

Warehouse Receipt Financing for Smallholders in Developing Countries: Long on Imagination, Short on Logic

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My Research Agenda

- ▶ Commitment to international development recent
- ▶ Three USAID/IFPRI funded projects in Africa
- ▶ Ghana - RCT on index insurance and credit
- ▶ Tanzania - framed field experiments on same
- ▶ Ghana - warehouse receipt financing
- ▶ Common Themes: Smallholder credit, technical transformation, finance, insurance

Warehouse Receipt

- ▶ Document issued by warehouse operator as evidence that a specified commodity of stated quantity and quality has been deposited at a particular warehouse by a named depositor
- ▶ When backed by legal/regulatory framework, becomes a formal financial instrument that confers security interest in stored commodity without requiring physical delivery
- ▶ May be used as collateral for a loan

- ▶ Negotiable WHR
 - ▶ permits holder to convey full ownership to others
 - ▶ allows impersonal, sight-unseen trade without delivery
 - ▶ essential for centralized commodity exchange
 - ▶ subject to high quality standards, minimum volumes
 - ▶ not for smallholders who market common quality grain
- ▶ Nonnegotiable WHR
 - ▶ conveys limited ownership rights to single specified holder
 - ▶ may be used to pledge commodity as collateral for loan
 - ▶ can be issued subject to minimal quality standards
 - ▶ virtually all WHRs issued to smallholders of this type

Smallholder Problem

- ▶ lacks collateral to obtain affordable credit
- ▶ lacks access to dependable storage facilities
- ▶ forced to sell surplus at harvest when prices are lowest

Warehouse Receipt Solution

Access to warehouse receipt financing permits smallholders to

- ▶ store their surplus safely in modern warehouse
- ▶ sell at a later date when prices are higher
- ▶ use commodity as collateral to secure a loan to finance household needs in the interim

Typical Claim

From 2012 IFAD Brief:

In Tanzania, . . . traders who can afford adequate storage sites often take advantage of smallholders' constraints: they collect agricultural products at very low prices and sell them during the most profitable market conditions. [As a consequence of the IFAD project,] . . . small-scale farmers were able to store their produce in warehouses during harvest, when prices are relatively low, and release them to the market at better prices during periods of low supply. After the WRS was introduced, farm gate prices increased up to 300 per cent.

Real Story

- ▶ IFAD pilot yet to prove sustainable or scalable
- ▶ Today, in Tanzania, warehouse receipts are used almost exclusively by traders, processors, and exporters
- ▶ Generally, WHR financing has failed to directly benefit smallholders in developing countries, as often claimed
- ▶ Smallholders do not use WHRs, continue to sell at harvest
- ▶ Why?

How WHRs Work

- ▶ Accepting WHR as collateral requires due diligence
- ▶ Accomplished by introducing third party: collateral manager
- ▶ Collateral manager serves the interests of the lender
 - ▶ Assumes “continuous, exclusive, and notorious possession”
 - ▶ Ensures commodity is safely stored in warehouse, is of stated quantity and quality, not pledged to another lender
 - ▶ Monitors commodity in the warehouse
 - ▶ Liable for losses due to theft, damage
 - ▶ Responsible for security, insurance
- ▶ May be independent surveillance company
- ▶ Warehouse operator often serves this role

Typical WHR transaction sequence

- ▶ Smallholder delivers grain to warehouse
- ▶ Warehouse accepts grain, performs cleaning and drying
- ▶ Warehouse issues WHR to smallholder
- ▶ Smallholder applies for loan, offers WHR as collateral
- ▶ Lender grants loan for fraction of market value of grain
- ▶ Later, smallholder finds buyer, settles on sales price
- ▶ Buyer pays lender, lender deducts amounts owed to him and warehouse, lender pays remainder to smallholder
- ▶ Lender authorizes transfer of warehouse receipt to buyer

Smallholder WHR Financing Problems

- ▶ Rising prices alone will not guarantee smallholder will benefit from WHR financing
- ▶ Prices must rise enough to cover storage, transactions costs
- ▶ Storing also exposes smallholder to downside price risk
- ▶ Smallholder can shift risk to lender though default option
- ▶ So lender discounts value of grain used for collateral

Transactions Costs

Smallholder incurs costs for services rendered by

- ▶ transporters to transport commodity to warehouse
- ▶ warehouse to clean, dry, store commodity
- ▶ collateral manager to certify grain, issue WHR
- ▶ warehouse for pest control, utilities, warehouse space
- ▶ collateral manager for security, insurance, and monitoring
- ▶ broker, to cover sales commission and delivery to buyer

Research Objective

- ▶ understand smallholder grain marketing, financing decisions
- ▶ understand lender WHR credit policies
- ▶ understand impact of transactions costs
- ▶ understand impact of default risk
- ▶ little published analytical research

Smallholder Model

- ▶ Annually stationary stochastic dynamic optimization model
- ▶ Smallholder produces, stores, consumes, sells “grain”
- ▶ Maximizes present value of expected utility from consuming grain and non-grain goods over an infinite horizon
- ▶ Each year divided into two seasons
- ▶ “Marketing” season begins with harvest, about five months
- ▶ “Lean” season ends with the following year’s harvest
- ▶ Think small maize producer in Northern Ghana

Marketing Season

- ▶ At harvest, smallholder observes
 - ▶ stock of harvested grain
 - ▶ stock of cash
 - ▶ prevailing market price
- ▶ Smallholder must decide how much grain to
 - ▶ consume over harvest season
 - ▶ store on farm for duration of marketing season
 - ▶ deposit in warehouse for duration of marketing season
 - ▶ sell at prevailing market price

- ▶ Grain stored on farm subject to post-harvest losses
- ▶ Grain deposited in warehouse does not suffer losses
- ▶ However, smallholder incurs transactions cost

- ▶ Smallholder receives WHR for grain deposited in warehouse
- ▶ Takes out loan offering WHR as collateral
- ▶ Loan amount a fraction of market value of grain
- ▶ Fraction called the “advance rate”
- ▶ Loan matures at conclusion of marketing season

Lean Season

- ▶ At start of season, smallholder observes:
 - ▶ stock of grain stored on farm
 - ▶ stock of grain deposited in warehouse
 - ▶ stock of cash
 - ▶ prevailing market price
- ▶ Must decide
 - ▶ whether to repay loan
 - ▶ how much to consume over lean season
 - ▶ how much to sell on market at prevailing prices
- ▶ Defaults if debt exceeds net value of grain in warehouse

Technical Notes

- ▶ Smallholder problem formulated via Dynamic Programming
- ▶ Problem poses pair of Bellman functional equations
- ▶ Model lacks known closed-form solution
- ▶ Solved numerically using orthogonal collocation
- ▶ See Miranda & Fackler (2002)

Euler conditions informative:

- ▶ Smallholder equates marginal utility of cash across seasons
- ▶ Expected return from depositing grain in warehouse, net storage/transactions costs, cannot exceed value of grain
- ▶ If value exceeds expected net return, farmer will not deposit
- ▶ Similar complementarity condition for on-farm storage

Analysis of Smallholder Marketing

Main drivers of smallholder storage and marketing decisions

- ▶ State at harvest
 - ▶ quantity harvested
 - ▶ market price
 - ▶ smallholder cash stocks
- ▶ Exogenous factors, including
 - ▶ WHR loan interest rate and advance rate
 - ▶ expected price appreciation, price volatility
 - ▶ storage costs, other transaction costs
 - ▶ rate of on-farm post-harvest losses
 - ▶ smallholder risk aversion

Model calibration:

- ▶ Representative of small Northern Ghanaian maize grower
- ▶ Harvest price and quantity normalized to 1
- ▶ Other parameters of interest
 - ▶ relative risk aversion - 4
 - ▶ annualized rate of interest on loan - 20%
 - ▶ expected price appreciation over marketing season - 40%
 - ▶ price volatility over marketing season - 40%
 - ▶ loan advance rate - 70%
 - ▶ grain on-farm post harvest loss - 10%
 - ▶ transactions costs - 25%

Analysis of Smallholder Marketing

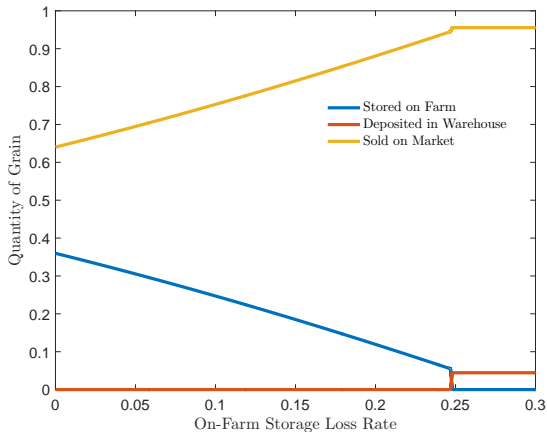


Figure: Use of Harvested Grain vs. On-Farm Storage Loss Rate

Analysis of Smallholder Marketing

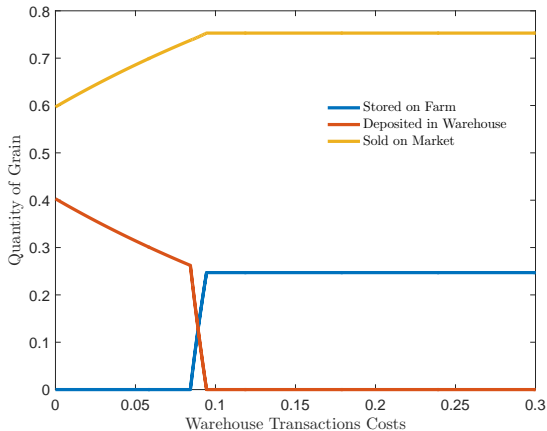


Figure: Use of Harvested Grain vs. Warehouse Transactions Cost

Analysis of Smallholder Marketing

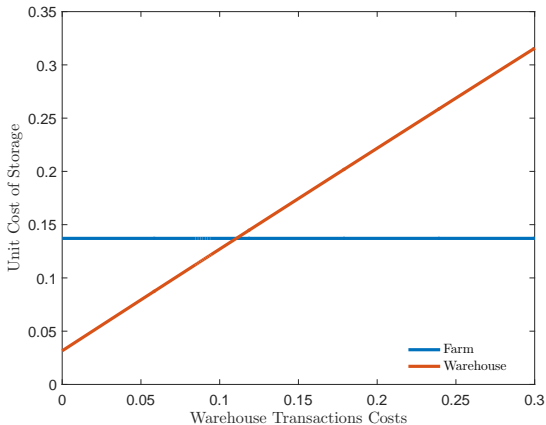


Figure: Unit Cost of Storage vs. Warehouse Transactions Cost

Analysis of Smallholder Marketing

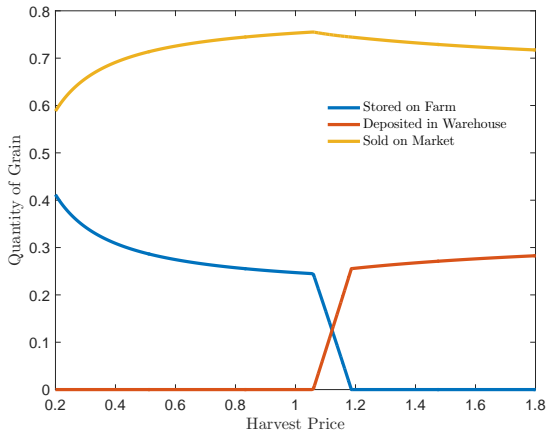


Figure: Use of Harvested Grain vs. Harvest Price

Analysis of Smallholder Marketing

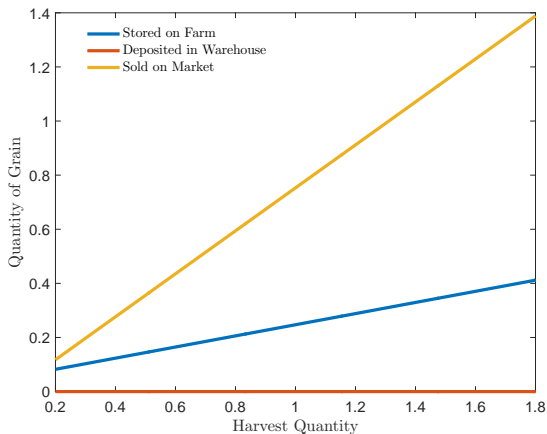


Figure: Use of Harvested Grain vs. Harvest Quantity

Analysis of Smallholder Marketing

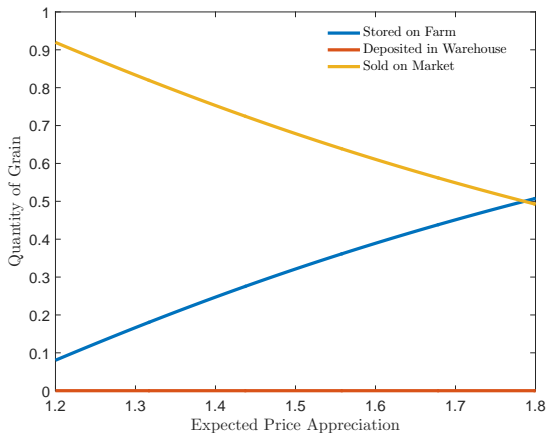


Figure: Use of Harvested Grain vs. Expected Price Appreciation over Marketing Season

Analysis of Smallholder Marketing

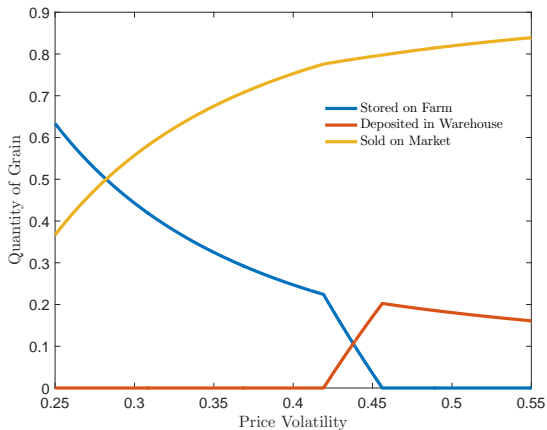


Figure: Use of Harvested Grain vs. Marketing Season Price Volatility

Analysis of Smallholder Marketing

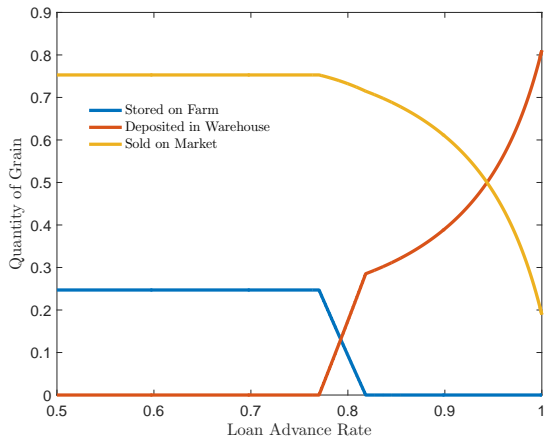


Figure: Use of Harvested Grain vs. Advance Rate

Analysis of Smallholder Marketing

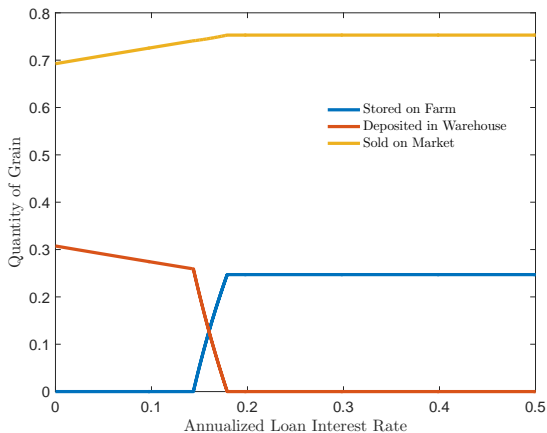


Figure: Use of Harvested Grain vs. Interest Rate

Lender's Problem

- ▶ Lender sets interest rate and advance rate maximize profit
- ▶ Primary concern is the possibility that smallholder will default
- ▶ Could occur if price fail to appreciate sufficiently
- ▶ Lower advance rate and higher interest rate protect lender, but reduce loan demand

Lender's Problem

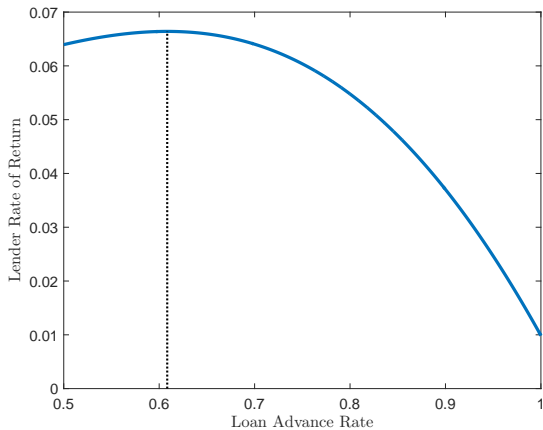


Figure: Lender Expected Rate of Return per Unit of Cash Loaned vs. Advance Rate

Lender's Problem

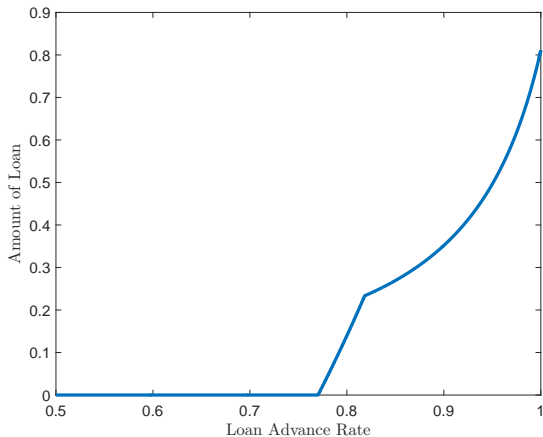


Figure: Amount of Loan vs. Advance Rate

Lender's Problem

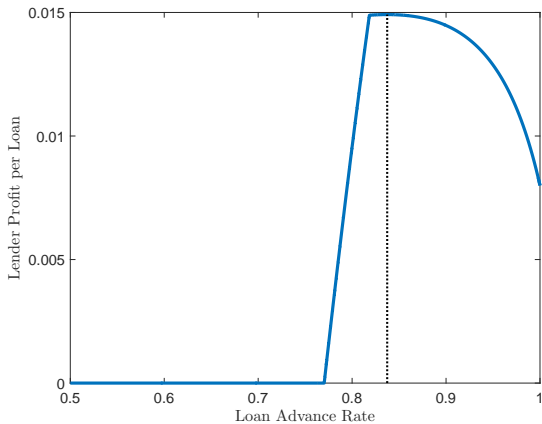


Figure: Lender Profit per Loan vs. Advance Rate

Lender's Problem

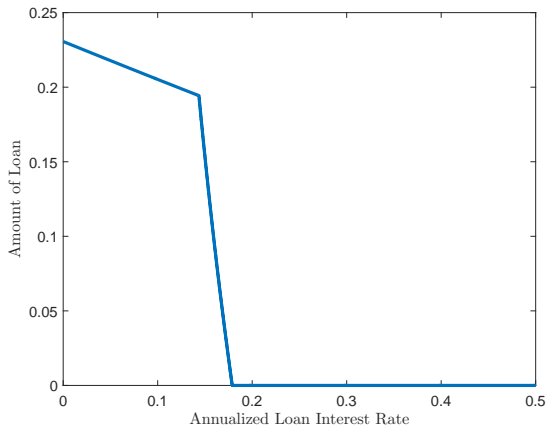


Figure: Amount of Loan vs. Annualized Loan Interest Rate

Lender's Problem

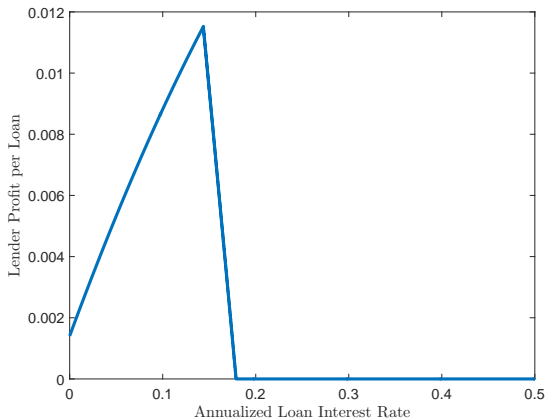


Figure: Lender Profit per Loan vs. Annualized Loan Interest Rate

Conclusions

- ▶ Champions of WHR claim they allow smallholders to
 - ▶ store their surplus safely in modern warehouse
 - ▶ sell at a later date when prices are higher
 - ▶ use WHR to collateralize household loans
- ▶ However, rising prices during marketing season insufficient
- ▶ Smallholder WHR financing undermined by high
 - ▶ costs of storage
 - ▶ transactions costs
 - ▶ cost of price/default risk
- ▶ These costs can be prohibitive in developing countries

- ▶ Take Northern Ghana maize for example
- ▶ To obtain WHR, grain must meet high quality standards
- ▶ But regional markets do not confer premium on quality
- ▶ Additional processing costs add 20% to price of grain
- ▶ But prices historically rise only 20% over marketing season
- ▶ WHR financing simply uneconomical for smallholders
- ▶ Only traders, processors will use them

Some surprising results

- ▶ Demand for warehouse storage does not fall dramatically as advance rate reduced
- ▶ However, demand for warehouse loans does
- ▶ Use of WHR very sensitive to interest rates
- ▶ May explain why WHR interest rates comparable to commercial rates

Policy prescriptions

- ▶ High quality standards kill smallholder WHR financing
- ▶ Markets for common grain will not confer premium
- ▶ Decouple objectives to give smallholder access to WHR financing and to develop commodity exchanges and exports
- ▶ One WHR instrument cannot serve both
- ▶ To reduce transactions costs, issue lower class WHR on common grain with less stringent quality standards

Plans for Future Research

- ▶ Better understand use of WHR by traders, processors
- ▶ Study role of community warehouses, warrantage
- ▶ How would centralized exchanges directly benefit smallholder?
- ▶ Does access to WHR stabilize market prices?
- ▶ Is there a compelling case for government subsidies?
- ▶ If so, credit guarantees or storage subsidies?
- ▶ Can NGO support be justified, better uses for the money?
- ▶ Wide open for research ... no published studies to speak of