Economic impact of coordination in vegetable chains

-- The Propensity Score Matching Method

Huaiyu Wang, Paule Moustier (CIRAD)
Nguyen Thi Tan Loc, Dang Dinh Dam (FAVRI)

-note: based on survey by Favri and Casrad-
Rationale

- Increasing demand by urban consumers for food quality and safety

- Fast development of supermarkets in Vietnam (20% per year between 2001 and 2006) although still limited share (12%) of total food supply (USDA, 2007)

- Small scale of agriculture in Vietnam: 1.7 ha/household on average in the country, 0.6 ha in the red River delta

- Rationale for farmer organizations and vertical integration in the chain (Vorley et al, 2007)
# Conceptual framework

<table>
<thead>
<tr>
<th>Forms of coordination (or governance)</th>
<th>Spot market</th>
<th>Market reciprocity</th>
<th>Contracts</th>
<th>Vertical integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanisms of coordination</td>
<td>Price</td>
<td>Trust</td>
<td>Interlinkages of transactions</td>
<td>Centralisation of decisions-property</td>
</tr>
<tr>
<td>Efficiency in reducing transaction costs</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Efficiency in competitive cost-cutting</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Transaction costs not measured directly; proxied by indicators of asset specificity

Application to vegetable chains in Vietnam

Nature of investigated information

Form of vertical coordination (farmer-buyer relations)

- Farmers' resources
- Farmers' inclusion in group
- Transaction costs (or information costs)
- Financial indicators
- Qualitative data on farmers' welfare
# Vegetable farmers’ survey sample

<table>
<thead>
<tr>
<th>Nature of relations with buyers</th>
<th>Location</th>
<th>Number of farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>In spot markets</td>
<td>Soc Son and Dong Anh districts</td>
<td>66</td>
</tr>
<tr>
<td>Contracted by Company (Hadico)</td>
<td>Soc Son and Dong Anh districts</td>
<td>19</td>
</tr>
<tr>
<td>Supermarkets</td>
<td>Ba Chu group, Dong Anh Dao Duc group, Dong Anh Minh Hiep group, Dong Anh Linh Nam group, Thanh Tri</td>
<td>45</td>
</tr>
<tr>
<td>Selling directly to consumers</td>
<td>Van Tri group, Dong Anh Dang Xa group, Gia Lam Linh Nam group, Thanh Tri</td>
<td>31</td>
</tr>
</tbody>
</table>
Preliminary results

- Basic household characteristics
- Land information and planting pattern
- Financial data – income from vegetables
- Advantages and disadvantages
Conclusion (1)

- Farmer organizations can help farmers increase the income in vegetable chains by linking them to supermarkets, companies, and consumers in rented shops.
- Selling directly to consumers in their own shops is the most profitable strategy for farmers.
- And followed by contracts with supermarkets and companies
- Farmers selling in spot markets have the lowest income.
- A further study (modeling) to quantify the economic impact by identify whether the differences in incomes result from farmers’ participation in contracts rather than their resource or location characteristics.
Propensity Score Matching Method

- **Rationale**
- Matching, which is a method for selecting comparison observations to match treated observations with similar covariates, has been becoming a popular procedure to estimate treatment effect under the assumption of unconfoundedness.
- When there are many covariates, it is impractical to match directly on covariates because of the curse-of-dimensionality. Since the celebrated result of Rosenbaum and Rubin (1983), an attractive way to overcome the curse-of-dimensionality has been matching by propensity score. [Zhao(2008,p.1)]
Literatures

- Rosenbaum and Rubin (1983)
- Literature review on PSM:
  Imbens (2004), Morgan and Harding (2006),
  Caliendo and Kopeinig (2008) etc.
- Details:
  Dehejia and Wahba (1997, 2002) etc.
- PSM in STATA:
  Abadie et al (2004), Becker and Ichino
  (2002), Becker and Caliendo (2007), Nicols
  (2007), Bia and Mattei (2008), etc.
PSM – Implementation Steps

STEP 0: Decide between PSM and CVM
STEP 1: Propensity Score Estimation
STEP 2: Choose Matching Algorithm
STEP 3: Check Overlap/Common Support
STEP 4: Matching Quality/Effect Estimation
STEP 5: Sensitivity Analysis

Drawn from Caliendo and Kopeinig (2008)
Assumptions

- A1. Conditional independence assumption
  \[ y_0, y_1 \perp D \mid x \]

- A2. Common support assumption (overlap assumption)
  \[ 0 < \Pr[D = 1 \mid x] < 1 \]
Propensity Score and Matching Method

- **Propensity Score**
  - a high dimensional vector $X$
    (curse of dimensionality)
  - Balancing Score
    \[ p(x) = \Pr[D = 1 \mid x] = E[D \mid x] \]
  - Probit / Logit model (Binary treatment)

- **Matching method**
  - Nearest Neighbor
  - Caliper and Radius
  - Stratification and Interval
  - Kernel and Local Linear
# Variables selection

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Household size in 2007 (persons)</td>
</tr>
<tr>
<td>Female</td>
<td>Percentage of female in the family (%)</td>
</tr>
<tr>
<td>Age</td>
<td>Average age of the members (years)</td>
</tr>
<tr>
<td>Labor</td>
<td>Labors aged from 15 to 65 (persons)</td>
</tr>
<tr>
<td>Education</td>
<td>Average education years of the family (years)</td>
</tr>
<tr>
<td>Motor</td>
<td>Number of motorbikes per household</td>
</tr>
<tr>
<td>Cattle</td>
<td>Number of cattle</td>
</tr>
<tr>
<td>Land</td>
<td>Land area (m²)</td>
</tr>
<tr>
<td>Market</td>
<td>Distance from nearest market (meter)</td>
</tr>
<tr>
<td>Road</td>
<td>Distance from nearest road (meter)</td>
</tr>
<tr>
<td>Percentage</td>
<td>Percentage of income from vegetable in household income (%)</td>
</tr>
</tbody>
</table>
Thank you