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Informal Debt and Agricultural Marketing Decisions of Smallholder Farmers

Khadija Yasen[1], Muhammad Fahid Shabbir[2], Robina Rashid[3]

[1]*Institute of Business Management Sciences, University of Agriculture Faisalabad, Pakistan*
[2]*Kazimieras Simonavicius University, Lithuania*
[3]*Institute of Business Management Sciences, University of Agriculture Faisalabad, Pakistan*

Abstract

The present study investigates the impact of informal debt dependency of farmers on marketing decisions of crops and explore the mechanisms through which this relationship takes place. It determines if informal debt impacts farmers' marketing decisions via creating repayment pressure in harvest period and through constraining farmers' market choices. The data was collected from 100 farmers of smallholders of Faisalabad and there were four constructs, namely, Informal Debt Dependence, Debt Repayment Pressure, Market Choice Restriction and Market Channel Choice Behavior. Hypotheses were tested using Partial Least Squares Structural Equation Modeling and bootstrapping, while controls related to socio-economic factors were used to test the robustness of results. It was found out that informal debt dependence has a significant impact on debt repayment pressure ($\beta = 0.317$, $p < .001$), which, in its turn, leads to increased restrictions on farmers' market choices ($\beta = 0.395$, $p < .001$). Market choice restriction was also found to be significantly influencing farmers' market channel decisions ($\beta = 0.313$, $p = .002$). At the same time, the direct effect of informal debt and repayment pressure on market channel choice proved to be insignificant. Thus, it can be concluded that informal credit does not directly control marketing decisions of farmers, but influences them through the time pressure of repayment.

Keywords: Informal Debt Dependence, Debt Repayment Pressure, Market Choice Restriction, Market Channel Choice Behavior.

Introduction

Pakistan's agriculture sector accounts for around 23.4% of its GDP and nearly 35% of its workforce (Pakistan Economic Survey, 2026). The majority of farmers depend on financial capital to purchase agricultural inputs (Islam et al., 2020). Financial capital is particularly crucial for agricultural production as it takes a long time to recuperate the cost of inputs and generate an equal value of output. Traditional agricultural credits have largely failed to reach small scale farmers, tenant farmers, and farmers without clear title to their land (Hussain & Thapa, 2012). Farmers are also increasingly forced to rely on informal financial markets for agricultural inputs. The informal financial markets provide capital quickly with less stringent credit requirements (Thapa, 2012). Informal financial markets are especially handy during off seasons when a farmer has no source of income to repay the credit.

Although informal credit has traditionally been associated with rural finance, the reason formal credit and informal credit coexist is because informal credit fills information and enforcement

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gaps in the credit market that the bank cannot solve at an acceptable cost (Hoff & Stiglitz, 1990; Besley, 1994; Conning & Udry, 2007). For instance, Aleem (1990) showed how informal moneylenders charge high interest rates because of the high costs of screenings and monitorings associated with moneylending and their monopolistic position in the market. Field evidence regarding arhtis shows informal credit allows greater flexibility and enables borrowers to defer repayment to less remunerative periods (Haq et al., 2013). Commission agents in the Indian state of West Bengal combine the functions of broker, banker, and trader (Minten et al., 2012).

How informal credit operates may alter when and how farmers sell. If the lender is also the buyer or commission agent, the credit and the output market are integrated (Bhaduri, 1973; Braverman & Stiglitz, 1982; Bell et al., 1997). In these cases, the lender is assured recovery of the credit advance by a claim on the farmer's crop. In other situations, farm productivity and constraints to the availability of working capital may result in the farmer being a net seller of the crop at the time of the harvest (Stephens & Barrett, 2011; Burke et al., 2019; Channa et al., 2022). In some instances, the sale of the crop may be exacerbated by the need to satisfy other cash-based obligations (Dillon, 2021). Transport costs and the distance to the market may determine if the farmer sells the crop at the farm gate (Goetz, 1992; Key et al., 2000) or if he/she has to travel to a commodity market (Fafchamps & Hill, 2005). Interest-free credit has been reported to improve the marketing opportunities of smallholders (Sher et al., 2021, 2024), and in the process, improve the prices attained (i.e. the producer price).

The missing piece is the mechanics. Informal debt may limit marketing for several reasons. It could be that the lender is a captive buyer, a tied debt buyer, who also controls where the borrower sells the crop (Mitra et al., 2018). Informal debt may also constrain marketing because of the harvest deadline. Farmers have to repay the debt at harvest, and the time constraint prevents farmers from storing, transporting or selling the crop. If the constraint is due to a tied debt buyer, then policies should address competition in the seed and other agricultural input market (Bergquist & Dinerstein, 2020). If the constraint is due to a cash crop at harvest, then policies should address how farmers repay the debt, and provide the farmers with ways to store their crop (Basu & Wong, 2015; Casaburi & Willis, 2018; Miranda et al., 2019). Because most studies evaluate how informal debt affects farm and crop choices, they do not address the other policies.

Arhti systems in Pakistan resemble those described above. For crops that require an input (e.g. seed), the cost of the input is recovered from the sale price, and a commission is charged (Haq et al., 2013). In the Indian context, similar arrangements have been criticized for limiting the bargaining power of farmers (Minten et al., 2012; Chatterjee, 2023). Farmers are at the mercy of traders (buyers) as well as lenders (Mitra et al., 2018), and price competition among traders determines the price farmers are willing to accept (Dillon & Dambro, 2017; Bergquist & Dinerstein, 2020). In the context of agriculture, relationship-specific investments create a situation in which, for a farmer to shift to a new buyer, the current buyer would have to absorb the cost of breaking the relationship (Williamson, 1985). It is this relationship, most commonly associated with the banking industry, that reduces the ability of farmers to market their crops. Farmers are limited in their ability to market their crops by informal lending arrangements in which farmers pledge their crop to a lender.

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Time plays a large role in liquidity constraints and the timing of repayments. Harvey et al. (2004) demonstrate farmers in Western Kenya are often forced to sell their crop at low prices due to a lack of funding to hold on to the crop until prices increase. Additionally, liquidity constraints affect timing of farm input purchases and the decision of what crops to produce and consume (Deaton, 1991). Liquidity constraints force farmers to forgo the consumption of more profitable crops (Deaton, 1991). While farmers can store most crops, they often can not store all crops, and the price of storage increases with the duration that the crop is stored (Saha and Stroud, 1994). Tahir (2026) investigated the implications of trade policy reforms for Pakistan's Basmati rice markets, highlighting the relevance of policy and market structures to agribusiness outcomes. Similarly, Noor et al. (2026) examined farm profitability and production constraints among sweet potato farmers in Punjab, identifying challenges such as high input costs, price fluctuations, and issues involving commission agents.

It's important to consider the timing of obligations. For example, in Malawi, the timeliness of school fees has consequence. Dillon (2021) shows that school fees due at harvest time result in households selling their crops at lower prices and potentially at a loss. Casaburi and Willis (2018) find that in the case of farming insurance in Malawi, the large uptake of the insurance policy is due to the premium being collected at harvest and not at the time of the insurance coverage. In other words, timing of a financial obligation alters behavior of farmers and affects how they use the cash. In the case of microfinance, the seasonal timing of repayment helps borrowers time their business activities (Field et al., 2013; Fink et al., 2020). From a farming perspective, the seasonal availability of cash dictates what farmers produce and how they allocate their time (Fink et al., 2020). There is a strong relationship between the timing of financial obligation and the farming activities of a household. For example, the timing of an informal farm loan may restrict the household's ability to engage in marketing activities because the farm loan repayment becomes due at harvest and the lender may be purchasing the crop.

Transaction costs, market access and channel choice

Channel choice is dictated by cost of accessing alternate buyers. Farmers, especially those situated far from trading centers, with poor or unpassable roads, and small surplus, are likely to face high transaction costs and either sell their produce at the farm gate or not sell at all (Goetz, 1992; Key et al., 2000; Fafchamps & Hill, 2005; Barrett, 2008). The type of buyers that are within a farmer's reach is influenced by the prevailing market and non-market interactions (Fafchamps, 2004; Poulton et al., 2010). Timely and adequate market information improves a farmer's ability to identify the best buyers in the market and improves farmers' bargaining positions (Jensen, 2007; Aker, 2010; Fafchamps & Minten, 2012). Therefore, when assessing the channels that can be used to combine credit and marketing services, it is important to take into account the costs of accessing different markets which can potentially constrain the choices of available channels.

Conceptual framework

The following integrates the different strands of the argument to detail how informal debt dependence may shape marketing behavior in at least two ways (see Figure 1). In the tied-buyer case, informal debt dependence restricts lenders that the farmer deals with, which, in turn, restricts the buyer and the channel (IND → MCR) and results in farmer behavior being tied to

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the preferences of the tied lenders. In the case of the timing of farm debt repayment, informal debt dependence may result in the farmer being under pressure to clear his/her debt after the harvest (IND → DPR). The farmer may then be constrained to sell through a particular channel (DPR → MCR). If he/she is unable to sell the produce, or if it is not harvested, then the farmer may be constrained to sell it through the channel of his/her preference (MCR → MCCB). Any other impact of informal debt and debt repayment pressure on marketing behavior is captured by the remaining direct paths. Farmers may be constrained to sell through the channel of his/her preference, for example by restricting his/her access to alternative channels and by selling his/her produce immediately after the harvest.

Hypotheses

Based on the above, we formulate the following hypothesis:

H1. Informal debt dependence has a positive influence on the marketing channel choice behavior of farmers.

H2. The presence of debt repayment pressure leads borrowers to consider a greater number of different marketing channels.

H3. The presence of debt repayment pressure leads borrowers to consider a greater number of different marketing channels.

Agricultural lending in Pakistan is usually advanced against the crop, and is recovered with the crop (Aleem, 1990; Haq et al., 2013). As such, reliance on such financing is likely to increase the perception of having to repay at the time of the crop harvest. Repaying debt reduces the set of alternatives from which a buyer can be chosen. This is because the borrower is under financial stress, and focuses mainly on repaying the debt. Repaying debt takes precedence over all other activities. Thus, there is perceived pressure to repay, which reduces the set of alternatives. Therefore,

H4. Dependence on informal debt increases the perception of having to repay debt.

H5. The perception of having to repay debt reduces the set of alternative buyers.

If H3 and H5 are supported by the data, the repayment-timing account suggests that the focus of informal lending on the constraints of the market for the channel of trade is mediated by the perception of having to repay debt (Hayes, 2022). Therefore, H6. The perception of having to repay debt constrains the market for the channel of trade (IND → DPR), and in combination with debt repayment pressure (DPR → MCR), constraints the market for the channel of trade (MCR).

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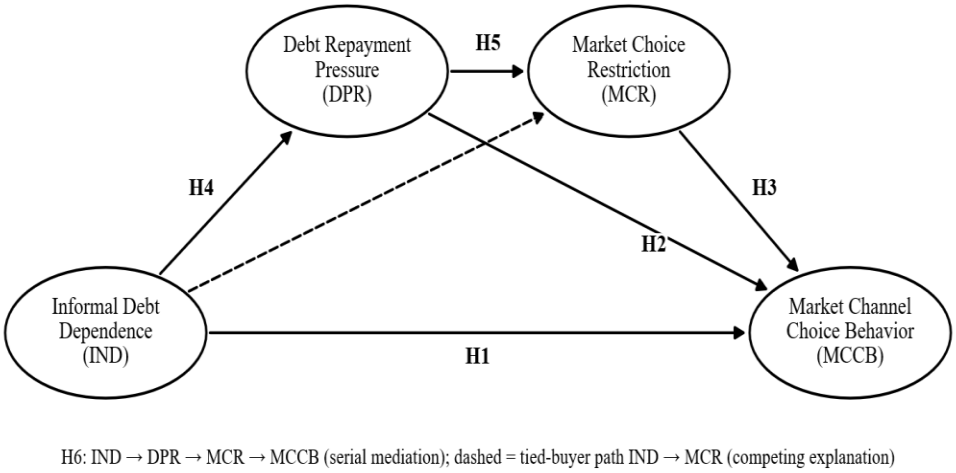


Figure 1. Research model

Methodology

Study context and data collection

The study was conducted in Faisalabad district, central Punjab. The study unit was purposively selected for three reasons. First, the district is a major agricultural district of Punjab, located in the canal irrigated area of the region, and in the wheat-sugarcane zone. The region is known for the cash crop rotation of wheat and sugarcane. Of the total respondents, 56% and 38% were wheat and sugarcane growers respectively. As mentioned above, the major cash crops of the region are wheat and sugarcane. Second, grain trading in the country is mainly done through a network of mandis, the largest of which is located in Faisalabad district. Many tehsil mandis are connected to the Faisalabad mandi. The arhti-farmer relationship as described in this study, exists in Faisalabad district. Last, cash flow constraints of growers in the district are the highest, due to the advance payments by the sugar mills and the timing of the payment by the mills to the growers.

Of the district's six tehsils, only Faisalabad City was considered predominantly urban, so it was excluded from the study. The remaining three tehsils, Faisalabad Saddar, Jaranwala and Samundri, cover a range of access to urban markets, where the mandis are considered the best alternative explanation to the constrained selling of agricultural goods (Key et al., 2000; Fafchamps & Hill, 2005). Farmers in the tehsil Faisalabad Saddar have easy access to the main grain market of the city. Jaranwala, situated to the east, is a large wheat and sugarcane growing tehsil; therefore, it has an established grain market. Samundri, located to the southwest, has a larger population of farmers who have restricted access to the main grain market of the city and rely on village level traders and a small local mandi. Because of the sameness of the district, it is assumed that most of the variation observed among farmers of the district is attributed to differences in their access to financial services (credit) and markets, rather than differences in the environment, climate, and infrastructure of the district.

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The research design employed a multistage sampling methodology. In the first phase of sampling, Faisalabad district was identified. In the second phase of sampling, three tehsils were identified. In the third phase of sampling, a list of all revenue villages of the respective tehsils was obtained, from which a sample of villages was selected, using the random sampling technique. In the fourth and final phase of sampling, field staff of the Agriculture Extension Department, prepared a list of all farmers of the selected villages. Only those farmers were included in the sample, who had cultivated wheat or sugarcane in the previous crop/ratoon season and had also sold the harvested crop. A total of 100 farmers were interviewed, and their opinions were used to analyze the research problem in this study. Interviews were conducted between July and August and 2026 using a questionnaire in Punjabi and Urdu, which were also the languages used in the development of the tools by the interviewers. The study was reviewed and approved by the name of the reviewing body with reference number. The questionnaire was used to collect the following information: socio-economic and demographic information of farmers, characteristics of the farm, information about the nearest Mandi, and four attitude and perception scales.

Analytical Sample and Sample Size Adequacy

Smart PLS 4 used 100 cases showed the presence of no invalid code frames, duplicates, straight lining, and uni- and multivariate outliers. A total of 18 (0.6%) respondent cases were missing and were replaced with indicator means. It was established that with such a small number of cases, mean replacement has no significant impact on the overall model estimates.

Three approaches were undertaken to evaluate sample size adequacy. First, in line with Rust (2014), if the number of arrows pointing to a construct is three or more, at least 30 cases are required. For a path to have a medium effect size ($f^2 = 0.15$) in a multiple regression framework, the required sample size is 77, based on a power analysis (Cohen, 1988). Using the more stringent standard (Kock & Hadaya, 2018), 100 cases are required to detect path coefficients with an effect size of 0.25. The sample is therefore sufficient to identify medium effects and larger in the path model, and insufficient for small effects, which is further analyzed in Sections 5 and 7. The sample is predominantly male (97%), married (86%), and is between 30-40 years of age (50%). The sample is relatively uneducated. Thirty-five percent have no schooling and 29% have only a primary education. Most of the sampled farms (80%) are less than 10 acres. A higher farm acreage increases the likelihood of off-farm employment. As a result, 54% of the farmers in the sample are sole owners of the farmland and 37% are both tenants and owners. The remaining 9% are tenants only. The crops grown on the sampled farms include wheat (56%) and sugarcane (38%). The sampled farmers all reside more than 5 km from the nearest mandi. The samples represent the small and less-educated farmer population in central Punjab who cultivate cash and staple crops.

Measures

The four constructs were created reflectively and measured by 7 reflective indicators adapted from studies on informal credit, interlinkage and marketing constraints (Stephens & Barrett, 2011; Haq et al., 2013; Sher et al., 2021) and validated by experts. Indicators for informal debt dependence (IND) include relying on arhtis and traders for financial services; providing and receiving credit and marketing services through an interlinked relationship, input credit, and

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other marketing services; and constraints in accessing formal financial services. IND includes relying on informal credit for farm production services. Debt repayment pressure (DPR) is the need to sell the farm produce at harvest and/or sell it at an approximately unfair price. Market choice restriction (MCR) is the financial constraint on the freedom to choose a buyer and sales channel. The constraint may result in selling the farm produce to the creditor. MCCB includes selling the farm produce at the first available opportunity, and/or not selling it to the most deserving buyer.

Analytical procedure

According to the authors (Hair et al., 2019; 2022; Sarstedt et al., 2022), PLS-SEM is appropriate for models containing composites with multiple items, which are based on a preliminary sample size, and when the intent of the model is to explain and/or forecast. Additionally, PLS-SEM does not impose any distributional limitations, and, therefore, provides greater flexibility than other methods of structural equation modeling. In the present study, the PLS-SEM model was estimated using SmartPLS 4 (Ringle et al., 2024). The path-weighting scheme was used. Other model estimates were performed using default parameters. Significance of the path coefficients was evaluated using 5,000 bootstrap samples. Percentile confidence intervals of two-tailed tests, at α=.05, were reported.

In accordance with established protocols (Chin, 1998; Hulland, 1999; Henseler et al., 2016; Becker et al., 2023), indicator loadings assessed the reflective measurement model. Internal consistency was evaluated by ρA and ρC (Nunnally & Bernstein, 1994; Dijkstra & Henseler, 2015), and convergent validity was assessed by average variance extracted (AVE $\geq$ .50). Discriminant validity was assessed by the HTMT (Henseler et al., 2015) and the Fornell–Larcker criterion (Fornell & Larcker, 1981). Collinearity was assessed by the variance inflation factor (VIF). Path coefficients and effect sizes (f^2; Cohen, 1988) were evaluated to assess the structural model. R^2 and out-of-sample prediction (PLSpredict; Shmueli et al., 2019) were also assessed. The standardised root mean square residual (SRMER; Hu & Bentler, 1999) was calculated to evaluate model fit. Mediation was evaluated based on the bootstrapped 95% confidence interval (Preacher & Hayes, 2008) and classified based on Zhao et al. (2010) and Hair et al. (2022). Podsakoff et al. (2003, 2012), Kock (2015), and Nitzl et al. (2016) were also consulted. Because the constructs assessed a single concern, use of the self-report measure was considered the best approach. Prior to analysis, procedural remedies for common method bias, including a statistically based assessment of full collinearity (Podsakoff et al., 2003, 2012), were undertaken.

Results

Descriptive statistics

Means of all four constructs are above the neutral value of 3 (one sample t-tests, all $p < .001$). The average level of debt dependence was 3.37 (0.85), repayment pressure was 3.45 (0.71), market choice restriction was 3.39 (0.76), and pressure from market actors was 3.27 (0.71). The most recognized forms of financial dependence were relying on traders for financing (IND1, 61%), needing to sell the crop after it was harvested (DPR1, 69%), financial constraints on who they could sell the crop to (MCR1, 56%), and preference to sell the crop at the farm (MCCB1, 67%). Only 36% (DPR4) stated that their lender (i.e. creditor) asked for the loan to be repaid

after harvest, and therefore repayment pressure was more likely caused by the cash availability in the farm.

Measurement model

The measurement model of SmartPLS is given in Figure 2, and loadings are given in Table 1. All 28 loadings are significant (smallest bootstrap t = 3.51). Fourteen loadings are greater than and the other thirteen are between .50 and .70. One loading MCCB7 ('I rarely participate in comparative market auctions or bidding'), which is above the threshold of .40, is 0.433. According to the study's limitations, this loading was kept. This item could be reflecting the structure of the market, since in many Pakistani mandis, price is determined through the arhti, and in the absence of that, farmers may conduct market auctions. Indicator collinearity is not an issue as the highest VIF among the indicators was 2.40. Loadings, standard deviation and SmartPLS 4 bootstrap (5,000 subsamples) t and p values are given in the table. VIF was calculated using the same regression model.

The levels of internal consistency are good (Table 2). Cronbach's alpha ranges between .789 and .861, ρA between .830 and .882, and ρC between .847 and .894. All values are between .70 and .95, therefore acceptable (Hair et al., 2022). AVE is greater than .50 for IND (.549) and MCR (.512), however, for DPR and MCCB, it is .476 and .451, respectively. Therefore, the convergent validity for these two dimensions is inadequate. Given the high composite reliability of the dimensions and no factors that have a individual loadings less than .40, it was decided to keep the dimensions, and it is believed that this is the most appropriate course of action (Fornell & Larcker, 1981).

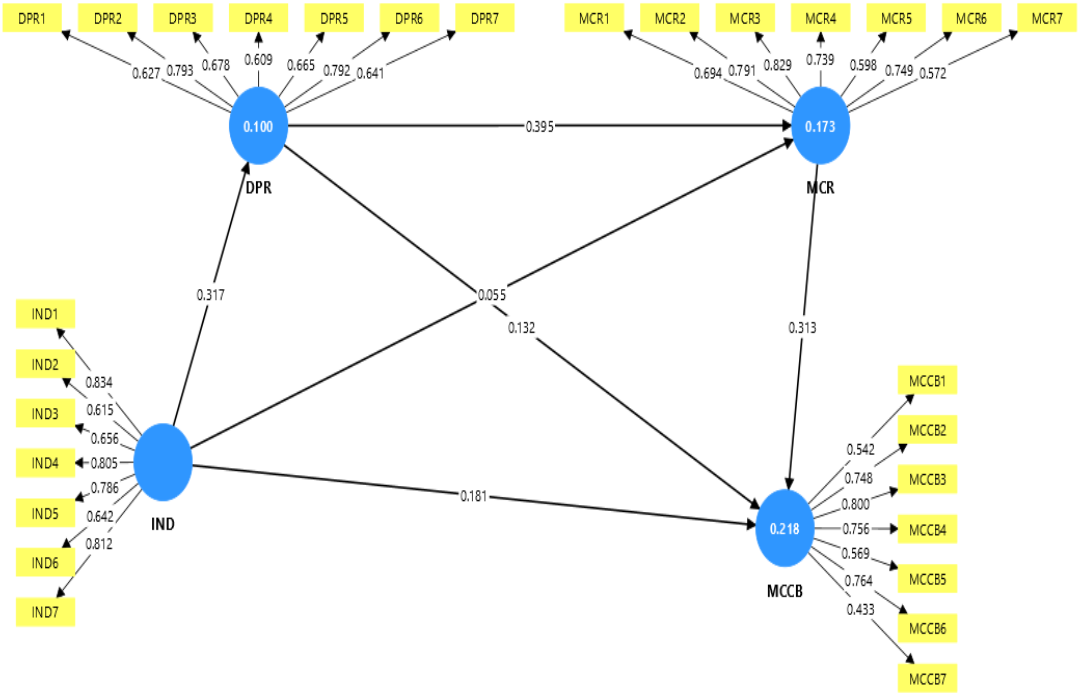


Figure 2. Measurement model: outer loadings and R^2 (SmartPLS 4 output, n = 100)

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Discriminant validity is also supported (Table 3). HTMT values for all latent variables are less than .85 (Henseler et al., 2015). The highest value is between the DPR and MCR latent variables, which is .484 (the upper limit of the 95% confidence interval is .671), and the HTMT for the MCCB and MCR latent variables is .454. According to the Fornell-Larcker criterion, this condition is also supported.

Table 1. Outer loadings, bootstrap significance and indicator collinearity

Indicator	Loading	SD	T	VIF	Indicator	Loading	SD	t	VIF
IND1	0.834	0.041	20.34	2.40	MCR1	0.694	0.070	9.88	1.84
IND2	0.615	0.098	6.28	1.48	MCR2	0.791	0.036	21.99	2.04
IND3	0.656	0.085	7.71	1.47	MCR3	0.829	0.034	24.69	2.33
IND4	0.805	0.055	14.60	2.26	MCR4	0.739	0.065	11.38	1.67
IND5	0.786	0.053	14.94	1.97	MCR5	0.598	0.085	7.03	1.41
IND6	0.642	0.083	7.76	1.43	MCR6	0.749	0.052	14.35	1.78
IND7	0.812	0.043	18.86	2.01	MCR7	0.572	0.096	5.96	1.40
DPR1	0.627	0.072	8.77	1.34	MCCB1	0.542	0.101	5.37	1.27
DPR2	0.793	0.041	19.22	1.93	MCCB2	0.748	0.064	11.65	1.80
DPR3	0.678	0.066	10.24	1.52	MCCB3	0.800	0.046	17.25	1.83
DPR4	0.609	0.087	7.00	1.42	MCCB4	0.756	0.065	11.59	1.74
DPR5	0.665	0.095	7.01	1.56	MCCB5	0.569	0.089	6.40	1.37
DPR6	0.792	0.053	14.83	2.00	MCCB6	0.764	0.062	12.35	1.84
DPR7	0.641	0.086	7.42	1.52	MCCB7	0.433	0.123	3.51	1.18

Table 2. Construct reliability and convergent validity

Construct	Cronbach's α	ρA	ρC	AVE
Informal debt dependence (IND)	.861	.882	.894	.549
Debt repayment pressure (DPR)	.816	.830	.863	.476
Market choice restriction (MCR)	.839	.854	.879	.512
Market channel choice behaviour (MCCB)	.789	.831	.847	.451

Table 3. Discriminant validity: HTMT [95% CI] and Fornell–Larcker criterion

	IND	DPR	MCR	MCCB
IND	.741	.357 [.256, .571]	.212 [.182, .435]	.354 [.236, .573]
DPR	.317	.690	.484 [.323, .671]	.378 [.268, .611]
MCR	.180	.412	.716	.454 [.329, .652]
MCCB	.279	.318	.400	.672

Structural model

VIFs for the inner model are between 1.00 and 1.30, which shows that collinearity is not an issue. Figure 3 presents the structural model. Table 4 lists the path coefficients. Results from the model indicate that informal debt has a significant positive effect on repayment pressure ($\beta = 0.317$, $p < 0.001$), and thus H4 is supported. Repayment pressure positively influences the restriction on the market choice ($\beta = 0.395$, $p < 0.001$), and therefore H5 is also supported. Lastly, the restriction positively influences the use of marketing channels ($\beta = 0.313$, $p = 0.002$),

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and thus H3 is supported. The influence of informal debt on the use of marketing channels is not significant (β = 0.002, p = 0.948), and the same result is shown for the influence of repayment pressure on the use of marketing channels (β = 0.118, p = 0.478). Thus H1 and H2 are not supported. The influence of the tied-buyer path from informal debt to the restriction on the use of the market is not significant (β = 0.055, p = 0.606).

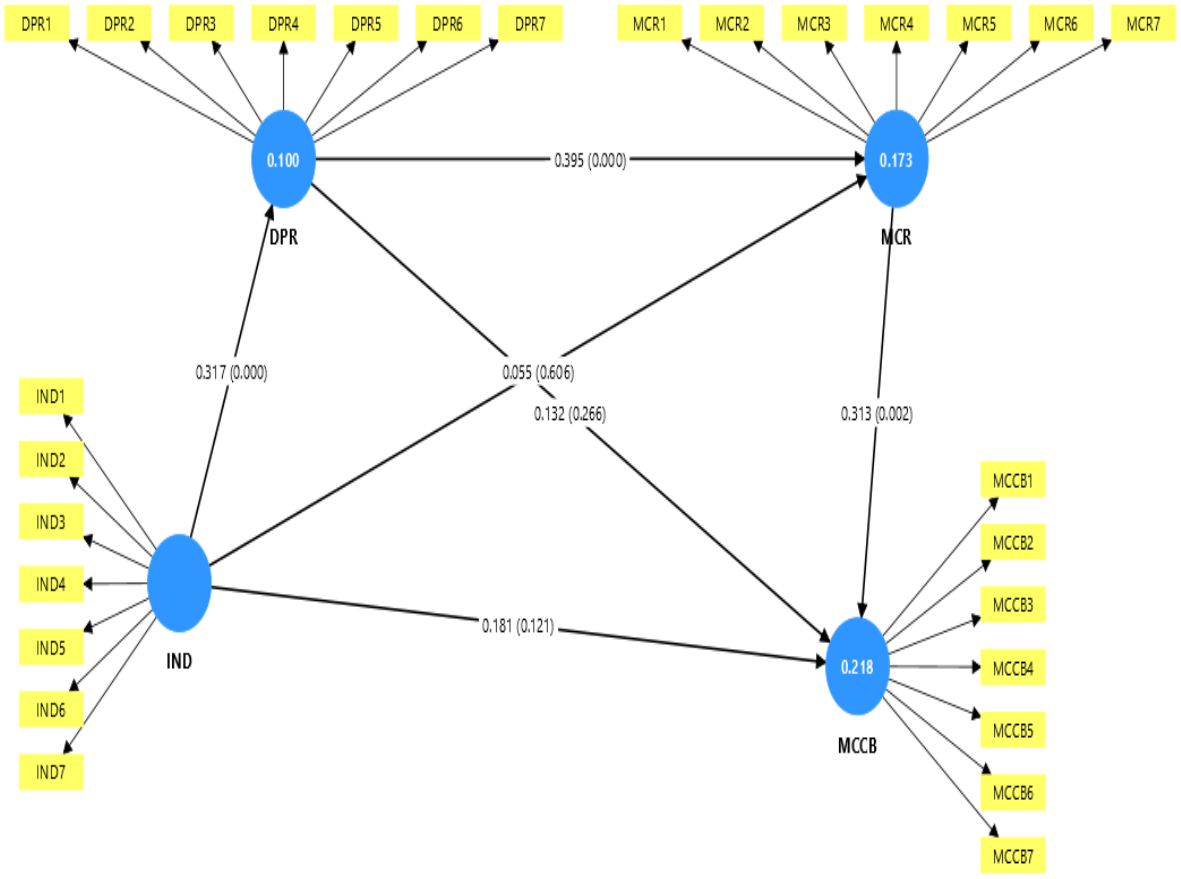


Figure 3. Structural model: path coefficients (p-values) and R^2 (SmartPLS 4 bootstrapping, 5,000 subsamples, n = 100)

Table 4. Structural model: path coefficients, significance and effect sizes

Path	B	M	SD	t	p	95% CI	f^2	Decision
H1: IND → MCCB	0.181	0.189	0.117	1.551	.121	[−0.050, 0.409]	.038 (small)	Not supported
H2: DPR → MCCB	0.132	0.142	0.118	1.113	.266	[−0.092, 0.366]	.017 (negl.)	Not supported
H3: MCR → MCCB	0.313	0.321	0.102	3.051	.002	[0.102, 0.510]	.103 (small)	Supported
H4: IND → DPR	0.317	0.347	0.087	3.625	< .001	[0.165, 0.506]	.111 (small)	Supported
H5: DPR → MCR	0.395	0.413	0.096	4.118	< .001	[0.210, 0.587]	.170 (medium)	Supported

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IND → MCR (competing)	0.055	0.060	0.107	0.516	.606	[−0.154, 0.260]	.003 (negl.)	—

The model estimates are 0.10 and 0.17 for repayment pressure and the restriction on the market choice, and 0.22 for the use of marketing channels. Effect size for DPR → MCR is $f^2 = .170$, and the effect size for MCR → MCCB and IND → DPR is $f^2 = .103$ and .111, respectively. SRMR is .078. According to Hu and Bentler (1999), this value is less than or equal to .08, and therefore the structural model shows an acceptable fit. The estimated structural model and the constrained structural model (saturated model) are the same.

Mediation analysis

Bootstrapped indirect effects are in Table 5. The serial indirect effect, IND → DPR → MCR → MCCB, is small (β = 0.039). The 95% confidence interval, however, is 0.010 to 0.096, indicating the effect is significant. The t-based p-value was .075. Preacher and Hayes (2008) and Hair, et al. (2022) indicate that in path analysis, where an indirect effect is mediated by more than one variable, the percentile intervals should be used to determine the significance of the effect. Therefore, Hypothesis 6 is supported. The indirect effect of IND on MCCB through DPR (0.042, 95% CI [-0.031, 0.115]) and through MCR (0.017, 95% CI [-0.049, 0.082]) are not significant. The effect of repayment pressure (DPR) is mediated through the restriction of channel behavior (MCR) and is significant (β = 0.123, p = 0.028). Because of this, the direct effect of repayment pressure (Hypothesis 2) is not significant. Overall, the total effect of informal debt (i.e. the sum of the direct and indirect effects) on channel behavior is significant. Using Hair et al. (2022) and Zhao et al. (2010), this case represents a situation of full indirect-only mediation.

Table 5. Specific indirect, total indirect and total effects

Effect	β	SD	T	p	95% CI
IND → DPR → MCR → MCCB (H6)	0.039	0.022	1.779	.075	[0.010, 0.096]
IND → DPR → MCCB	0.042	0.045	0.918	.358	[−0.031, 0.146]
IND → MCR → MCCB	0.017	0.036	0.475	.635	[−0.049, 0.094]
DPR → MCR → MCCB	0.123	0.056	2.200	.028	[0.033, 0.254]
IND → DPR → MCR	0.125	0.045	2.779	.005	[0.059, 0.237]
Total indirect: IND → MCCB	0.098	0.057	1.725	.085	[0.009, 0.234]
Total effect: IND → MCCB	0.279	0.103	2.721	.007	[0.083, 0.490]
Total effect: DPR → MCCB	0.255	0.107	2.394	.017	[0.058, 0.472]

Predictive power and common-method variance

Results from PLS predict (10 folds, 10 repeats) showed that Q^2 predict was positive for all three endogenous constructs, but values were very close to zero (DPR = .063; MCR = .002; MCCB = .043). Q^2predict was positive for 14 of 21 endogenous constructs. Thus, based on Shmueli et al. (2019), the research model has low or zero constructs' level of prediction. The model captured various mechanisms in the research model, but was not able to predict individual farmers' behavior. Results from PLSpredict should be interpreted with caution, as the computer program, in general, has many limitations. Full-collinearity VIFs ranged from 1.16 to 1.33. Based on

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Kock's (2015) standard, 3.3 would indicate presence of common-method variance. However, based on this standard, it is unlikely that common-method variance affected the results of the research model.

Robustness checks

Table 6 presents three sets of estimates by SmartPLS. (a) This specification uses all 108 respondents using the same algorithm and settings as SmartPLS. (b) In this specification, the construct scores are regressed on the sets of independent variables (IVs) and control variables (CVs) of the study and estimates are obtained using HC3. The estimates for the relationships hypothesized do not vary with the three sets of estimates presented. The full-sample estimate of the serial indirect effect is 0.040 (95% CI: 0.015, 0.093), and provides support for Hypothesis 6. Among the control variables, reporting more repayment pressure was limited to sugarcane growers (b = 0.499, p = 0.009). The effect of distance to the mandi was positively related to reporting more lending pressure through the informal financial market (b = 0.338, p = 0.006). In the full sample, the AVE of MCCB also increased to 0.524, and the association with Hypothesis 1 also remained the same (p = 0.180).

Table 6. Robustness of key paths

Path	SmartPLS 4, n = 100	All respondents, N = 100	Scores + controls, N = 100
H1: IND → MCCB	0.181 (p = .121)	0.155 (p = .150)	0.167 (p = .081)
H2: DPR → MCCB	0.132 (p = .266)	0.151 (p = .167)	0.124 (p = .206)
H3: MCR → MCCB	0.313 (p = .002)	0.352 (p < .001)	0.361 (p < .001)
H4: IND → DPR	0.317 (p < .001)	0.296 (p < .001)	0.277 (p = .007)
H5: DPR → MCR	0.395 (p < .001)	0.388 (p < .001)	0.395 (p < .001)
H6: serial indirect	0.039 [0.010, 0.096]	0.040 [0.015, 0.093]	—
R^2 (MCCB)	.218	.247	.349

Summary of hypothesis tests

Table 7. Hypothesis decisions

Hypothesis	Path	β	p	Decision
H1	IND → MCCB	0.181	.121	Not supported
H2	DPR → MCCB	0.132	.266	Not supported
H3	MCR → MCCB	0.313	.002	Supported
H4	IND → DPR	0.317	< .001	Supported
H5	DPR → MCR	0.395	< .001	Supported
H6	IND → DPR → MCR → MCCB	0.039	.075; CI [0.010, 0.096]	Supported (small; CI-based)

Discussion

The results mainly confirm the fundamental philosophies of the model. As described by the model, in the absence of informal debt, agents would be indifferent to the existence of other

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agents in the crop and livestock marketing channels. Constraints to marketing are primarily due to repayment pressures. Agents under repayment pressure are unable to market their produce to a broad range of potential buyers, and are limited to a small set of buyers and marketing channels. In the sample, informal debt had no direct influence on marketing decisions of the agents. Agents are more concerned with the market and channel to fulfill their cash obligation at harvest. This pattern demonstrates that farmers do not always sell at harvest due to market power. Rather, it is liquidity constraints that drive farm level sales (Stephens & Barrett, 2011; Burke et al., 2019; Dillon, 2021; Channa et al., 2022).

This case study does not strongly support a pure case of credit-market linkage, where the credit relationship dictates the path (Bhaduri, 1973; Bell et al., 1997). It does not rule out credit market linkage; in this study 45% of respondents noted the same individual provided them credit and marketing services (IND4). It is likely that in this case, credit market linkage is employed to enforce the farmer to repay the creditor, and is therefore, consistent with the efficiency rationale of interlinked contracts (Braverman & Stiglitz, 1982; Basu, 1983). This is supported by the case study descriptive evidence. The case study provides evidence of the liquidity constraint; the farmer must sell at harvest, however, not all creditors demanded immediate repayment.

The strongest relationship in the model is between DPR and MCR (r^2 = .170). Restricting the number of alternatives constrains the farmer's set of possible choices and leads to selling behavior that is restrained and controlled (Goetz, 1992). Farmers perceive selling behavior as restricting and controlling, and as a result, farmers will alter their selling behavior to reduce the perceived controls (Key et al., 2000). This illustrates that selling behavior is constrained by the farmer's perceived set of alternatives. Repayment pressure increases the number of alternatives perceived by the farmer. This is described as the farmer's perceived feasible set. Increased repayment pressure reduces the farmer's perceived feasible set and increases the sense of control. The farmer then alters his selling behavior to mitigate the sense of control (Fafchamps & Hill, 2005; Kadjo et al., 2018). Selling behavior in the sugarcane farmer sample was also found to be restricted and controlled. This is expected, as the sugar mills purchase the sugar cane, and if the mills don't have sufficient working capital, the farmers receive an advance.

Conclusion

Applying PLS-SEM to survey data from smallholder farmers in Punjab, this study investigates the ties between informal debt, crop marketing, and tied buyers. The results showed informal debt, instead, constrains crop marketing by restricting farmers to a single crop/buyer. As a result, farmers sell their crops at whatever price is offered. Besides, the study highlights that the lapse between the sale and purchase of crops by farmers affects crop marketing negatively. Farmers who do not repay their debt on time sell their crops at lower prices. Therefore, to ensure an improved price and marketing of crops, it is of primary importance to guarantee farm credit and extended repayment windows to farmers, as well as improve the accessibility of markets.

Theoretical implications

The study finds that the link between informal credit and marketing comprises a timing component as well as a component related to the kind of buyer the credit is tied to, and that in this case the timing component is more important. Researchers studying linked markets should measure when repayment relative to cash flow and demand is expected to occur, as well as the

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degree of liquidity constraints, rather than assuming constraint from the presence of an interlinked lender (Conning & Udry, 2007).

The study provides evidence at the intersection of the two bodies of literature that until now have been isolated, namely the literature on the connection between markets in the developing world and the literature on the connection between markets in the developed world. The study provides evidence at the intersection of the two bodies of literature that until now have been isolated, namely the literature on the connection between markets in the developing world and the literature on the connection between markets in the developed world. The study provides evidence at the intersection of the two bodies of literature that until now have been isolated, namely the literature on the connection between markets in the developing world and the literature on the connection between markets in the developed world.

Practical and Policy Implications

The authors of the study provide multiple suggestions for policy and practical changes based on their findings including policy changes that would tie the credit to storage and changes that would tie credit to the break between harvest and the sell season. The changes would help alleviate financial constrains that encourage farmers to sell at suboptimal prices. For changes that tie credit to the break between harvest and the sell season to be effective, the credit would need to come from a reliable source. Changes that tie credit to storage would help break the constraint that encourages farmers to sell at suboptimal prices and would help overcome the credit-Market-storage (CMS) link (Coulter & Onumah, 2002; Basu & Wong, 2015; Miranda et al., 2019). Storage costs should be subsidized in order to help smallholders.

Aker (2010) and Fafchamps and Minten (2012) highlight ways to reduce the cost of transporting agricultural produce to market. These include opening up collection points and procurement centers, using group-based transport aggregation and mobile services for price information. Arhti credit may shift the timing of cash outflow, but it may not alleviate the pressure to repay. As such, formal sector credit may not help if it is not coupled with similar changes in the timing of repayment. Repayment pressure may be high for some crops. Regulatory authorities should examine the case of sugarcane, for which mill payments may create an advance against future payments.

Future Research

First, the study is limited to a self-reported cross-section. As such, it identifies only descriptive relationships. The sample of 100 is small. There was a case-limit on the survey software, and as such eight respondents were excluded. Convergent validity is poor for two of the constructs. Since all survey statements are of a positive nature, respondent's agreement may not reflect the opinion of the researcher. Lastly, MCCB is an index of behavior. Observed choice may support the argument of behavioral shift; however, it may not fully capture the case.

Future studies should also include data on the actual sales channels, the prices, and the times at which sales occurred. Along with improved data on farm loans, which should include the name of the lender, the loan amount, the due date, the implied interest, and whether the lender also purchases the crop, additional research could analyze groups of crops and/or compare different crops.

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Appendix A. Measurement items (n = 100)

Code	Item (1 = strongly disagree … 5 = strongly agree)	Mean	SD	% agree
IND1	I depend mainly on informal lenders such as arhtis or traders for agricultural financing.	3.69	1.20	61
IND2	I obtain farm credit without formal documentation or banking procedures.	3.37	1.11	42
IND3	My borrowing is mostly based on trust or verbal agreement.	3.49	1.14	55
IND4	The same person provides me both credit and marketing services.	3.24	1.17	45
IND5	I frequently take input loans such as seed and fertilizer from traders.	3.29	1.16	45
IND6	I have limited access to formal agricultural credit institutions.	3.19	1.12	43
IND7	My farming activities depend heavily on informal credit availability.	3.34	1.15	44
DPR1	I feel strong pressure to sell my produce immediately after harvest.	3.87	0.90	69
DPR2	Loan repayment timing affects my crop selling decision.	3.57	0.99	59
DPR3	I cannot delay selling due to financial obligations.	3.61	0.95	64
DPR4	My lender expects quick repayment after harvest.	3.02	1.25	36
DPR5	I experience stress related to repayment of informal loans.	3.42	1.04	46
DPR6	I prioritize debt repayment over market price optimization.	3.18	1.08	40
DPR7	I often sell crops at low prices due to urgent cash needs.	3.43	1.03	50
MCR1	My financial condition limits my choice of buyers.	3.71	1.01	56
MCR2	I cannot freely choose between farm gate, mandi, or retail channel.	3.27	1.11	41
MCR3	I mostly sell to the buyer who gives me credit.	3.16	1.08	41
MCR4	I have limited access to wholesale mandi market.	3.48	1.10	56
MCR5	I avoid distant markets due to financial constraints.	3.48	1.06	56
MCR6	My selling options are restricted by debt obligations.	3.33	1.08	43
MCR7	I rarely compare multiple buyers before selling produce.	3.27	1.03	39
MCCB1	I prefer selling at farm gate rather than wholesale markets.	3.87	0.95	67

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MCCB2	My buyer selection depends on credit relationship, not price.	3.45	1.07	54
MCCB3	I sell immediately after harvest instead of waiting for better prices.	3.35	1.09	48
MCCB4	I do not actively search for alternative buyers or markets.	2.84	1.06	29
MCCB5	Convenience is more important than price in my selling decision.	3.56	1.03	54
MCCB6	My creditor influences where I sell my produce.	3.09	1.17	37
MCCB7	I rarely participate in comparative market auctions or bidding.	2.75	1.14	27