Dairy Value Chains in Kyrgyzstan from Food Safety and Nutrition Perspective

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Kyrgyzstan dairy

- 90% of households consume milk
- important source of income for many rural households
- positioned to become a leading dairy exporter

- Transformation since 1990s
  - initial contraction in volume of raw milk and share of output processed
  - back-yard, small-scale dairies replaced large, intensive operations

- Uneven upstream and downstream development
  - some instances of FDI or upgrading of capacity in dairy processing
  - still many dairy enterprises cannot export
  - most of raw milk is produced at “house-cow” dairies

Survey of dairy supply chains in Kyrgyzstan in 2014
(IFPRI and National Academy of Sciences of Kyrgyzstan)

- Farmers (520), milk collectors (12 stationary and 53 mobile), and milk plants in Chui, Issuk-Kul, Narun and Talas oblasts
- Farms were small: 2-7 dairy cattle
- Price of raw milk was 30% of retail milk price
- Low investment in production: breeds, feed efficiency, care, milking equipment
- Mobile collectors assess quality visually or by smell
- Stationary MCCs measure fat content and level of bacteria (not well)
- Milk plants check fat content, but few have modern equipment
- Plants reported that quantity and quality of raw milk is constrained

Marketing channels

- mobile milk collectors (85%, 11.6 liters per farmer)
- stationary milk collection centers (15%, 8.6 liters per farmer)

Small number of farmers also sold to:

- neighbors (9 liters per farmer)
- local markets (24 liters per farmer)
- milk plant (8 liters per farmer)

Quality/safety control along value chain

- Relationships in dairy chain
  - between farmers and collectors: stable but informal
  - between collectors and plants: vary

- Mobile collectors
  - aggregate milk from about 100 farmers

- Farmers
  - no assessment of quality on-farm
  - are paid by volume several times a month
  - cannot verify quality of aggregated milk
  - plant’s acceptance depends on aggregate quality
  - no dairy cooperatives (some team activities: pasture)

Problems for increasing food safety and nutritional values

For milk originating on small farms

- processors cannot signal through prices or contractually influence upstream practices
- no investment in improving milk quality by farmers and collectors

=> milk quality control during processing is critical

=> processors have to lead transformation

=> processors face credibility problems:

low public opinion of domestic industry

Research question

- Firms rely on both internal and external food quality control
  - In-house vs contract laboratory testing by food producers in US
    - 48% used both
    - 30% used only in-house
    - 18% used only outside
    - 4% did neither
  - Salmonella testing in US
    - 37% in 2001 to 63% in 2013 of plants used contract laboratories

  When external certification/quality control is profitable?

  Is additional public oversight of quality control a good policy?

Theoretical predictions

Develop a model

- makes no a priori assumption as to which one is better
- takes into account moral hazard concerns in quality control

What we find

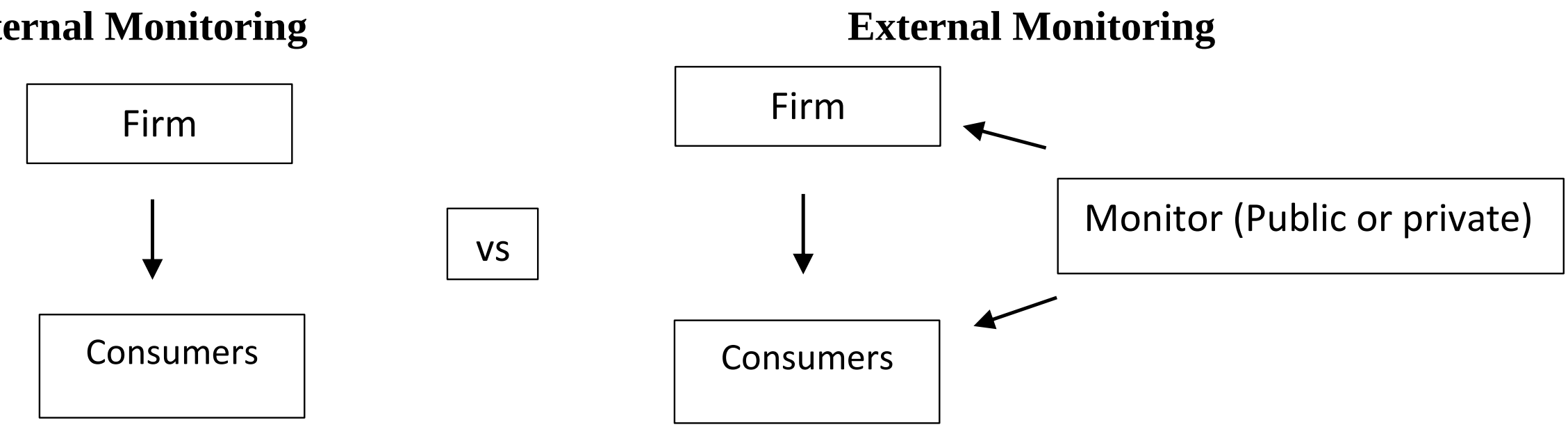
External quality control may or may not be optimal:

- Small plants benefit from external monitoring
- Large plants benefit from an in-house monitoring unit
- Mode of communication, formality, and contracting frictions also matter

Policy implications based on this model

- Mandatory third-party certification can decrease profitability
- Government agencies should target smaller enterprises
- Mode of communication by third party monitors: public
- Communication between monitor and firm: verifiable
  - excessive monitoring costs under third-party monitoring

Model of quality control



Repeated interaction and forward-looking actors: discount factor δ

Quality is good or bad with probability α

Consumers get $v_h - p$ if quality is good ($v_l - p$ if bad), $v_l < 0 < v_h$

Quality control is necessary: $\alpha v_h + (1-\alpha) v_l \leq 0$

Model (cont'd)

Pre-sale monitoring: Monitor (either Firm or Third Party) can observe quality at cost C

Post-sale monitoring: Consumers observe correct signal with probability β

Monitor's compensation: Fixed fee

Internal quality control

Quality is realized	Firm invests in monitoring or not	In case of monitoring, Firm observes pre-sale signal	Firm offers the good or not	If sale occurs, consumers observe their signal of quality

External quality control

Firm pays fee to monitor or not	Quality is realized	Monitor invest in monitoring or not	Monitor reports publicly	Firm offers the good or not	If sale occurs, consumers observe signal of quality

Profit-maximizing behavior

Two moral hazard concerns in quality control

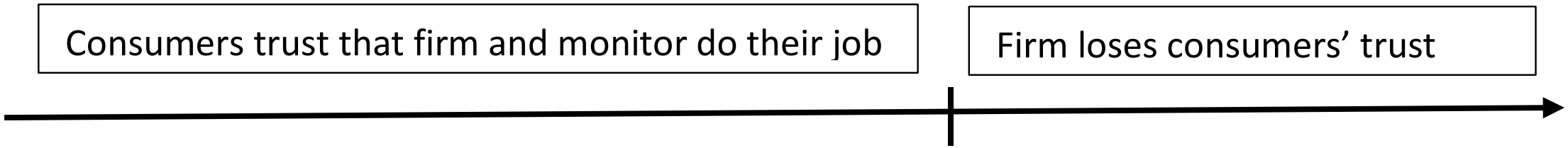
- invest in monitoring (cost savings from deviation)
- keep bad products out (additional sales from deviation)

Incentives arise through "trust"

Consumers trust at first but lose trust after a bad experience/public news

Firm is concerned about losing trust (can't sell)

Monitor is concerned about losing trust (can't be hired)



Internal quality control

Key incentive compatibility condition:

"Smaller sale revenue - monitoring cost + greater continuation value | keeps bad products out"

≥ "Greater sale revenue + smaller continuation value | does not control quality"

or

"Incremental continuation value due to monitoring ≥

Revenue from selling bad products + cost savings from not monitoring"

External quality control

Key incentive compatibility condition:

“Fixed fee - monitoring cost + greater continuation value | monitors quality” ≥

“Fixed fee + smaller continuation value | does not monitor quality”

or

“Incremental continuation value due to monitoring ≥ Cost savings from not monitoring”

Optimal mode of quality control

Internal
- disadvantage: both moral hazard concerns (to gather information and to act on it) are present
- advantage: no incentive costs due to a third party

External
- advantage: moral hazard concern with keeping bad products out is dispensed with
- disadvantage: rents to make investing in monitoring incentive compatible

Delegate less if

- more frequent/volume of trade
- better consumer feedback
- more costly to discover defects/test for contamination
- incidence of low quality (ambiguous)

Intuition

- internal quality control is effective if firm has much at stake and employing third party is not profitable
- internal quality control is not effective if firm has little at stake and third party is necessary to establish credibility

Evidence

- Evidence from developed countries seems to support
  - large firms infrequently lose consumer trust and do not employ third parties
  - small firms frequently lose consumer trust and employ third parties
- No external certification on dairy enterprises in Kyrgyzstan
  - lack of accredited and accrediting organizations?

Additional considerations

- Private disclosure of certification outcome
  - no benefit from external certification

- Collusion between firm and monitor against consumers
  - reduces but does not eliminate benefit of external certification

- Non-verifiability of presale signals of quality also reduces benefit from external certification
  - leads to excessive monitoring cost: firm checks itself before paying for external certification

- Economies of scope in certification

Conclusions

- For large firms, internal quality control can be effective in the presence of contracting frictions and corruption
- Third-party public oversight or certification can benefit smaller firms
- Product quality standards and safety norms increase benefits from public oversight/certification
- Feasibility of external quality control in Kyrgyzstan

    - no HACCP or ISO22000 accreditation organization (equivalents?)

    - government role in supporting certification industry

Upstream investment in improving product quality (another but related research question):

- aggregation across farmers by milk collectors makes feedback difficult
- may reduce the cost of providing incentives for milk collectors in the presence of non-verifiable quality
- formalizing relationships and quality control between farmers and buyers to improve nutrition