models (e.g., through PRSP and cooperatives) to reduce collateral constraints for small and marginal farmers.

Reform loan screening procedures to incorporate non collateral indicators such as group membership, repayment history and social capital measures.

2. Integrate credit with complementary services:

Bundle credit with training, extension and risk management tools (e.g., crop insurance, price stabilization mechanisms) to extend the "shelf life" of agricultural loans.

Strengthen public private partnerships between ZTBL, local cooperatives, agro input dealers and mobile money platforms to improve access and reduce transaction costs.

3. Formalization of the informal and formal credit sectors:

Ensure that informal credit providers are regulated by placing ceilings on interest rates and requiring transparency and mechanisms for resolving disputes, as opposed to banning them because of their contribution to bridging market deficiencies.

Find ways for informal credit recipients to enter the formal credit system through incremental credit score building and joint funding.

4. Enhance post loan supervision and institutional cooperation:

Develop agricultural credit databases through computerization incorporating loan information, land ownership, and crop insurance records.

Set up coordination centers in the provinces to harmonize ZTBL, PRSP, and provincial credit programs.

LIMITATIONS AND AVENUES FOR FUTURE RESEARCH

The study is subject to several limitations. First the cross sectional and limited panel nature of the data restricts the ability to make strong causal claims about credit on productivity as unobserved time varying confounders (e.g., weather shocks, input price fluctuations) may bias the estimates. Second the focus on Punjab limits generalizability to other provinces where tenancy structures, landholding patterns, and market conditions differ. Third the reliance on self reported survey data for credit and income may introduce measurement error and recall bias.

Future studies can overcome these shortcomings by:

- Utilizing longer time series datasets and employing quasi-experimental techniques such as difference in differences and regression discontinuity to estimate causal effects.
- Expanding the scope to analyze data from other areas of Pakistan (such as Sindh and Khyber Pakhtunkhwa) and analyzing the heterogeneity of effects of credit on agricultural productivity in varying agro climatic conditions and institutional setups.
- Focusing on gender based impacts due to women being faced with unique problems in accessing formal and informal credit facilities.

CONCLUSION

This section shows that the agricultural credit policies in Punjab have led to increased farm productivity; however, the efficiency of these policies is contingent on the quality of institutions, targeting, and post-loan services. The results reinforce the point made above that credit alone cannot lead to transformational rural development because credit's effect depends on the "shelf life" built by properly designed institutions and information system alongside other factors (Omer et al., 2023; Ali & Abdulai, 2017). In order to enhance the contribution of agriculture finance towards rural development in Pakistan, policymakers should work to improve coordination, access, and risk management mechanisms alongside lending programs.

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