

The Effect of Warehouse Receipt Finance on Farmers' Terms of Trade

Evidence from the WDRA program in India

Beáta Itin-Shwartz (BIU) Ayal Kimhi (HUJI)

Introduction

- ▶ Warehouse receipt finance has received substantial attention as a policy tool to improve trading terms for small scale farmers in developing countries.
- ▶ Although present in some African countries since the liberalization wave in the 1980's, it has then mostly catered to large import-export companies.
- ▶ Multiple pilots and initiatives have since been launched by different NGOs to increase access for small holder farmers.

Introduction

- ▶ Insufficient access to institutional credit and to adequate storage facilities is claimed to hamper the ability of small-scale farmer to transfer wealth across time.
- ▶ In order to meet household consumption needs and repay production loans, farmers are forced to sell their crops at unfavorable prices right after harvest.
- ▶ In some cases, a phenomenon of "selling low and buying high" has been recorded, where farmers effectively buy back their produce for higher prices during the lean season (Barret (2006) for rice in Madagascar; Stephens and Barret (2011) for Maize in western Kenya; Burke et al. (2019) also for Maize in Kenya).
- ▶ This also creates a pattern of sharp seasonal price fluctuations, a common characteristic of staple crops in many developing countries (Sahn 1989), which was found to cause a reduction in welfare among small farmers.

Introduction

- ▶ Warehouse receipt systems are intended to provide farmers producing storable crops with liquidity coupled with adequate storage conditions, allowing them to wait out for higher prices rather than selling their produce at unfavorable terms right after harvest.
- ▶ Expected to reduce inter-temporal crop price variability.

Introduction

- ▶ In this project we conduct a country-wide analysis of the effect of a new warehouse receipt financing system in India.
- ▶ In 2007, the central government of India initiated a program (WDRA) establishing a system of warehouse receipt finance including both government and private initiative warehouses across the country.
- ▶ The implementation took place in 2010, and since then the amount of credit given as warehouse receipt financing rose steadily (estimated at 5.4 billion dollars in 2017).

Literature

Experimental studies with storage-credit interventions:

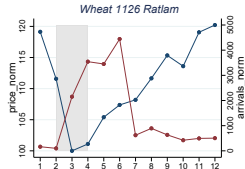
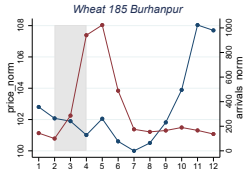
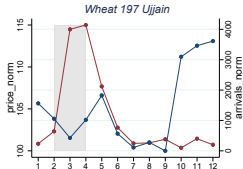
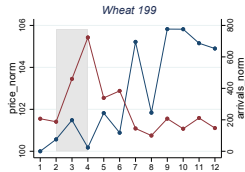
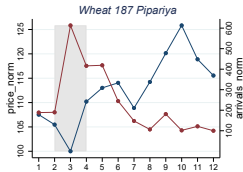
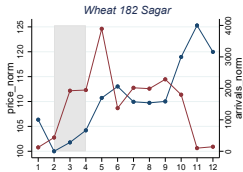
- ▶ Channa et al. (2022) randomly offered storage bags / loans to smallholder farmers in Tanzania after harvest. No effect for the storage intervention; credit increased storage and sales during the lean season.
- ▶ Burke et al. (2019) maize farmers in Kenya, randomly offering farmers a loan at harvest. They found that farmers sold less and bought more maize after harvest. Inter-temporal convergence of prices in nearby markets following the intervention.
- ▶ Basu and Wong (2015) randomly offered a seasonal storage program or credit in the form of crops, to staple farmers in west Timor, Indonesia. They found no effect on staple food consumption. The storage program increased non-food consumption and the credit program increased reported income and reduced seasonal gaps in consumption.
- ▶ Negede et al. (2024) offered hermetic storage bags to maize farmers in Ethiopia in a randomized trial. They found an extended storage period due to the treatment but no effect on welfare indicators.

WDRA warehouses, by state and year

State	2011	2012	2013	2014	2015	2016	2017	2018
Andhra Pradesh						3		24
Assam							1	1
Bihar						1	1	6
Gujarat			2			11	66	54
Haryana							2	6
Jharkhand								1
Karnataka						15	1	20
Kerala		1				1	5	2
Madhya Pradesh	1	3	10	1	1	34	59	69
Maharashtra						9	30	39
Odisha								2
Puducherry							1	
Punjab								5
Rajasthan	6			9		15	52	83
Tamil Nadu						1	19	2
Telangana							2	19
Tripura								1
Uttar Pradesh	2						2	29
West Bengal								1

Source: The Warehousing Development and Regulatory Authority (Dept. of food and public distribution, GOI).

Data - Seasonality in Prices



Harvest price_norm arrivals_norm

WDRA Warehouses

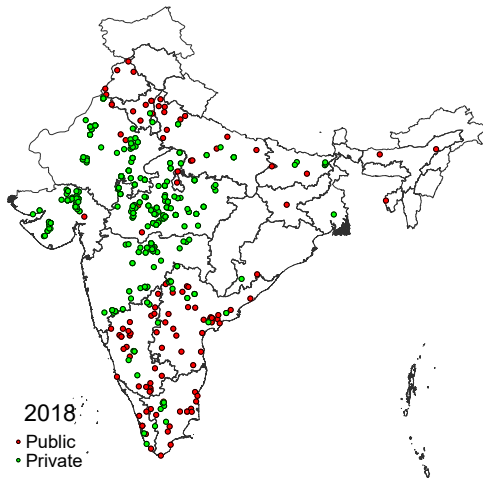
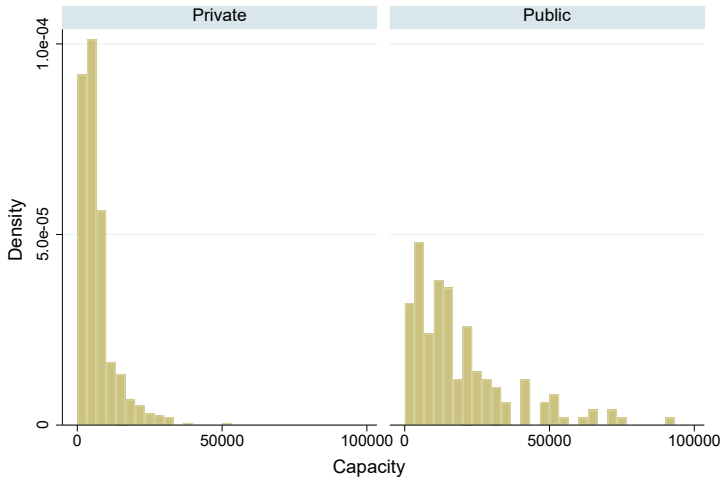


Table 1: WDRA Warehouses by company

Percent	Number	Private/Public	Warehousing Company
17.65	129	Public	Central Warehousing Corporation
12.45	91	Public	National Bulk Handling Corporation PR
11.49	84	Public	National Collateral Management Services
10.12	74	Private	StarAgri Warehousing Collateral Management
8.48	62	Private	LTC Commercial Company Private Limited
5.75	42	Private	Kalyx Warehousing Private Limited
3.56	26	Private	Shree Shubham Logistics Limited
2.05	15	Private	Navjyoti Commodity Management Services
1.92	14	Private	Yamada Logistics Private Limited
1.78	13	Public	Karnataka State Warehousing Corporation
1.64	12	Private	Janhavi Promoters Private Limited
1.09	8	Public	Uttar Pradesh State Warehousing Corporation
22.43	161	Private	Others
100	731		Total

Warehouse capacity distributions



Graphs by private1

Methodology

Difference-in-differences with fixed effects

Define $Treatment_m$ a market m which is "near" a WDRA warehouse registered by month t . The baseline specification is:

$$y_{cmt} = \alpha + \beta(Treatment_m \times After_{mt}) + \gamma(Treatment_m \times After_{mt} \times Storable_c) + \delta_c + \delta_m + \delta_t + \epsilon_{cmt}$$

Event studies

$$y_{cmt} = \alpha + \sum_{t=-T}^T \beta_t + \delta_c + \delta_m + \delta_t + \epsilon_{cmt}$$

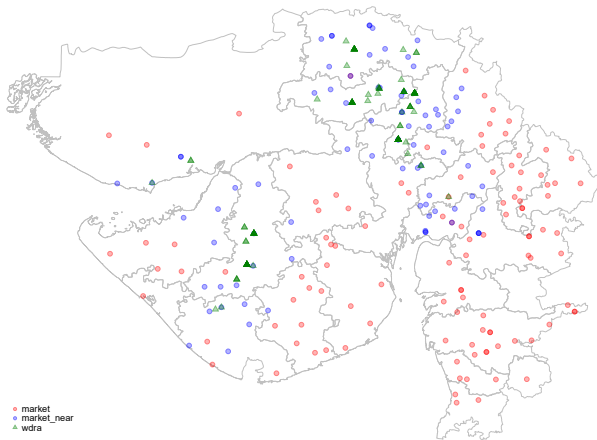
Seasonality

$$y_{cmt} = \alpha + \sum_{i=1}^{12} month_i + \delta_c + \delta_m + \delta_y + \epsilon_{cmt}$$

Minimum distances, summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Distance from market to nearest warehouse (2018)	2,439	63.4	57.8	0	296
Distance from warehouse to nearest market (2018)	698	9.6	8.4	0	40.8
Distance from WDRA to nearest other WDRA (2018)	698	29.5	32.3	1.6	345.7
Distance from Market to nearest other Market	2,439	19.2	11.4	0.2	126.2

Methodology



Results

Diff-in-Diff, Mandi prices

VARIABLES	(1) Log-price any	(2) Log-price number	(3) Log-price capacity
<i>Treatment × After</i>	-0.047** (0.018)	-0.008*** (0.002)	-0.0007*** (0.0002)
<i>Treatment × After × Storable</i>	0.115*** (0.028)	0.011*** (0.002)	0.0012*** (0.0002)
Combined effect storable	0.068	0.003	0.0005
P-val for combined effect	0.000	0.000	0.000
Observations	438,555	438,555	438,555
R-squared	0.6603	0.66	0.6599
Makret FE	Yes	Yes	Yes
Crop FE	Yes	Yes	Yes
Month-year FE	Yes	Yes	Yes

Treatment defined at the 60km boundary; Only states ever treated included and the years 2013-2018; Standard errors are clustered at the district level; * * * $p < 0.01$, * * $p < 0.05$, * $p < 0.1$

Results

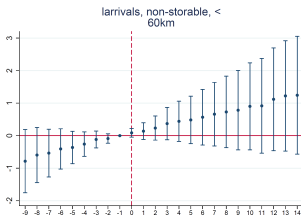
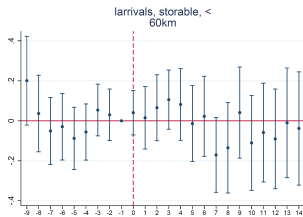
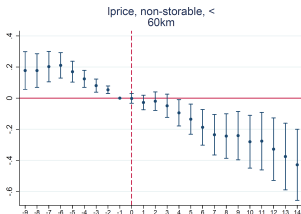
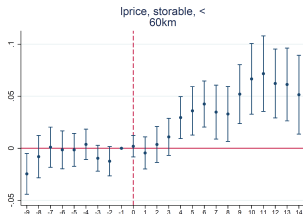
Diff-in-Diff, Mandi arrivals

VARIABLES	(1) Log-arrivals any	(2) Log-arrivals number	(3) Log-arrivals capacity
<i>Treatment</i> × <i>After</i>	-0.037 (0.069)	-0.011 (0.012)	-0.0018 (0.0013)
<i>Treatment</i> × <i>After</i> × <i>Storable</i>	0.029 (0.105)	0.006 (0.014)	0.0012 (0.0017)
Combined effect storable	-0.008	-0.006	-0.0006
P-val for combined effect	0.889	0.079	0.267
Observations	439,408	439,408	439,408
R-squared	0.5301	0.5301	0.5301
Makret FE	Yes	Yes	Yes
Crop FE	Yes	Yes	Yes
Month-year FE	Yes	Yes	Yes

Treatment defined at the 60km boundary; Only states ever treated included and the years 2013-2018; Standard errors are clustered at the district level; * ** $p < 0.01$, * * $p < 0.05$, * $p < 0.1$

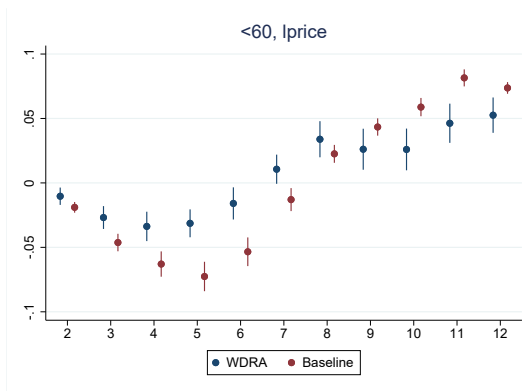
Results

Event studies



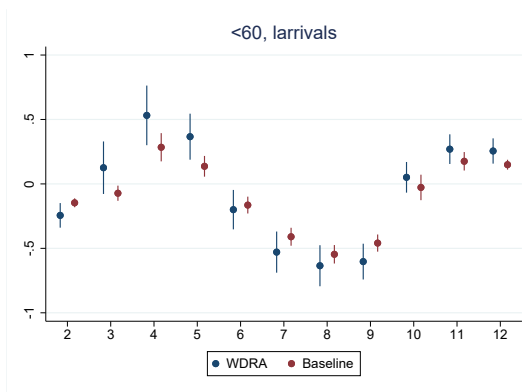
Results

Seasonality - Prices



Results

Seasonality - Arrivals



WDRA market structures

private/public	0	1	2	3	4+	Total
0	476	37	10	3	2	528
1	25	3	1	0	0	29
2	12	0	1	1	0	14
3	2	0	2	1	0	5
4+	16	2	0	0	1	19
Total	531	42	14	5	3	595

Out of 595 districts in the data, 476 have no WDRA warehouses in 2018 and 119 districts have at least one program warehouse. Out of those only 12 districts have both public and private warehouses, so in most cases the two types have entered different districts at this point in time. In total 62 districts have one program warehouse, 25 have two and 6 have three.

Results

VARIABLES	private	public
In area of holdings	0.647*** (0.238)	0.701*** (0.230)
In ave. size of holdings	-0.0296 (0.264)	0.566** (0.274)
In literate population	0.0198 (0.328)	0.496 (0.361)
Agricultural credit societies	0.000319 (0.001)	-0.00240*** (0.001)
Cooperative banks	0.00306 (0.002)	-0.00275 (0.003)
Commercial banks	-0.00650* (0.004)	0.0115*** (0.004)
Cutoff 1	9.405*** (3.290)	16.94*** (4.267)
Cutoff 2	9.876*** (3.294)	17.61*** (4.280)
Cutoff 3	10.18*** (3.296)	18.20*** (4.286)
Cutoff 4	10.29*** (3.296)	18.84*** (4.297)
Observations	321	321
Log-Likelihood	-143.3	-124.9
s2/s1	1.035 (0.020)	1.301 (0.012)
s3/s2	1.07 (0.015)	1.554 (0.012)
s4/s3	0.879 (0.008)	1.86 (0.017)

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

Summary

- ▶ Post-harvest credit programs coupled with access to storage facilities are hoped to provide small farmers with more flexibility in choosing the timing of their sales.
- ▶ We studied a warehouse receipt program in India using detailed data on warehouse locations and rural market prices.
- ▶ We found a significant and persistent increase in prices of storeable crops.
- ▶ The seasonality analysis showed attenuation in the inter-seasonal price fluctuations.

Thank you!

beata.itin-shwartz@biu.ac.il
ayal.kimhi@mail.huji.ac.il