Asymmetric Information and Middleman Margins: An Experiment with Potato Farmers in India

Sandip Mitra

Indian Statistical Institute, Kolkata

Dilip Mookherjee

Boston University

Maximo Torero

International Food Policy Research Institute

Sujata Visaria

Hong Kong Univ of Science & Technology

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  - coffee in Uganda (Fafchamps and Hill 2008)
  - cashews in Mozambique (McMillan, Rodrik and Horn 2002)

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  1. imperfect credit markets:
     - farmers have long-term contractual relationships with traders
     - these long-term relationships are a barrier to enter the middleman business
  2. lack of information:
     - farmers do not know the prices in the larger markets where traders sell
     - traders understate prices
     - farmers get low prices

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- What types of contracts do farmers enter with middlemen?

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- we delivered daily information about potato prices from the neighbouring large wholesale markets
- collected data on potato planting and harvest, and fortnightly data on potato sales

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- local traders re-sell in neighboring wholesale markets (*mandis*) to large traders
- large traders sell them in Kolkata retail markets or to markets in neighboring states (Orissa, Andhra Pradesh)

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- Focus on margins earned by local traders *vis-a-vis* potato farmers, and pass-through of retail and wholesale price increases to farmers
- **To what extent do the middleman margins depend on asymmetric information about market prices between traders and farmers**
- What can we infer about:
  - the nature of contracting (commitment, timing, bargaining power, risk-sharing etc.)?
  - likely impacts of policies of information provision to potato farmers?

The Experiment

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- sample of 72 villages from Hugli and West Medinipur districts in West Bengal
- villages more than 8 km apart (to avoid information spillovers)
- stratified random sample of 24-26 potato farmers per village
- Information intervention:
  - 24 villages: public information
  - 24 villages: private information
  - 24 villages: control

The Experiment, contd.

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- **Private Information treatment**
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  - phones were restricted – no connectivity to anyone else

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- In either case, information provided to a small number of farmers relative to the size of any wholesale market (mandi)

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- Do not expect general equilibrium effects on the wholesale prices

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  - limited pass through of external price increases to farmgate prices (less than 40%)
  - no **average** impact of information provision (either private or public) on middleman margins

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  - by market price: significant impacts on the pattern of risk-sharing between farmers and middlemen, in the post-harvest period, for both potatoes

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  - quantities traded also vary more with wholesale prices, so farmer revenues become more volatile
- consistent with a model of *ex post* bargaining over the price, while models of *ex ante* contracting are rejected


বাজার চাঁদপাড়া = মৌজা-একজমি =
= আলুর প্রাত্যহিক বাজার দর =
তারিখ | প্রকার | বেচি | আড়া
৬/৮/০৭ | চন্দ্রমুখি | ৪৬৫ | ৬৭৫
৭/৮/০৭ | " | ৪৫৫ | ৬৬৫
৮/৮/০৭ | " | ৪৫৫ | ৬৭২
৯/৮/০৭ | " | ৪৬৫ | ৬৭৫
১০/৮/০৭ | " | ৪৬৫ | ৬৭৫
প্রতি ৫০ কেজি পাইকারি দর
তারিখ | প্রকার | বেচি | আড়া
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১০/৮/০৭ | " | ৬৮০ | ২৮০
বাজার সিয়ালসারা
তারিখ | প্রকার | বেচি | আড়া
৬/৮/০৭ | চন্দ্রমুখি | ৪৫০ | ৬৫৫
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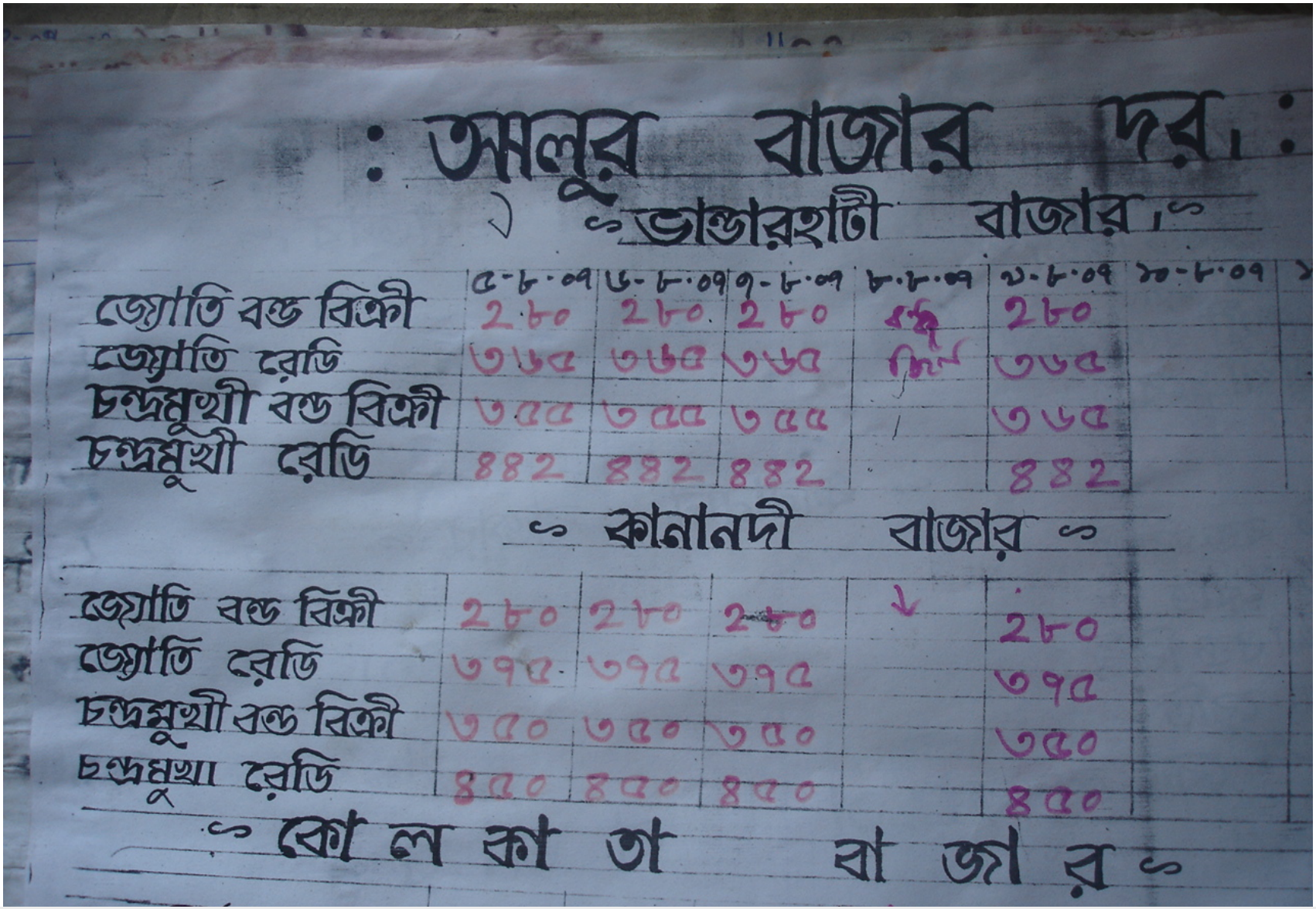

: আলুর বাজার দর :

১ ভান্ডারহাটী বাজার

	৫-৮-০৭	৬-৮-০৭	৭-৮-০৭	৮-৮-০৭	৯-৮-০৭	১০-৮-০৭
জ্যোতি বড় বিক্রী	২৮০	২৮০	২৮০	বন্ধ	২৮০	
জ্যোতি রেড়ি	৩৬৫	৩৬৫	৩৬৫	ছিল	৩৬৫	
চন্দ্রমুখী বড় বিক্রী	৩৫৫	৩৫৫	৩৫৫		৩৬৫	
চন্দ্রমুখী রেড়ি	৪৪২	৪৪২	৪৪২		৪৪২	

কানানদী বাজার

জ্যোতি বড় বিক্রী	২৮০	২৮০	২৮০	↓	২৮০
জ্যোতি রেড়ি	৩৭৫	৩৭৫	৩৭৫		৩৭৫
চন্দ্রমুখী বড় বিক্রী	৩৫০	৩৫০	৩৫০		৩৫০
চন্দ্রমুখা রেড়ি	৪৫০	৪৫০	৪৫০		৪৫০

কোলকাতা বাজার

Descriptives

Table 1: Descriptive Statistics (2007) by Treatment Group

	Control	Private	Public	Pvt v. Ctrl	Pub v. Ctrl	Pub v. Pvt
Number of farmers	562	558	559			
Male household head	0.97	0.95	0.96	-0.03 **	-0.02	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Hindu	0.84	0.83	0.84	-0.01	-0.02	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Lower caste	0.31	0.47	0.36	0.17 ***	0.05	-0.12 ***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Homestead area (acres)	2.02	2.02	2.01	0.001	-0.01	-0.007
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Kachcha walls	0.67	0.59	0.61	-0.07 **	-0.06 **	0.01
	(.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Kachcha floor	0.69	0.60	0.61	-0.09 ***	-0.08 ***	0.01
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Electric connection	0.64	0.69	0.70	0.05 *	0.05 *	0.01
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Have landline phone	0.26	0.22	0.25	-0.04	-0.01	0.03
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Have cell phone	0.34	0.30	0.35	-0.04	0.02	0.06 **
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)

The Potato Cycle

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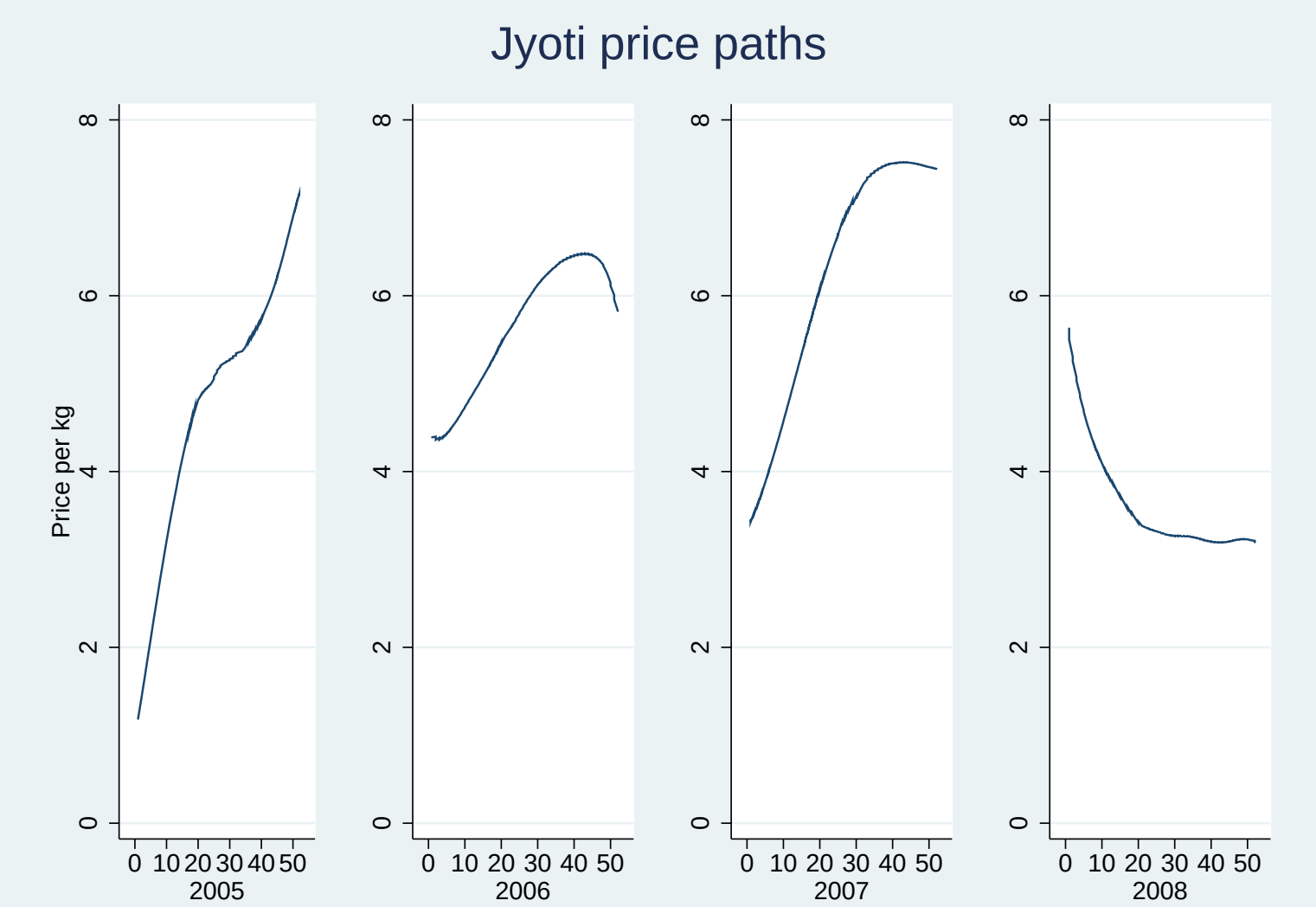
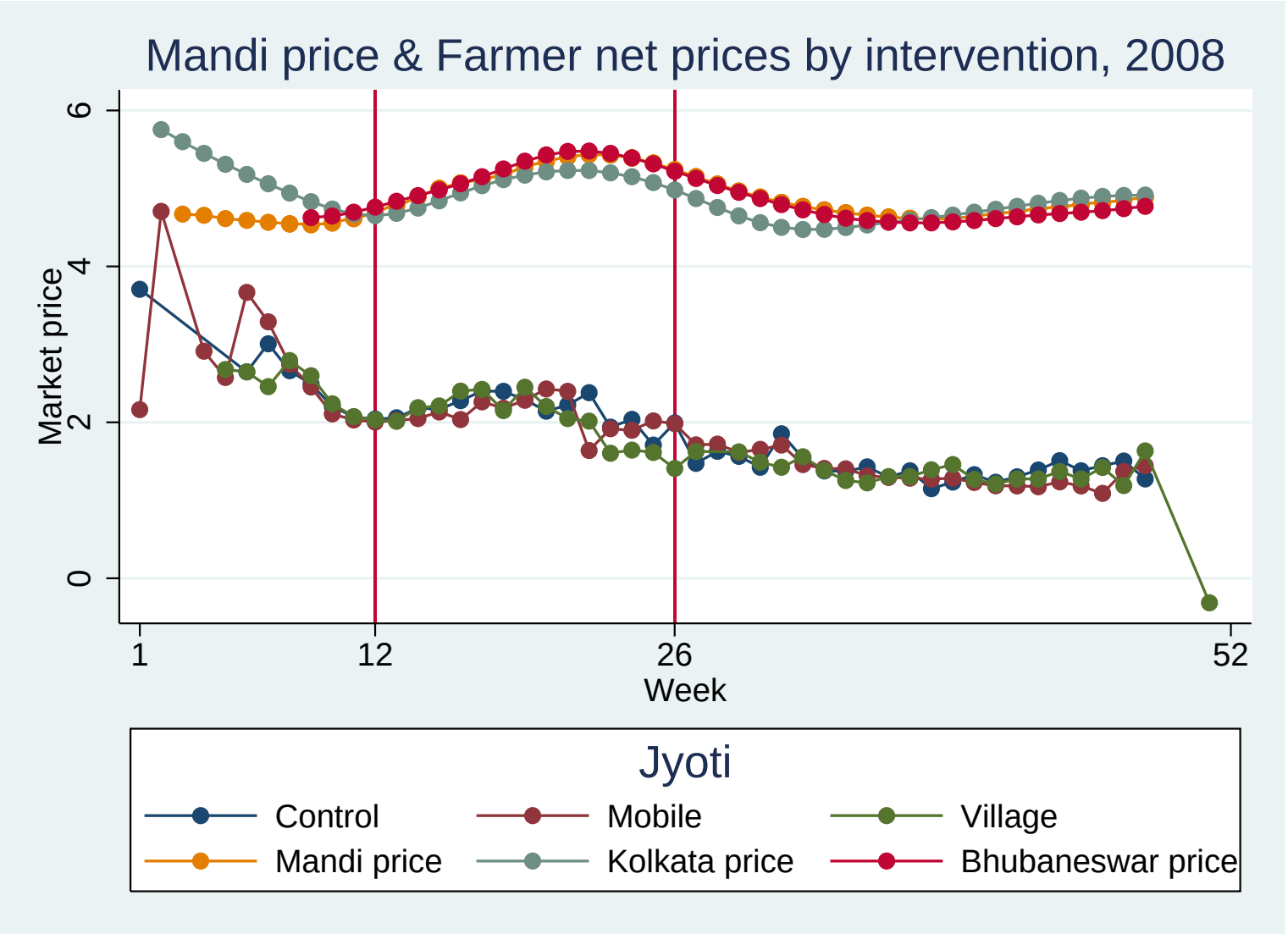
- June – Nov 2008: sales from cold stores
- Farmers decide how much to sell in any given period/day
  - cash needs
  - price expectations

The Study & Data Collection

- Intervention: June – November 2007, March – November 2008
- Household surveys:
  - production survey: February-March 2008
  - harvest survey: March 2008
  - fortnightly trading survey: March-November 2008
- Village survey: 2007

Price Paths


Jyoti price paths
Price per kg
0
2
4
6
8
0 10 20 30 40 50
2005
2006
2007
2008


Mandi price & Farmer net prices by intervention, 2008
Market price
0
2
4
6
1
12
26
52
Week
Jyoti
Control
Mobile
Village
Mandi price
Kolkata price
Bhubaneswar price

Middlemen Margins

- back-of-the-envelope estimate of middlemen margins:
- mandi prices = gross of transport costs
- mandi price – farmer price $\geq$ Rs. 2 per kg
  - transport costs: Rs. 0.24 per kg
  - handling and other costs: Rs. 0.35 per kg
  - cold-storage costs: Rs. 0.89 per kg

$$\begin{aligned} \text{middleman margin} \approx \quad & 2 - 0.59 = \quad 1.40 \text{ in harvest \& PHE period} \\ \approx \quad & 2 - 1.48 = \quad 0.52 \text{ in PHL period} \end{aligned}$$

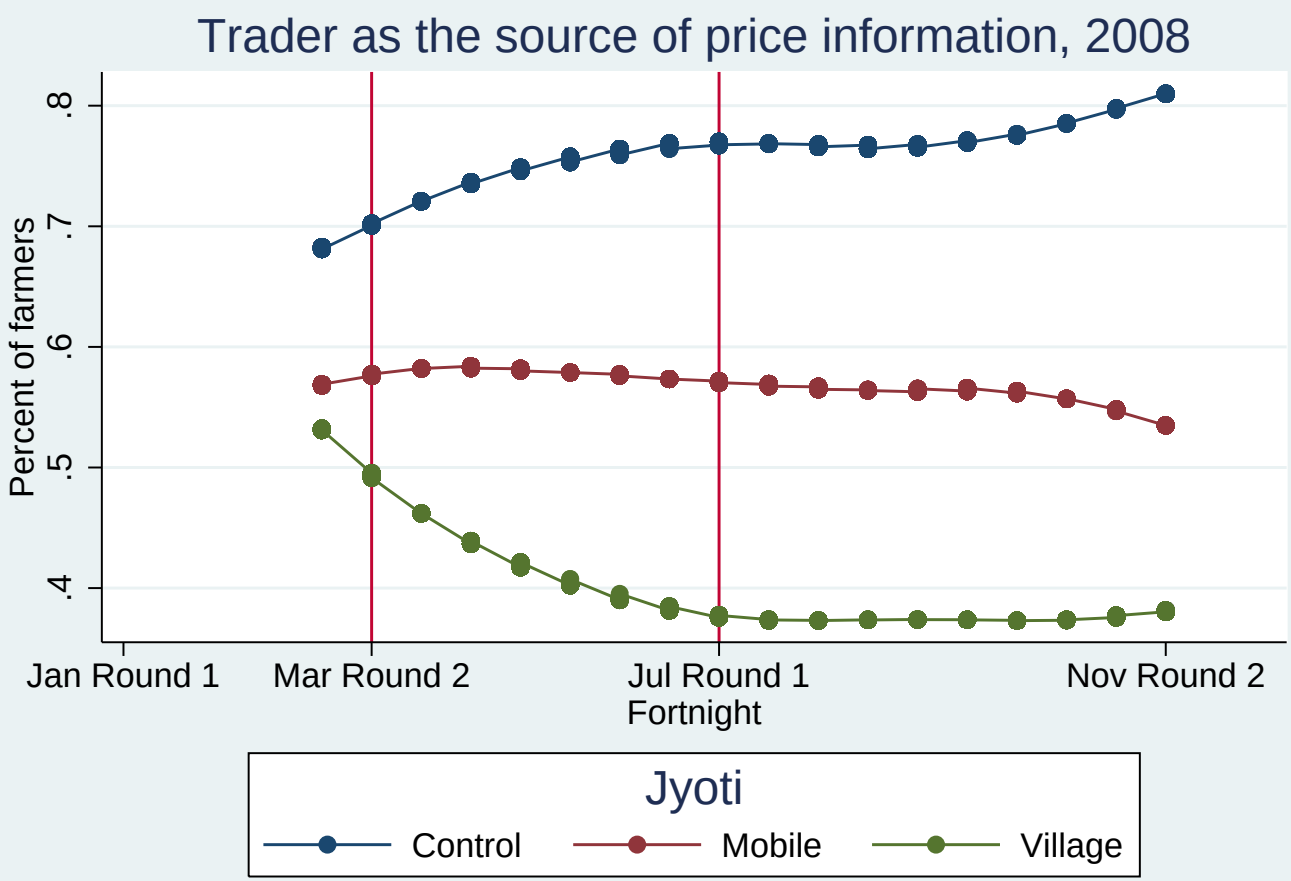
Impact on Information

Table: Effect of interventions on price tracking behavior

	Probability that farmer tracks wholesale prices		How long ago did you last track prices? (minimum) (days)		Tracked price (Rupees/kg)	
Private info	-0.12	-0.22	-0.38 ***	-0.34 ***	0.04	0.02
	(0.25)	(0.46)	-(3.27)	-(2.99)	*0.35*	*0.20*
Phone recipient		0.60 **		-0.18 ***		0.08
		(2.00)		-(3.05)		*1.12*
Public info	2.14 ***	2.14 ***	-0.29 **	-0.29 **	0.26 **	0.26 **
	(3.22)	(3.22)	-(2.54)	-(2.54)	*2.42*	*2.42*
Land	0.46 ***	0.46 ***	-0.01	-0.01	0.01	0.01
	(3.41)	(3.45)	-(0.74)	-(0.72)	*0.37*	*0.36*
Constant	2.01 ***	2.01 ***	1.65 ***	1.65 ***	2.76 ***	2.76 ***
	(3.63)	(3.62)	(15.57)	(15.57)	*30.75*	*30.75*
Observations	*11746*	*11746*	*11746*	*11746*	*1282*	*1282*
R-squared	*0.16*	*0.16*			*0.53*	*0.54*

Notes: During the fortnightly trading surveys (March -- Dec 2008) a randomly selected 50% sample (stratified by village) was asked "Do you keep track of retail (potato) prices? Do you keep track of wholesale (potato) prices?" and if they answered yes to either question, were asked to list up to 3 markets (2 varieties per market) where they tracked prices, how long ago they last tracked the price. Each observation is a household-variety-market combination. The dependent variable takes value 1 if the household answers yes to this question at least once during the trading surveys.

Impact on Source of Information



Note: Question was only asked to a random one−half of the sample.

Table: Effect of interventions on area, output and yield of potatoes

	Area planted (acres)		Output (kg)		Yield (kg/acre)	
Private info	0.02	0.02	447.8	404.8	1313.2***	1180.5***
	(0.63)	*(0.44)*	*(1.19)*	*(1.06)*	*(2.96)*	*(2.93)*
Phone		0.04		267.9		826.5
		(1.31)		*(0.85)*		*(1.22)*
Public info	0.03	0.03	201.6	201.5	-86.90	-86.96
	(0.73)	*(0.73)*	*(0.51)*	*(0.51)*	*(-0.23)*	*(-0.23)*
Land size	0.17***	0.17***	1672.2***	1673.1***	94.11	96.95
	(13.38)	*(13.42)*	*(11.89)*	*(11.92)*	*(1.19)*	*(1.25)*
Constant	0.39***	0.39***	3739.78***	3740.82***	9570.63***	9572.59***
	(10.44)	*(10.45)*	*(9.07)*	*(9.07)*	*(26.97)*	*(26.92)*
Observations	*3386*	*3386*	*3386*	*3386*	*3386*	*3386*
R-squared	*0.44*	*0.44*	*0.42*	*0.42*	*0.04*	*0.04*

Note: Each observation is a household-potato variety-quality combination. Regressions also include dummies for variety and quality of potatoes, and a district dummy. t-statistics are in parentheses. Standard errors are clustered at the village level.

Table : Effect of interventions on allocation of harvest

			Percentage of quantity sold that was sold:					
	Pct of harvest sold		At harvest		Post-harvest early		Post-harvest Late	
Private info	-0.02	-0.06	-0.05	-0.05	0.02	0.01	0.04	0.03
	(-0.32)	(-0.15)	(-0.85)	(-0.69)	(0.22)	(0.16)	(1.09)	(0.91)
Phone		-0.04*		-0.06		0.03		0.03
		(-1.95)		(-1.60)		(0.53)		(0.82)
Public info	-0.001	-0.001	-0.05	-0.05	-0.05	-0.05	0.11***	0.11***
	(-0.03)	(-0.03)	(-0.75)	(-0.75)	(-0.80)	(-0.81)	(2.92)	(2.92)
Land size	0.03***	0.03***	-0.03***	-0.03***	-0.03***	-0.03***	0.06***	0.06***
	(4.34)	(4.35)	(-2.71)	(-2.74)	(-2.95)	(-2.93)	(6.55)	(6.60)
Constant	0.96***	0.96***	0.53***	0.53***	0.24***	0.24***	0.23***	0.23***
	(31.46)	(31.51)	(8.42)	(8.42)	(3.72)	(3.72)	(6.80)	(6.80)
Observations	*3386*	*3386*	*2318*	*2318*	*2318*	*2318*	*2318*	*2318*
R-squared	*0.53*	*0.54*	*0.07*	*0.08*	*0.03*	*0.03*	*0.121*	*0.122*

Each observation is a household-potato variety-quality combination. Regressions also include dummies for variety and quality of potatoes, and a district dummy. t-statistics are in parentheses. Standard errors are clustered at the village level.

Effects, annual data

Table: Effect of interventions, Average effects on quantity sold and price received by farmers over the year.

	Quantity sold		Net price received	
Private info	218.01	140.06	0.04	0.04
	0.42	*0.26*	*0.36*	*0.34*
Phone		459.50		0.01
		1.19		*0.13*
Public info	-261.46	-262.31	-0.04	-0.04
	0.55	*0.56*	*0.37*	*0.38*
Land	2018.63 ***	2020.58 ***	-0.07 ***	-0.07 ***
	12.66	*12.72*	*5.20*	*5.19*
Constant	2999.73 ***	2998.76 ***	2.48 ***	2.48 ***
	7.40	*7.41*	*31.81*	*31.80*
Observations	*3120*	*3120*	*2908*	*2908*
R-squared	*0.39*	*0.39*	*0.48*	*0.48*

Note: Each observation is a household-potato variety-quality combination. Dummies for variety and quality are included. Market fixed effects are included. Standard errors are clustered at the village level.

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- Average effects: *no significant effects on either farmgate prices or quantity sold, for either information treatment*

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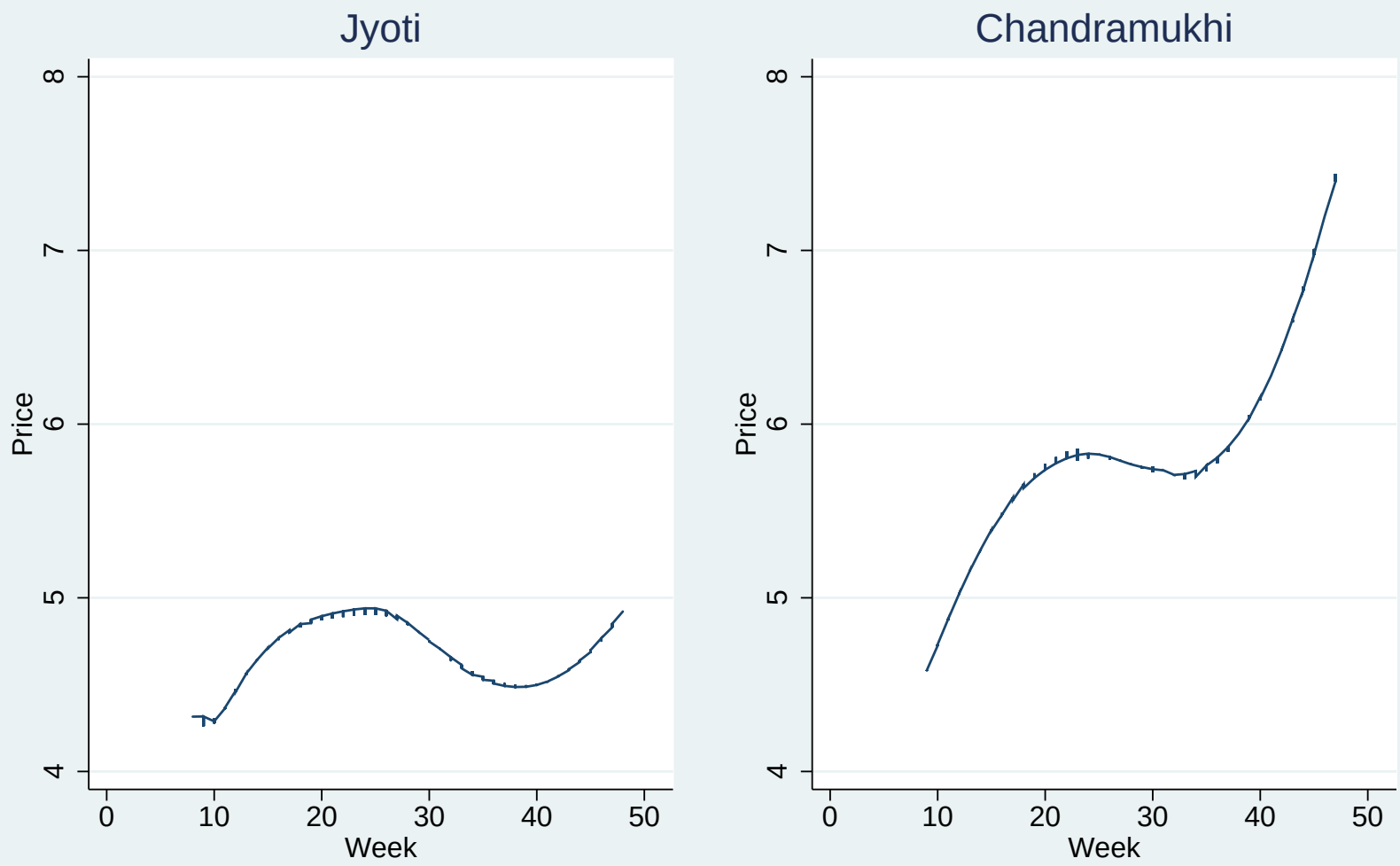
- Yet, private information treatment has a significant average effect on yields
- And public information treatment has a significant effect on farmers' price information and storage

Heterogeneity of treatment effects

- Investigate heterogeneity of treatment effects
  - by potato variety
    - Jyoti & Chandramukhi had different price paths
  - as market prices change
    - the intervention may have different effects depending on prevailing prices

Mandi prices, 2008, high quality

Our sample, Hugli & West Medinipur districts



Effects, broken by variety, annual data

Table: Effect of interventions, broken by variety. Average effects on quantity sold and price received by farmers over the year.

	Jyoti				Chandramukhi			
	Quantity Sold		Price received		Quantity sold		Price received	
Private info	415.89	333.42	0.07	0.05	395.53	441.26	0.32 *	0.39 **
	0.68	*0.54*	*0.65*	*0.47*	*0.79*	*0.87*	*1.72*	*2.20*
Phone		525.65		0.12		-240.51		-0.48 ***
		1.07		*1.48*		*1.01*		*2.97*
Public info	-161.93	-164.65	-0.03	-0.04	713.14 **	706.66 **	0.29 *	0.29 *
	0.28	*0.28*	*0.30*	*0.31*	*2.64*	*2.61*	*1.96*	*1.95*
Land	2246.02 ***	2246.60 ***	-0.07 ***	-0.07 ***	840.57 ***	833.21 ***	-0.09 **	-0.10 ***
	11.84	*11.91*	*4.58*	*4.59*	*3.21*	*3.15*	*2.76*	*3.16*
Constant	3161.55 ***	3162.25 ***	2.19 ***	2.19 ***	1025.76 **	1036.48 **	3.31 ***	3.33 ***
	6.30	*6.32*	*23.95*	*23.97*	*2.59*	*2.59*	*18.86*	*19.13*
Observations	*2182*	*2182*	*2040*	*2040*	*320*	*320*	*278*	*278*
R-squared	*0.39*	*0.39*	*0.30*	*0.31*	*0.29*	*0.29*	*0.65*	*0.66*

Note: Each observation is a household-quality combination. Dummies for quality are included. Market fixed effects are included. Standard errors are clustered at the village level.

Heterogeneity by market prices

- What were the effects on the pass-through (from traders to farmers) of changes in wholesale prices?

Heterogeneity by market prices

- What were the effects on the pass-through (from traders to farmers) of changes in wholesale prices?
- related to risk-sharing between farmers and traders

Models of Contracting

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- Farmer produces exogenous quantity $\bar{q}$.
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  - Information intervention makes s perfectly informative about v.

Model contd.

- Trader pays farmer price p (farmgate price)
- Trader's *ex post* payoff = $vq - pq$
- Farmer's *ex post* payoff = $m + u(c) = pq + u(\bar{q} - q)$; $u'(\cdot) > 0$, $u''(\cdot) < 0$

Model contd.

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- Farmer's *ex post* payoff = $m + u(c) = pq + u(\bar{q} - q)$; $u'(\cdot) > 0$, $u''(\cdot) < 0$
- Farmer's outside option is to sell directly in the *mandi*
  - receives an expected price of s
  - incurs additional transport costs t
- or to consume.

First-best, efficient contract

- In the first-best world, the sum of the trader's and farmer's payoffs would be maximised.

$$q_F(v) = \arg\max vq + u(\bar{q} - q)$$

  - $v \leq u'(0) \Rightarrow q_F(v) = 0$

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- $\Rightarrow q_0(v) = q_F(v-t)$
- corresponding indirect utility $= I(s-t)$

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- $p(v, s) = \frac{\max\{I(s-t), u(\bar{q})\} - u(\bar{q} - q_F(v))}{q_F(v)}$

H1 Prediction

- **Quantity q is unaffected by information intervention.**
- **Price p is affected if t is not too large.**

H1 Prediction

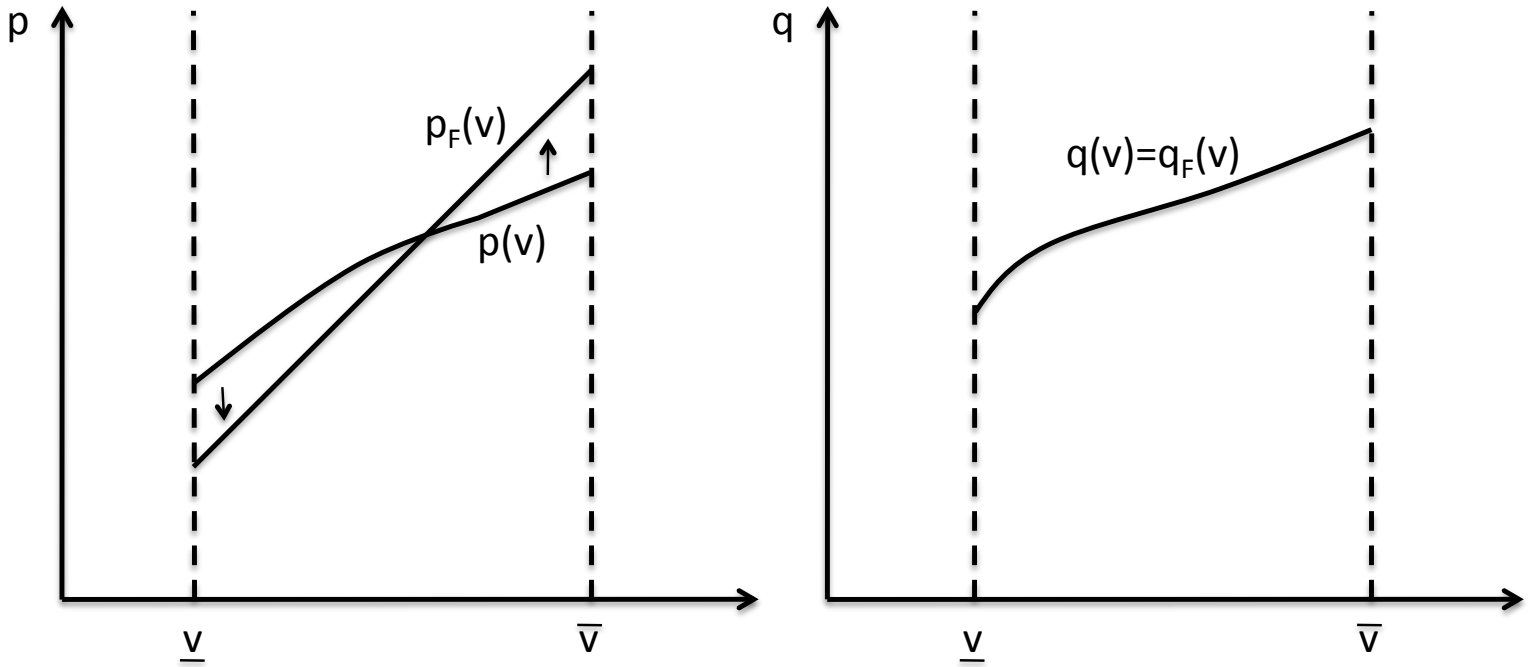

Figure: **H1: Trader has all bargaining power; no risk/inequality aversion**

H2: Ex ante contract; risk-neutral farmer; $\lambda < 1$

- Ex ante contract: commit to trade $q(v|s)$ at price $p(v|s)$

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  - q is distorted downwards when v is low

H2 Prediction

- **In $q = \alpha + \beta v$, $\alpha \uparrow$; $\beta \downarrow$ with information intervention.**
- **In $p = \gamma + \delta v$, $\gamma \downarrow$; $\delta \uparrow$ with information intervention.**

H2 Prediction

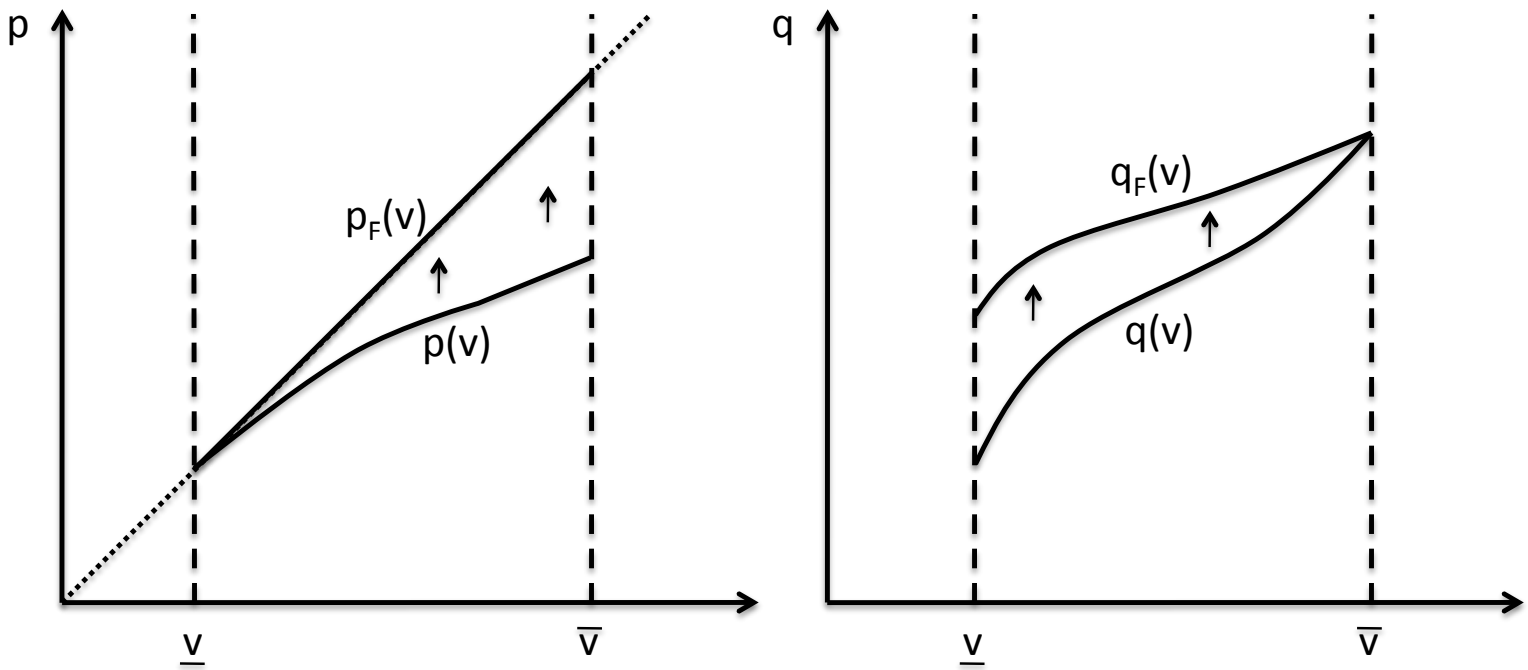

Figure: **H2: $\lambda < 1$, no risk/inequality aversion**

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- risk-sharing between farmers and traders worsens the incentive problem, $p(v|s)$ co-moves more with v
- information intervention relaxes the incentive problem and allows more risk-sharing
- intervention causes p to co-move more closely with v; q to co-move less closely with v

H3 Prediction

- **In $q = \alpha + \beta v$, $\alpha \uparrow$; $\beta \downarrow$ with information intervention.**
- **In $p = \gamma + \delta v$, $\gamma \downarrow$; $\delta \uparrow$ with information intervention.**

H3 Prediction

- **In $q = \alpha + \beta v$, $\alpha \uparrow$; $\beta \downarrow$ with information intervention.**
- **In $p = \gamma + \delta v$, $\gamma \downarrow$; $\delta \uparrow$ with information intervention.**
- Welfare effects
  - if v is low then farmers are worse off
  - if v is high then farmers are better off

H3 Prediction

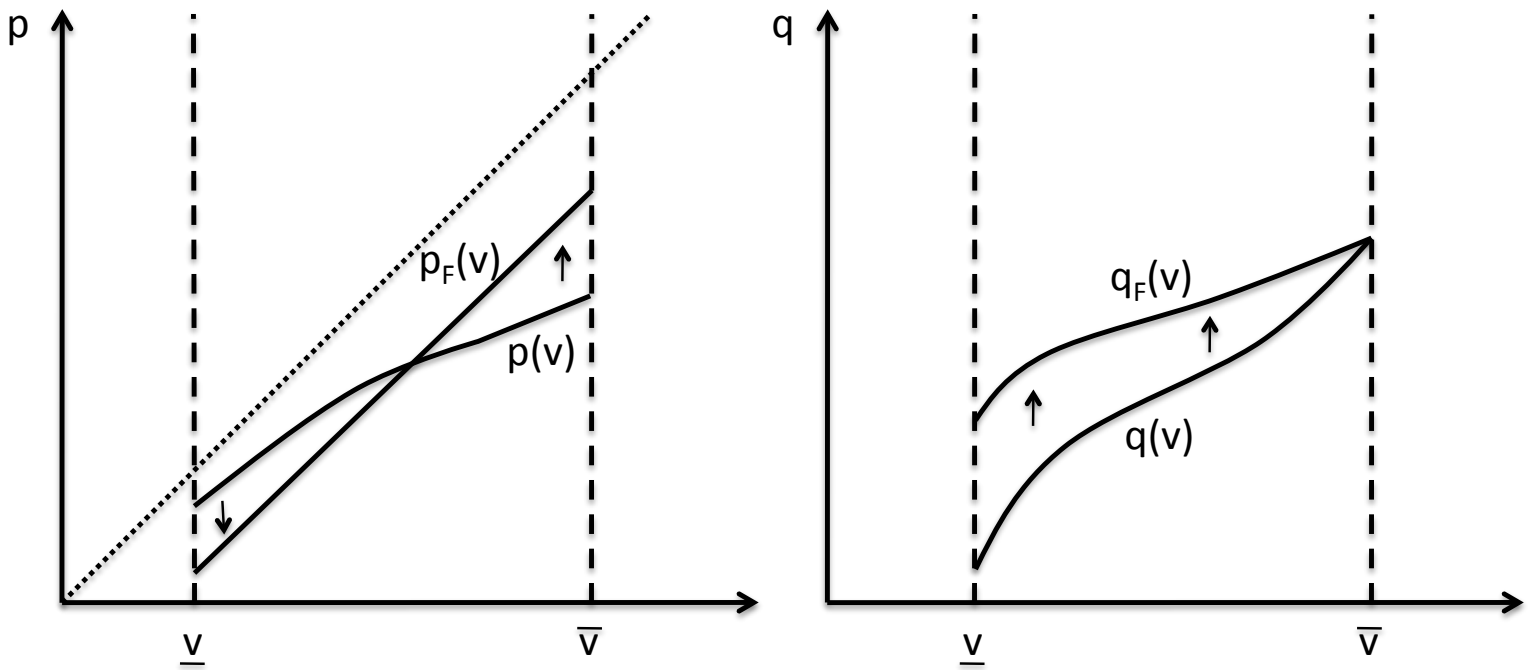

Figure: **H3:** $\lambda < 1$**, farmer is risk averse**

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- Trader anticipates this supply response
- Price depends on bargaining power and outside options:
  - if trader has all bargaining power and t is not too large, $p(v|s) = s - t$
  - if farmer has all bargaining power, $p(v|s) = v - t$

H4 Prediction

- **In $q = \alpha + \beta v$, $\alpha \downarrow$; $\beta \uparrow$ with information intervention.**
- **In $p = \gamma + \delta v$, $\gamma \downarrow$; $\delta \uparrow$ with information intervention.**

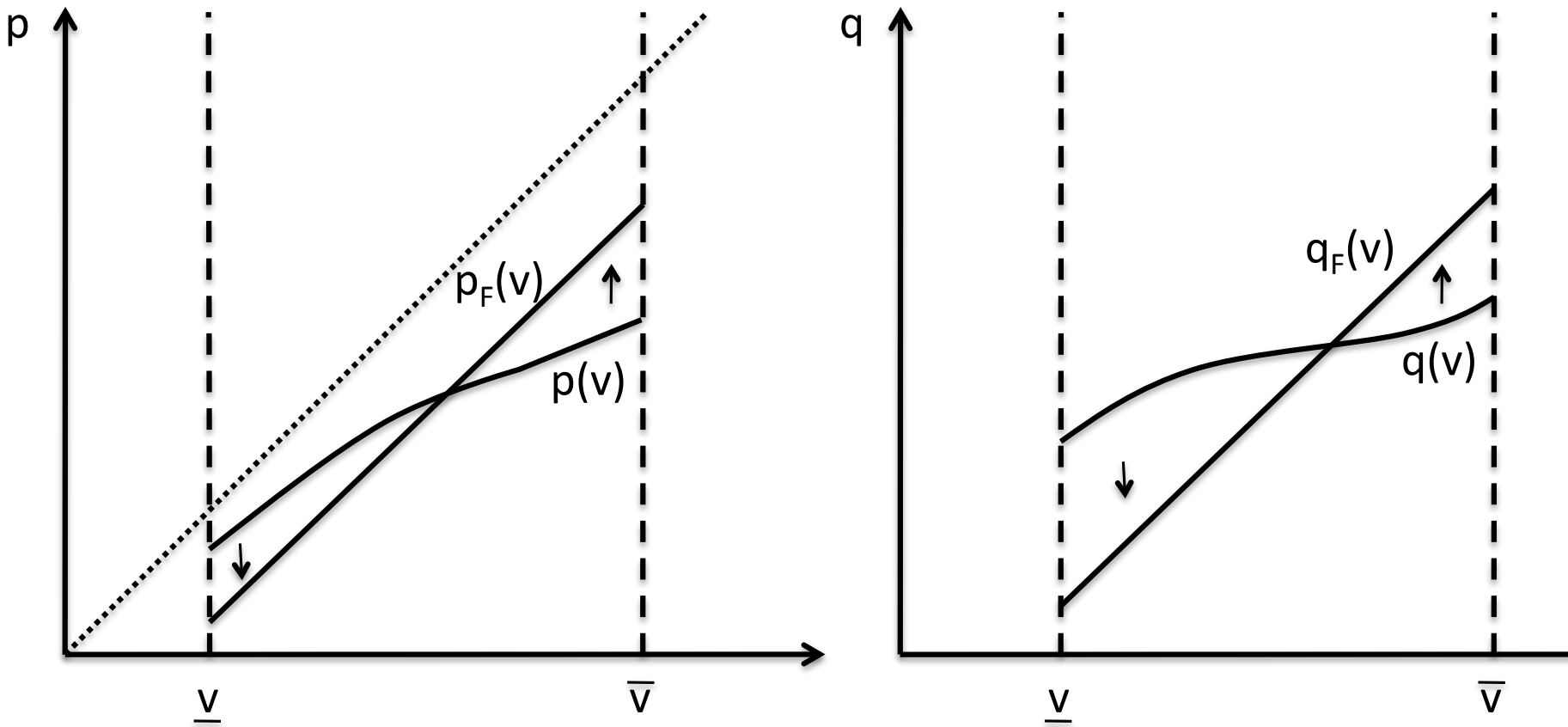

Figure: **H4: Ex post bargaining over price**

Summary of Theoretical Predictions

- H1 and H4 similar with respect to absence of ex ante contract; ex post price bargaining
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- Differ w.r.t. decision making-power over quantity decisions (possibly reflecting farmer heterogeneity in outside options), with differing consequences only for quantity traded
- H2 and H3 require ex ante contracts: differing consequences for prices and quantities traded
- These help to empirically discriminate between the different theories

Interactions with market price

- Run regressions of q and p on *mandi* price.

Pass-Through of Mandi Prices: Using weekly data

- Farmgate prices received $=$
  f(mandi price prevailing in the same week (conditional on selling)
- Do analysis separately for different periods of the year
  (harvest, post-harvest-early, post-harvest-late)
- Broken by variety

Table: Effect of Interventions; weekly data categorized by period, Jyoti

	Fraction Sold						Net price received					
	Harvest		Post-harvest early		Post-harvest late		Harvest		Middle		Late	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
Control	0.34	-0.04	0.29	-0.05	0.35	-0.07	0.73	0.29	1.51	0.13	-0.30	0.28
Mobile	-0.05	0.01	0.04	0.00	0.03	-0.01	-0.04	0.02	-0.82 **	0.20 **	0.50	-0.09
	0.66	*0.66*	*0.52*	*0.87*	*0.50*	*0.63*	*0.91*	*0.82*	*0.02*	*0.01*	*0.17*	*0.28*
Village	0.06	-0.02	-0.03	0.00	-0.06	0.02 **	0.13	0.00	-0.59 *	0.14 *	0.27	-0.05
	0.60	*0.40*	*0.43*	*0.87*	*0.13*	*0.04*	*0.68*	*0.99*	*0.10*	*0.08*	*0.44*	*0.54*
	Observations 51001, R-squared 0.01						*Observations 3470, R-squared 0.55*					

Note: The unit of observation is a household-quality-week. Market fixed effects are included. Standard errors are clustered at the village level.

Table: Effect of Interventions; weekly data categorized by period, Chandramukhi

	Fraction Sold						Net price received					
	Harvest		Post-harvest early		Post-harvest late		Harvest		Middle		Late	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
Control	0.22	-0.03	0.01	0.01	0.00	0.04	3.56	-0.12	3.55	-0.07	2.83	0.08
Mobile	-0.07	0.01	0.00	-0.02	0.13 *	-0.03 *	-1.96	0.42	-2.58	0.50	-3.09 *	0.51 *
	0.52	*0.71*	*0.99*	*0.65*	*0.07*	*0.07*	*0.16*	*0.14*	*0.20*	*0.21*	*0.07*	*0.09*
Village	-0.24 **	0.03 **	0.40	-0.07	0.22	-0.04	-1.39	0.41	-1.13	0.24	-3.55 ***	0.63 ***
	0.03	*0.05*	*0.25*	*0.24*	*0.12*	*0.15*	*0.57*	*0.42*	*0.57*	*0.54*	*0.01*	*0.00*
	Observations 8025, R-squared 0.003						*Observations 449, R-squared 0.67*					

Note: The unit of observation is a household-quality-week. Market fixed effects are included. Standard errors are clustered at the village level.

Puzzle: Impact on Information

Table: Effect of interventions on tracked prices

	Annual Data		Fortnightly Data			
Private info	0.04	0.02	0.00	0.00	0.65 *	0.65 *
	0.35	*0.20*	*0.03*	*0.04*	*1.76*	*1.75*
Phone		0.08		0.00		
		1.12		*0.08*		
Public info	0.26 **	0.26 **	0.17	0.17	0.90 **	0.90 **
	2.42	*2.42*	*1.49*	*1.49*	*2.51*	*2.51*
Mandi price					0.34 ***	0.34 ***
					4.80	*4.80*
Private info x Mandi price					-0.14 *	-0.14 *
					1.92	*1.89*
Public info x Mandi price					-0.15 **	-0.15 **
					2.30	*2.30*
Land	0.01	0.01	0.00	0.00	0.00	0.00
	0.37	*0.36*	*0.37*	*0.37*	*0.17*	*0.17*
Constant	2.76 ***	2.76 ***	2.50 ***	2.50 ***	1.29 ***	1.29 ***
	30.75	*30.75*	*18.36*	*18.36*	*4.17*	*4.17*
Observations	*1282*	*1282*	*12281*	*12281*	*12281*	*12281*
R-squared	*0.53*	*0.54*	*0.39*	*0.39*	*0.41*	*0.41*

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  - in contrast, near-100% pass-through of retail to wholesale prices

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- Information had some effect on the relationship between farmgate price and *mandi* price
- The evidence suggests that farmers and traders engage in ex post bargaining over price
- Reject other hypotheses of ex ante contracts (H2, H3)

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  - negative in low v states
  - positive in high v states
- Farmers ended up bearing more risk: revenues became more volatile
- Average middleman margins did not decline
  - unlikely to be a form risk premium for price insurance

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- Information treatments seem to have raised farmers' perceived *intercept* of market prices (small but significant change)
- Why did they not improve ability to *track* mandi price movements?
  - how do farmers process our information?
- If farmers do not track prices better, can our findings be interpreted as resulting from
  -
  -

More Puzzles

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- How/why do the private and public information treatments differ
  - in the way that farmers process information
  - in their impact on price received
- Note: no evidence that farmers discuss prices more/less when information delivered verbally v. through written means
- Note: did written information allow farmers to see price trends developing, while verbal information did not?