Policy analyses based on structural econometric models

Taiju Kitano
Chapter 1 Introduction

Taiju Kitano
Organization of the dissertation

- Ch.1: Introduction
- Ch.2-4: Study on US motorcycle safeguards
- Ch.5: Study on US-Canada softwood lumber disputes
- Ch.6: Study on telecommunications policy
Chapter 2: Study on US motorcycle safeguard I

Taiju Kitano
Motivation

- US motorcycle industry in the 1980s.
  - Harley-Davidson achieved drastic recovery in the presence of safeguard.
    - Safeguard: temporary protection policy
  - Assess whether or not US motorcycle safeguard resuscitated Harley-Davidson.
Methods of Assessment

- Structural econometric model of demand and supply
  - Demand: Random coefficient logit model,
  - Supply: Multiproduct oligopolistic competition

- Counterfactual simulation:
  - Quantifying the effect of safeguard on the sales and profit.
  - Cross price elasticity
Simulation

- Measuring the effect of tariffs

Effects on profit

Analyze the demand shift focusing on cross-price elasticity

Effects on sales
## Simulation results

<table>
<thead>
<tr>
<th>Harley-Davidson</th>
<th>Bertrand Competition</th>
<th>Collusion among the Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual Sales (Units)</td>
<td>Actual Profits (Million USD)</td>
</tr>
<tr>
<td>1983</td>
<td>26675</td>
<td>18.10</td>
</tr>
<tr>
<td>1984</td>
<td>26636</td>
<td>18.55</td>
</tr>
<tr>
<td>1985</td>
<td>27564</td>
<td>18.86</td>
</tr>
<tr>
<td>1986</td>
<td>29940</td>
<td>21.47</td>
</tr>
<tr>
<td>1987</td>
<td>33426</td>
<td>25.71</td>
</tr>
<tr>
<td>Average</td>
<td>28848</td>
<td>20.54</td>
</tr>
</tbody>
</table>

**Merely 13% at 95% confidence level**
Summary of findings

- The safeguard was unlikely to resuscitate Harley-Davidson because the simulation results indicate that
  - the effects on sales and profit of Harley are small (merely 13% at the 95% confidence level).
  - the cross price elasticity among Harley and Japanese motorcycles are small.
- Questions ITC’s Injury determination:
  - Did domestic industries get injured seriously from import competition?
Problems of the assessment: counterfactual simulation

- Only quantify the effect of safeguard on the sales and profit.
  - “All other things being equal”
    - Neglect the indirect effect
- Insufficient analysis in terms of assessing the protectionists’ argument
  - Protectionists’ argument: Efficiency gains from learning-by-doing, Innovation, Technology adoption during the periods of protection.
  - Important to reveal what resuscitated Harley-Davidson.
## Problems of the assessment: cross-price elasticity

<table>
<thead>
<tr>
<th>Model</th>
<th>Engine</th>
<th>FXSB</th>
<th>FXWG</th>
<th>XLH1000</th>
<th>XLX1000</th>
<th>KZ550</th>
<th>CB650</th>
<th>VF750</th>
<th>VT750</th>
<th>VF1100</th>
<th>GL1100</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-D FXSB</td>
<td>1340</td>
<td>-9.476</td>
<td>0.046</td>
<td>0.036</td>
<td>0.032</td>
<td>0.006</td>
<td>0.006</td>
<td>0.006</td>
<td>0.006</td>
<td>0.005</td>
<td>0.008</td>
</tr>
<tr>
<td>H-D FXWG</td>
<td>1340</td>
<td>0.050</td>
<td>-9.452</td>
<td>0.039</td>
<td>0.035</td>
<td>0.006</td>
<td>0.007</td>
<td>0.007</td>
<td>0.006</td>
<td>0.006</td>
<td>0.009</td>
</tr>
<tr>
<td>H-D XLH1000</td>
<td>1000</td>
<td>0.025</td>
<td>0.026</td>
<td>-7.395</td>
<td>0.027</td>
<td>0.005</td>
<td>0.005</td>
<td>0.006</td>
<td>0.005</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td>H-D XLX1000</td>
<td>1000</td>
<td>0.018</td>
<td>0.019</td>
<td>0.022</td>
<td>-7.437</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td>Kawasaki KZ550</td>
<td>553</td>
<td>0.011</td>
<td>0.011</td>
<td>0.014</td>
<td>0.015</td>
<td>-4.238</td>
<td>0.020</td>
<td>0.019</td>
<td>0.020</td>
<td>0.021</td>
<td>0.018</td>
</tr>
<tr>
<td>Honda CB650</td>
<td>655</td>
<td>0.026</td>
<td>0.026</td>
<td>0.034</td>
<td>0.035</td>
<td>0.047</td>
<td>-4.792</td>
<td>0.047</td>
<td>0.048</td>
<td>0.050</td>
<td>0.043</td>
</tr>
<tr>
<td>Honda VF750</td>
<td>748</td>
<td>0.044</td>
<td>0.045</td>
<td>0.054</td>
<td>0.056</td>
<td>0.072</td>
<td>0.073</td>
<td>-5.449</td>
<td>0.073</td>
<td>0.075</td>
<td>0.071</td>
</tr>
<tr>
<td>Honda VT750</td>
<td>749</td>
<td>0.017</td>
<td>0.018</td>
<td>0.023</td>
<td>0.025</td>
<td>0.033</td>
<td>0.033</td>
<td>0.033</td>
<td>0.035</td>
<td>0.035</td>
<td>0.030</td>
</tr>
<tr>
<td>Honda VF1100</td>
<td>1098</td>
<td>0.045</td>
<td>0.016</td>
<td>0.023</td>
<td>0.025</td>
<td>0.033</td>
<td>0.034</td>
<td>0.033</td>
<td>0.034</td>
<td>-7.043</td>
<td>0.029</td>
</tr>
<tr>
<td>Honda GL1100</td>
<td>1085</td>
<td>0.060</td>
<td>0.060</td>
<td>0.066</td>
<td>0.058</td>
<td>0.069</td>
<td>0.071</td>
<td>0.075</td>
<td>0.070</td>
<td>0.069</td>
<td>-7.802</td>
</tr>
</tbody>
</table>

- **This findings of this table:**
  - Cross elasticity within Japanese models are larger that that between Japanese and Harley.
  - The difference is about 20% for the Japanese motorcycles that has similar characteristics with Harley.
  - Seems to be insufficient to judge whether or not the safeguard resuscitated Harley.
Chapter 2 to Chapter 3

Third chapter:
- first show that the introduction of new engine well explain the recovery of Harley,
- then assess the role of temporary protection as an inducement of technology adoption.
  - assess whether the cross-price elasticity was small enough for Harley not to induce technology adoption and hence achieve resuscitation.
Chapter 3: Study on US motorcycle safeguard II

Taiju Kitano
Temporary protection and industry growth

Breathing room argument:
- Temporary protection policy allows domestic industries to catch up with foreign rivals by giving time and resources to achieve technology adoption and innovation.
- Variation of infant industry protection argument, but usually be employed in developed countries in order to justify the protection of the non-infant industries.

Pseudo infant industry argument
- Economists admit theoretically feasibility of the argument (Rodrick(1992), Miyagiwa and Ohno(1995 AER, 1999 IER))
- However, they usually put doubt on the causal link between protection policies and industry growth.
Temporary protection and industry growth

- A Few empirical works on the temporary protection and industry growth.
  - Head (1994): US steel rail industry
  - Ohashi (2005): Export subsidy on the Japanese steel export
  - Miravete (1998): Spanish Steel

⇒ Feenstra (2004): “further empirical work would be desirable.”
Purpose of Research

- Provide an evidence on the temporary protection and industry growth:
  - Technology adoption

- Assess the role of temporary protection on the technology adoption.
  - Temporary protection, technology adoption and sales growth.
    - Introduction of new technology and learning-by-doing
U.S. Motorcycle Industry

- Harley-Davidson: sole US motorcycle manufacturer
  - Faced with a danger of bankruptcy between the late 1970s and the early 1980s.
  - Recovered its performance dramatically from the middle 1980s.
  - “This case will strengthen those who argue that temporary protectionism can lead to successful adjustment.” (NY Times, Mar. 18, 1987)
- 4 Japanese (Honda, Kawasaki, Suzuki, Yamaha)

Logo: American Icon

FXST(SOFTAIL), 1984
Three key features: Sales turn-around, technology adoption and temporary protection


Number of new registrations (actual sales)

Market share

Share of Harley’s motorcycles equipped with the Evolution engine


(Units) 80000 70000 60000 50000 40000 30000 20000 10000 0

(%) 35 30 25 20 15 10 5 0

Related Literature

- **US motorcycle safeguard**
  - Irwin (2002): Questions the causal link between the policy and the recovery

- **Structural econometric analyses of trade policies**
  - Irwin and Pavcnik (2004, JIE): Airbus vs. Boeing, R&D subsidy
  - Clerides (2008, JIE): Trade liberalization on the used car in Cyprus.
  - Kitano and Ohashi (2009, JIE)
Two stage model

- **1st Stage**: Harley’s adoption decision (Evolution engine to its models of motorcycles)
  - Technology adoption

- **2nd Stage**: Bertrand competition given the adoption decision (Kitano and Ohashi(2009, JIE))
  - Demand, BLP’s random coefficient logit.
  - Multi-product oligopolistic competition with safeguard tariffs

Indirect utility from product \( j \):

\[
    u_{ij} = x_j \beta + \beta_A A_j + \xi_j + \alpha \ln(y_i - p_j) + \sum_k \nu_{ik} x_{jk} \sigma + \epsilon_{ij}, \quad j = 1, 2, \ldots, J
\]

⇒ Each consumer chooses one from \( j = 1, \ldots, J \) and outside option that gives the highest utility.

- \( x_j \): Characteristics (cc, dry-weight, etc)
- \( A_j \): Dummy variable for the equipment of Evolution engine
- \( \xi_j \): Unobserved demand shock
- \( \delta_j = x_j \beta + \beta_A A_j + \xi_j \)

 Consumers’ valuation of Evolution engine

- \( \alpha \ln(y_i - p_j) \): Cobb-Douglas specification, income effect
- \( \nu_{ik} \): Heterogenous taste on characteristics \( k \sim \text{i.i.d. normal} \)
- \( \epsilon_{ij} \): Taste heterogeneity \( \sim \text{i.i.d. extremum value} \)
- \( \mu_{ij} = \alpha \ln(y_i - p_j) + \sum_k \nu_{ik} x_{ik} \sigma_k \)
Second stage: Supply

- f’s variable
  profit function:  $\pi_f = \sum_{j \in J_f} \left( \frac{p_j}{1 + \tau_j} - mc_j \right) \cdot MS_j(A_j)$

- FOC:
  $\frac{s_j}{1 + \tau_j} + \sum_{r \in J_f} \left( \frac{p_r}{1 + \tau_r} - mc_r \right) \frac{\partial s_r}{\partial p_j}$

  $\rightarrow mc = (1 + \tau)^{-1} p - \Delta^{-1}(1 + \tau)^{-1} s$

  $\Delta_{jr} = \begin{cases} - \frac{\partial s_r}{\partial p_j} & \text{if } j \text{ and } r \text{ are produced by a same firm.} \\ 0 & \text{otherwise.} \end{cases}$

- Marginal cost function:
  $\ln(mc_j) = w_j \gamma + \gamma A_j + \omega_j$

  Cost shock unobservable to the econometrician
Data

- Price and Characteristics, 1977-1987, tri-annual, N.A.D.A.
  - Both price and quantity data are available from 1983-1987.
  - 13 periods
- Evolution engine: Conner “Harley-Davidson Data Book”
## Estimation Results: Demand

### (3) Random Coefficient Logit

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef.</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-52.19</td>
<td>23.43</td>
</tr>
<tr>
<td>Evolution</td>
<td>1.306</td>
<td>0.419</td>
</tr>
<tr>
<td>Engine Displacement</td>
<td>4.019</td>
<td>2.085</td>
</tr>
<tr>
<td>Dry-weight</td>
<td>12.837</td>
<td>4.709</td>
</tr>
<tr>
<td>Forward Speeds</td>
<td>0.514</td>
<td>0.092</td>
</tr>
<tr>
<td>Cylinders</td>
<td>0.037</td>
<td>0.054</td>
</tr>
<tr>
<td>Age</td>
<td>-0.076</td>
<td>0.018</td>
</tr>
<tr>
<td>Harley</td>
<td>0.479</td>
<td>1.374</td>
</tr>
<tr>
<td>Constant</td>
<td>-11.864</td>
<td>1.621</td>
</tr>
</tbody>
</table>

| Harley                     | 2.847 | 1.322| **  |
| Engine Displacement        | 2.456 | 0.600| *** |
| Constant                   | 1.138 | 0.661| *   |

- ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Evolution engine shifts the demand upwardly.

Support the existence of Heterogeneity.

- ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Rsq: 0.93
J-stat(df): 29.52 (12)

1st stage Rsq: 0.93
1st stage partial F-test: 61.24

Number of observations: 785
## Estimation Results: Marginal Cost

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef.</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolution</td>
<td>0.047</td>
<td>0.020 **</td>
</tr>
<tr>
<td>Engine Displacement</td>
<td>0.549</td>
<td>0.064 ***</td>
</tr>
<tr>
<td>Dry-weight</td>
<td>0.925</td>
<td>0.109 ***</td>
</tr>
<tr>
<td>Forward Speeds</td>
<td>0.303</td>
<td>0.093 ***</td>
</tr>
<tr>
<td>Cylinders</td>
<td>0.070</td>
<td>0.030 **</td>
</tr>
<tr>
<td>Constant</td>
<td>8.424</td>
<td>0.176 ***</td>
</tr>
</tbody>
</table>

Rsq 0.87

Number of Observations 785

Production of Evolution engine is costly.
Simulation Results: Impacts of the introduction of Evolution on Harley’s sales

In the absence of Technology adoption, Harley’s sales continues to decline following the trend from 1977. → Evolution engine triggered the sales turn-around.
First stage: Technology adoption

- Findings in the second stage: V-shaped recovery was induced by the technology adoption.
- Did temporary protection induce technology adoption?
- Estimate the adoption cost and implement a counter-factual simulation.
  - Identification from the variation in adoption among models.
First stage: Technology adoption

- New product and Learning-by-doing:
  - Learning-by-doing: decrease in production
  - New product
    - Theory: Dasgupta and Stiglitz (1988, OEP), Krugman (JDE, 1987)...
  - Fixed cost reducing learning-by-doing: Miravette (1998, IJIO)

- Evolution engine
  - Temporary protection policy might play significant role in the adoption decision by accelerating the accumulation of production experience at an initial stage of technology adoption.
First stage: Technology adoption

- **Timing**
  - Harley makes an adoption decision at the timing of new model introduction and model change.
  - Adoption decision is made before realizing $(\xi_j, \omega_j)$.
    - Harley maximizes its expected profit.
  - Distributions of $\xi_j$ and $\omega_j$ are computed based on the estimates of second stage.
  - Example:

```
Model 1  Model 2  Model 3  Model J_H
Adopt the Evolution
```

```
Model 1  Model 2  Model 3  Model J_H
Not adopt the Evolution
```
First stage: Technology adoption

- Harley’s profit function:
  \[ \Pi_t(A_t) = \pi_t(A_t) - \sum_{j \in J_{Harley,t}} A_{jt} \cdot C_{jt}^A \]

- Adoption cost
  \[ C_{jt}^A = \exp(\tilde{\theta}_1 + \tilde{\theta}_2 \ln(1 + N_{jt})-\eta_{jt}) \]

Learning parameter

\[ N_t = \sum_{j \in J_{Harley,s}}^{t-1} A_{js} \] : Cumulative number of models equipped with Evolution engine.

Cost shock, unobservable to Econometrician, but observable to Harley
First stage: Technology adoption

- Optimal adoption decision:
  \[ A^*_t = \arg \max_{A_t \in \{0,1\}} E[\Pi(A_t)] \]

- Focus on the deviation
  \[ E[\Pi(A^*_t)] - \Pi(A_{jt} \neq A^*_j, A^*_{-j,t}) \geq 0, \forall j \]
  \[ \iff A^*_j = 1\left\{ \ln E\left[ \pi^*_t(A^*_t) - \pi^*_t(A^*_{-j,t}) \right] - \left( \tilde{\theta}_1 + \tilde{\theta}_2 \ln(1 + N_t) - \eta_{jt} \right) \geq 0 \right\}, \forall j \]

Expected Return from adoption:
\[ \bar{\pi}_{jt} = \pi_t(A_{jt} = 1, A^*_{-j,t}), \bar{\pi}_{jt} = \pi_t(A_{jt} = 0, A^*_{-j,t}) \]
calculated from the estimates of the second stage.
Notes: Dynamics

- Importance of dynamic aspect of technology adoption
  - Technology adoption is dynamic problem.
  - Existence of learning-by-doing generates a dynamic incentive.
    - Benkard(2004, RES): Dynamic pricing(Introductory pricing)

- However, my model is static.
  - Harley introduced new models and replaced the models every year.
    - Non-stationary product space
    - Only 5 years in time series.
  - If dynamic incentive mattered, Harley would sacrifice the current profit in order to step down the learning curve. However, could Harley afford to do so?
    - No! Harley faced with the financial crisis.
      - Reid(1990)
First stage: Estimation

- $\eta_{jt} \sim i.i.d.$ extreme value with scale parameter $\zeta$.

- Adoption probability:
  \[
  \Pr(A_{jt} = 1) = \frac{\exp(\theta_0 \ln(E[\pi(A_{-jt}) - \pi(A_{jt})] - \theta_1 - \theta_2 \ln(1 + N_t)))}{1 + \exp(\theta_0 \ln(E[\pi(A_{-jt}) - \pi(A_{jt})] - \theta_1 - \theta_2 \ln(1 + N_t)))}
  \]
  where, $\theta_0 = 1/\zeta$, $\theta_1 = \tilde{\theta}_1 / \zeta$, $\theta_2 = \tilde{\theta}_2 / \zeta$

- Maximum Likelihood
Notes: Estimation

- Problem in estimation: endogeneity
  - \( \eta_{jt} \) is correlated with \( E\left[\pi_{jt}(A_{-j,t}^*) - \pi_{jt}(A_{-j,t}^*)\right] \) by construction.
  - Positive \( \eta_{jt} \) may induce Harley to adopt Evolution to product \( j \).
  - Adoption in product \( j \) decreases the return from technology adoption of other products.
  - Decrease in the return from technology adoption reduces the number of models with Evolution other than \( j \).
  - In turn, decrease in the number increases the return from technology adoption of product \( j \).
  - As a result, \( \eta_{jt} \) and the return from technology adoption correlates positively.

- \( \theta_0 \) biased upwardly.
  - Since the temporary protection affects the magnitude of expected return from technology adoption, the bias exaggerates the effect of temporary protection on the adoption.

→ Upper-bound
### Estimation Results: Adoption Cost

<table>
<thead>
<tr>
<th></th>
<th>Est.</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_0$</td>
<td>5.961</td>
<td>2.803 **</td>
</tr>
<tr>
<td>$\theta_1$</td>
<td>-92.102</td>
<td>43.077 **</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>2.570</td>
<td>0.894 ***</td>
</tr>
</tbody>
</table>

Learning Coef. **-0.431** 0.126 ***
Learning Rate **0.348** -0.117 ***

Learning rate = 35%: the magnitude of the cost drop with doubling the experience (cumulative number of models equipped with Evolution) ⇒ Larger than the ordinary learning rate (around 20%) surveyed in Argote and Epple (1990, Sci).

Under the strong learning effect, the initial accumulation of production experience is important.
→ Temporary protection can be a key of the recovery.
Simulation Results: Endogenous adoption

- Without temporary protection, the timing of recovery was delayed for two years.
- However, at the end of protection, Harley achieved the recovery.
Simulation Results: Net income

- Measuring the effect of safeguard on the financial condition
  - Net income: total revenue and gains minus all expenses and losses for a reporting period.
  - Variable profit is a part of net income.

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual (mil. USD)</th>
<th>Counter-factual (mil. USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>-25.077</td>
<td>-25.077</td>
</tr>
<tr>
<td>1983</td>
<td>0.937</td>
<td>-0.301</td>
</tr>
<tr>
<td>1984</td>
<td>2.637</td>
<td>-0.752</td>
</tr>
<tr>
<td>1985</td>
<td>3.000</td>
<td>-1.858</td>
</tr>
<tr>
<td>1986</td>
<td>4.871</td>
<td>2.193</td>
</tr>
<tr>
<td>1987</td>
<td>21.215</td>
<td>20.750</td>
</tr>
</tbody>
</table>

- Although the safeguard turned the net profit to be positive, the contribution of the safeguard in improving the net income was tiny compared to that of the reduction of the fixed cost.
Summary of findings

- This paper shows that:
  - Harley’s recovery in the 1980s was thanks to the introduction of new engine, Evolution.
  - Although temporary protection slightly accelerated the pace of adoption and the recovery of the sales, Harley could recover its sales without temporary protection.

⇒ *Pseudo infant industry.*

- Konings and Vandenbussche (2008, JIE)
  - Productivity growth
  - Protected firms vs. non-protected firms
So far, we neglect the role of local production of exporters.

However, two Japanese motorcycle makers, Honda and Kawasaki owned local production facility when the safeguard was in place.

This chapter focuses on the role of the local production.
Chapter 4: Study on US motorcycle safeguard III

Taiju Kitano
Tariff-jumping FDI: Theory

- Foreign direct investment to avoid tariffs: Tariff-jumping FDI

- Smith (1987, EER), Motta (1992, EER)
  - One domestic firm and one foreign firm, the foreign firm can make FDI.
  - Investigate the effect of tariffs

- Blonigen and Ohno (1998, JIE)
  - Multiple foreign firms, difference in ability (cost) to make FDI (local production)
    ⇒ Firms with low FDI cost may benefit from protection because the protection forecloses other foreign firms.
  - Differences in the cost of local production:
    Past experience of FDI, whether to have local production facility or not, …
Case of US motorcycle

- The case of motorcycle safeguard provides an ideal environment to analyze the tariff-jumping FDI:
  - Honda and Kawasaki owned local production facilities.
  - Suzuki and Yamaha did not.

- Irwin (2002)
  - Honda and Kawasaki might favor the safeguard because it could protect them from their Japanese based rivals Suzuki and Yamaha.
**Tariff-jumping FDI: Empirics**

- Several studies investigate the determinants of FDI focusing on the role of trade policies

- A few studies analyze the effects of tariff-jumping FDI on firms’ profits
  - Blonigen, Tomlin and Wilson (2004, CJE) assess the effects of tariff-jumping FDI on domestic firms’ profits using event study analysis
Purpose of research

- Quantifying the effects of tariff-jumping FDI on domestic and foreign firms’ profits
  - How much the tariff-jumping FDI reduces the benefit of domestic firms from the protection policy.
  - Investigates differences in the impacts of trade policies between foreign firms that do FDI and not.
    - Did foreign firms benefit from protection?
- Structural econometric models
  - Almost same as Ch.2 & 3
  - Additional data: information on the local production by models
    - IRC
Pass-through analysis

- First look at the effects of local production
  - Investigate the difference in the effects of tariffs on pricing between FDI firms and no-FDI firms
  - Time series: 1977-1987

\[
\ln p_{jt} = \alpha + \beta_e \ln(e_t) + \beta_\tau \ln(1 + \tau_{jt}) + \gamma z_{jt} + \eta_{jt}
\]

- Exchange rate pass-through
- Pass-through of tariff
- Quality: Engine displacement, Dry-weight, etc.
### Estimation results: Pass-through

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef. (i)</th>
<th>S.E. (i)</th>
<th>Coef. (ii)</th>
<th>S.E. (ii)</th>
<th>Coef. (iii)</th>
<th>S.E. (iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(Exchange rate)</td>
<td>0.290</td>
<td>0.086</td>
<td>0.003</td>
<td>0.201</td>
<td>0.293</td>
<td>0.085</td>
</tr>
<tr>
<td>FDI*ln(Exchange rate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(1+Tariff rate)</td>
<td>0.391</td>
<td>0.069</td>
<td>1.000</td>
<td>0.244</td>
<td>0.498</td>
<td>0.083</td>
</tr>
<tr>
<td>FDI*ln(1+Tariff rate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(Engine displacement)</td>
<td>0.444</td>
<td>0.049</td>
<td></td>
<td></td>
<td>0.442</td>
<td>0.050</td>
</tr>
<tr>
<td>ln(Dry-weight)</td>
<td>0.940</td>
<td>0.094</td>
<td></td>
<td></td>
<td>0.941</td>
<td>0.095</td>
</tr>
<tr>
<td>ln(Speeds)</td>
<td>0.031</td>
<td>0.041</td>
<td></td>
<td></td>
<td>0.027</td>
<td>0.041</td>
</tr>
<tr>
<td>Constant</td>
<td>0.553</td>
<td>0.575</td>
<td>7.760</td>
<td>1.152</td>
<td>0.567</td>
<td>0.572</td>
</tr>
</tbody>
</table>

Num. Obs.  | 568 | 305 | 568 |
R-sq.      | 0.905 | 0.634 | 0.906 |

Feenstra(1989) analyzed the same case: tariff pass-through > 1.
⇒ Why the result is so different from this paper?
U.S. motorcycle safeguard targeted at motorcycles more than 700cc
Feenstra(1989) did not account for the changes in quality⇒(ii)

Pass-through of FDI firms is smaller than that of no-FDI firms by 21%
Structural model: Marginal cost

- Specification of marginal cost

\[ mc = (1 + \tau)^{-1} p - \Delta_{ij}^{-1} (1 + \tau)^{-1} s \]

Mark-up, \( \tau \) depends on local production status

\[ \Delta_{jr} = \begin{cases} -\frac{\partial s_r}{\partial p_j} & \text{if } j \text{ and } r \text{ produced by the same firm} \\ 0 & \text{otherwise} \end{cases} \]

Marginal cost function

\[ \ln(mc_j) = w_j \gamma + \omega_j. \]

- Quality of product \( j \) (cc, dry-weight,...)
- Local production dummy
Counterfactual simulation

- Two counter-factual simulations
  1. Derive the equilibrium price and quantity in the case of no tariff-jumping FDI.
     - Quantifying the reduction of profit in the presence of Tariff-jumping FDI and in the absence of Tariff-jumping FDI.
     - Evaluating the analysis in Blonigen, Tomlin and Wilson (2004, CJE) by structural estimation
  2. Derive the equilibrium price and quantity in the absence of the safeguard.
     - Assess whether FDI firms benefitted from protection or not.
Simulation results: domestic firm’s profit

<table>
<thead>
<tr>
<th>Year</th>
<th>Period</th>
<th>Effect on domestic firm’s profit (i) w/o tariff-jumping FDI (mil. USD)</th>
<th>Effect on domestic firm’s profit (ii) w/ tariff-jumping FDI (mil. USD)</th>
<th>Rate of change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>May-Aug.</td>
<td>0.98</td>
<td>0.34</td>
<td>65.28</td>
</tr>
<tr>
<td>1983</td>
<td>Sep.-Dec.</td>
<td>0.11</td>
<td>0.04</td>
<td>64.17</td>
</tr>
<tr>
<td>1984</td>
<td>Jan.-Apr.</td>
<td>0.33</td>
<td>0.11</td>
<td>66.05</td>
</tr>
<tr>
<td>1984</td>
<td>May-Aug.</td>
<td>0.95</td>
<td>0.39</td>
<td>59.23</td>
</tr>
<tr>
<td>1984</td>
<td>Sep.-Dec.</td>
<td>0.05</td>
<td>0.02</td>
<td>58.29</td>
</tr>
<tr>
<td>1985</td>
<td>Jan.-Apr.</td>
<td>0.24</td>
<td>0.13</td>
<td>43.23</td>
</tr>
<tr>
<td>1985</td>
<td>May-Aug.</td>
<td>0.24</td>
<td>0.13</td>
<td>44.00</td>
</tr>
<tr>
<td>1985</td>
<td>Sep.-Dec.</td>
<td>0.03</td>
<td>0.01</td>
<td>47.29</td>
</tr>
<tr>
<td>1986</td>
<td>Jan.-Apr.</td>
<td>0.20</td>
<td>0.10</td>
<td>52.53</td>
</tr>
<tr>
<td>1986</td>
<td>May-Aug.</td>
<td>0.18</td>
<td>0.10</td>
<td>43.01</td>
</tr>
<tr>
<td>1986</td>
<td>Sep.-Dec.</td>
<td>0.05</td>
<td>0.02</td>
<td>51.04</td>
</tr>
<tr>
<td>1987</td>
<td>Jan.-Apr.</td>
<td>0.13</td>
<td>0.07</td>
<td>44.81</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>0.29</td>
<td>0.12</td>
<td>53.24</td>
</tr>
</tbody>
</table>

Tariff-jumping FDI reduces domestic firm’s benefit from protection by more than 50%. Cf. Blonigen, Tomlin and Wilson(2004, CJE)
## Simulation results: foreign firms’ profits

<table>
<thead>
<tr>
<th>Year</th>
<th>Period</th>
<th>U.S. firm</th>
<th>FDI firms</th>
<th>No-FDI firms</th>
<th>U.S. firm</th>
<th>FDI firms</th>
<th>No-FDI firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Harley</td>
<td>Honda</td>
<td>Kawasaki</td>
<td>Suzuki</td>
<td>Yamaha</td>
<td>Harley</td>
</tr>
<tr>
<td>1983</td>
<td>May-Aug.</td>
<td>8.34</td>
<td>47.26</td>
<td>9.49</td>
<td>9.54</td>
<td>13.16</td>
<td>7.70</td>
</tr>
<tr>
<td>1983</td>
<td>Sep.-Dec.</td>
<td>3.99</td>
<td>14.36</td>
<td>2.53</td>
<td>2.58</td>
<td>3.52</td>
<td>3.92</td>
</tr>
<tr>
<td>1984</td>
<td>Jan.-Apr.</td>
<td>5.66</td>
<td>27.22</td>
<td>4.46</td>
<td>4.71</td>
<td>8.10</td>
<td>5.44</td>
</tr>
<tr>
<td>1984</td>
<td>May-Aug.</td>
<td>9.94</td>
<td>40.27</td>
<td>8.57</td>
<td>6.94</td>
<td>14.87</td>
<td>9.37</td>
</tr>
<tr>
<td>1984</td>
<td>Sep.-Dec.</td>
<td>2.89</td>
<td>12.39</td>
<td>1.86</td>
<td>1.34</td>
<td>1.95</td>
<td>2.86</td>
</tr>
<tr>
<td>1985</td>
<td>May-Aug.</td>
<td>7.75</td>
<td>33.92</td>
<td>11.81</td>
<td>6.30</td>
<td>7.83</td>
<td>7.64</td>
</tr>
<tr>
<td>1985</td>
<td>Sep.-Dec.</td>
<td>4.42</td>
<td>7.56</td>
<td>2.82</td>
<td>1.17</td>
<td>1.37</td>
<td>4.40</td>
</tr>
<tr>
<td>1986</td>
<td>Jan.-Apr.</td>
<td>7.11</td>
<td>17.87</td>
<td>5.44</td>
<td>3.71</td>
<td>4.66</td>
<td>7.00</td>
</tr>
<tr>
<td>1986</td>
<td>Sep.-Dec.</td>
<td>4.11</td>
<td>6.37</td>
<td>2.45</td>
<td>2.17</td>
<td>2.24</td>
<td>4.09</td>
</tr>
</tbody>
</table>

FDI firms benefitted from the protection.
Summary of findings

Tariff jumping FDI decreased the domestic firm’s profits by about 50%.

- Consistent with the finding in Blonigen, Tomlin and Wilson (2004).

For some periods of protection, multinationals benefitted from protection because the safeguards eased the competition with other Japanese rivals or exporters.

- Supports the assumption made in “protection building trade” literature.
Antidumping duty

Different from standard ad valorem tariffs because of the institutional reasons surrounding administration of AD duties:

- Determination of dumping margin
  - Foreign and domestic price differences
  - Facts available
- ITC vs. DOC
- Administrative review
  - Refund policy

Recent research on the trade policies:
- Investigate the effect the different institutional structure about the implementation of trade policies among countries on the firms’ behavior.
Anticipatory effects in the presence of AD duty

- Refund through administrative review:
  - During administrative review periods, USDOC recalculates dumping margin based on the most recent exporters’ pricing.
  - Importers may be refunded their payment of AD duties if the revised rate of AD duties are lower than the rate previously determined.

- Importers’ anticipation
  - Importers determines the volume of imports accounting for the future refund of the AD duties.

- Exporters’ anticipation
  - Exporters have incentives to increase their price in order to raise the refund rate that contribute to increase demand for their products.
Export price movement

Export price (USD) vs. Tariff rate (%)

Average export price during SLA
Average export price during AD&CVD

Average tariff rate during SLA
Average tariff rate during AD&CVD

Export price movement graph
Purpose of research

- Reveal the role of the anticipatory effects: importers’ anticipation and exporters’ anticipation
  - Canadian Softwood lumber

- Demand analysis: importers’ anticipation
  - Discrete choice methods

- Pass-through analysis: exporters’ anticipation
  - Export price pass-through:
Contributions to the literature

- **Importers’ anticipation**
  - Blonigen and Park (2004, AER): Exporters’ anticipation
  - Blonigen and Haynes (2002, AER) treat the role of importers’ anticipation incorrectly.
    - Kelley (2010, AER), Blonigen and Haynes (2010, AER)

- **Unobserved demand shock**
  - Controlling for the unobserved demand shocks in the pass-through regression
  - Goolsbee and Petrin (2004, EMA)

- **Welfare analysis**
  - Gallaway et al. (1999, JIE): Welfare costs of ADD and CVD w/o exporters’ anticipation
Related Literature: price responses to trade policies

- **Reduced form**
  - Feenstra (1989, JIE): Car, compact trucks, and motorcycles in US
  - Knetter (1994, JIMF): German and Japanese exports

- **Structural form**
  - Berry, Levinsohn and Pakes (1999, AER): US automobile market, VER
  - Goldberg and Verboven (2001, RES): EU automobile market, relative and absolute quota
  - Irwin and Pavcnick (2004, JIE): Airbus vs. Boeing, subsidy
  - Friberg and Ganslandt (2006, JIE; 2007, JF), Swedish mineral water
  - Clerides (2008, JIE): Cyprus used car market, trade liberalization
  - Kitano (2011): US motorcycle safeguard
Timeline of events

SLA periods: tariff-rate-quota

AD and CVD investigation periods

CVD gap periods

AD gap periods

Coverage of 1st review

Coverage of 2nd review

Coverage of 3rd review

Coverage of 4th review

01.4: AD&CVD petition filed.

01.8: USDOC’s prelim. determination on CVD: Positive, Retroactive

01.11: USDOC’s prelim. determination on AD: Positive, Not Retroactive

01.12: 120 days passed after the prelim. determination on CVD: CVD gap started.

02.5.5: 180 days passed after the prelim. determination on AD: AD gap started.

02.5.22: USDOC’s final determinations on AD&CVD: Positive, Not Retroactive for both cases

03.4: AD1

04.4: AD2

05.4: AD3

06.4: AD4

06.10: New SLA started.
Model of AD duty

- Importers and Exporters
  - Exporters’ market: Monopolistic competition (Blonigen and Park(2004, AER))
    - Product differentiation is an important characteristic in the softwood lumber market.
    - An exporter $k$ sets its price $\bar{P}_{kq}$ at time $q$.
  - Importers’ market: Perfect competition
    - Importers pay AD duties.
    - Note: Blonigen and Haynes(forthcoming, AER), Kelly(forthcoming, AER)
    - Total volume of imports of product $k$ at time $q$ is $x_{kq}$
Model of AD duty: Importers’ anticipation

- Importers decide their volume of imports based on US market price:

\[ p_{kq} = \bar{p}_{kq} \left[ (1 + \tau) - r_q^I \right] \]

- Export price
- AD duty rate
- Expected rate of refund, assumed to depend on the past exporters’ pricing. *(Independent of current pricing.)*
Model of AD duty: Exporters’ anticipation

- Exporter $i$’s profit function:
\[
\pi_k = \bar{p}_{kq} \cdot x_{kq} (e\bar{p}_{kq}[1 + \tau] - r^I_q) - c(x_{kq}(e\bar{p}_{kq} \cdot [(1 + \tau) - r^I_q])) + v^E(\bar{p}_{kq})
\]

- Pricing equation:
\[
\bar{p}_{kq} = \left( \frac{\eta}{1 - \eta} \right) (c' + g(v^{E'})),
\]
\[ (+) \]
\[
g(v^{E'}) \equiv \frac{v^{E'}}{\partial x/\partial p}.
\]
Demand: Nested Logit Model

- Purchasing unit $i$’s utility from one unit of product $j$:

$$u_{ijt} = \delta_{jt} + \zeta_{ig(j)t}(\sigma) + (1 - \sigma)\epsilon_{ijt}$$

$$\delta_{jt} = -[\lambda + (d_j \times D_{tq})\lambda_q]e_t\tilde{p}_{jt} + D_j\pi + \xi_{jt}$$

- Prices: different coefficients across AD time periods
- Characteristics and other demand shifters (quarterly dummies)
- Product dummies

Mean valuation of product $j$ at time $t$

$$\frac{\lambda_{ADi}}{\lambda} = 1 + \tau - r_{qi}$$
Importers’ anticipation

- AD+CVD rate
- Estimated rate
- Adaptive expectation
- Perfect foresight

Expectations

- **Adaptive expectation:**
  - Importers adjust their expectations according to the revised rate released in the administrative reviews.

- **Perfect foresight:**
  - Importers can correctly anticipate the future refund rate.
  - Gallaway, Blonigen and Flynn (1999, JIE) and Blonigen and Haynes (2010, AER) implicitly assume the perfect foresight.
Exporters’ anticipation

\[ \ln(p_{i,t}) = \alpha \ln(\text{exchange rate}_t) + \beta \ln(1 + \text{tariff rate}) + \varepsilon_{i,t} \]

**Pass-through coefficient:**
Exchange rate pass-through, Pass-through of tariff

Table 4: Pass-through Estimates: export prices

<table>
<thead>
<tr>
<th></th>
<th>SLA</th>
<th>AD</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4-i)SL</td>
<td>Est.</td>
<td>-1.153</td>
<td>-0.759</td>
</tr>
<tr>
<td></td>
<td>S.E.</td>
<td>0.147</td>
<td>0.177</td>
</tr>
<tr>
<td>(4-ii)SL&amp;HL</td>
<td>Est.</td>
<td>-0.657</td>
<td>-0.535</td>
</tr>
<tr>
<td></td>
<td>S.E.</td>
<td>0.155</td>
<td>0.145</td>
</tr>
<tr>
<td>(4-iii)SL&amp;HL with (\xi)</td>
<td>Est.</td>
<td>-0.800</td>
<td>-0.462</td>
</tr>
<tr>
<td></td>
<td>S.E.</td>
<td>0.082</td>
<td>0.071</td>
</tr>
</tbody>
</table>
US market prices & welfare

Table 5: Pass-through estimates: US market prices

<table>
<thead>
<tr>
<th></th>
<th>SLA</th>
<th>AD</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5-i) All AD periods</td>
<td>Est. 0.200</td>
<td>0.206</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>S.E. 0.082</td>
<td>0.092</td>
<td>0.065</td>
</tr>
<tr>
<td>(5-ii) AD1 &amp; AD2</td>
<td>Est. 0.200</td>
<td>0.358</td>
<td>0.158 **</td>
</tr>
<tr>
<td></td>
<td>S.E. 0.082</td>
<td>0.087</td>
<td>0.078</td>
</tr>
<tr>
<td>(5-iii) AD3 &amp; AD4</td>
<td>Est. 0.200</td>
<td>0.064</td>
<td>-0.136</td>
</tr>
<tr>
<td></td>
<td>S.E. 0.082</td>
<td>0.093</td>
<td>0.080</td>
</tr>
</tbody>
</table>

• Differences in the effects on US market prices between standard tariffs and AD duties are small and not significant on average.
• However, the differences are different from period to period; in particular, AD duties increased US market prices more at early stages of the AD duties.
• AD duties are more costly measure if the discount factor is taken into account.
Summary of findings

This paper shows:

- Evidence of exporters’ anticipation: exporters increased their prices higher under AD duties in order to increase the refund rate.
- Evidence of importers’ anticipation: importers’ anticipation on the refund rate evolves in an adaptive fashion.
- Average pass-through of the AD duties on US market prices during the 4 AD duty periods are similar to that of the standard tariffs.
Chapter 6: Study on telecommunications policy

Taiju Kitano
Background of this study

- Mobile number portability (MNP) was introduced in Japanese mobile telecommunications market in October 2006.
  - MNP: mobile users can retain their numbers when changing from one mobile carrier to another.
  - Expected to increase customers’ mobility among mobile carriers.

- As a result of the MNP introduction, the Japanese mobile telecommunications market experienced drastic change:
  - the largest carrier, **NTT DoCoMo**, decreased the number of its subscribers from 52143700 to 52126200 for the first time in its history.
  - docomo decreased the share from 55 to 53%, while the following two carriers, **au** and **Softbank**, increased its share from 29 to 30% and from 16 to 17%, one year after the introduction.
Purpose of this paper

- Quantifying the effects of MNP on switching costs in the Japanese mobile telecommunications

- Two-stage nested logit model
  - 1st stage: carrier choice, 2nd stage: MNP usage choice
  - Choice-based sampling
Related literature

- **Switching costs**

- **Consumer behavior**
  - **Revealed preference**
    - Chen and Hitt (2002, ISR): Online brokerage
    - Shum (2004, JEMS): Cereal
    - Goldferb (2006, JEMS): Internet portal
      - Uses only aggregate data
  - **Stated preference**
    - Lee et al. (2006, IJIO): MNP in Korean mobile telecommunications

- **Firm behavior**
  - Shy (2002, IJIO), Kim et al. (2003, JFI),…
Data

- Web questionnaire
  - Past & current carrier choice
  - Billing information: minutes of calls and volume of packet usage.
  - Individual characteristics: current status (e.g. student, etc), monthly allowance, …

- Data used in this study is obtained from choice-based-sampling procedure because only a fraction of consumers switched their carriers after the MNP introduction.
  - Fraction of switched customer in this sample: 34%
  - Should be larger than actual.
Model

- $i_h$’s utility function, $(j, MNP_{ij}), h$: past carrier

\[ U_{i,j,MNP_{ij}} = (\alpha_0 + x_i^P \alpha_1) \cdot p_{ij} + [\beta_0 + x_i^S \beta_1 + (\gamma_0 + x_i^M \gamma_1) \cdot MNP_{ij}] \cdot SWITCH_{ij} + x_{ij} \delta + \epsilon_{i,j,MNP_{ij}}(\lambda) \]

\[ = V_{ij}(\theta) + V_{i,j,MNP_{ij}}(\gamma) + \epsilon_{i,j,MNP_{ij}}(\lambda) \]

- Consumer characteristics
- Consumer characteristics * Carrier dummy

\[ V_{ij}(\theta) \equiv (\alpha_0 + x_i^P \alpha_1) \cdot p_{ij} + (\beta_0 + x_i^S \beta_1) \cdot SWITCH_{ij} + x_{ij} \delta \]

\[ V_{i,j,MNP_{ij}}(\gamma) \equiv [(\gamma_0 + x_i^M \gamma_1) \cdot MNP_{ij}] \cdot SWITCH_{ij}. \]
Estimation

- Weighted Exogenous Sampling Maximum Likelihood

\[ WLL(\theta, \gamma, \lambda) = \sum_{h} \sum_{i \in N_h} \left[ w_{ih} y_{ih} \ln P_{ih} + \sum_{j \neq h} \sum_{MNP_{ij} \in \{0,1\}} w_{ij} y_{i,j,MNP_{ij}} \ln P_{i,j,MNP_{ij}} \right] \]

- Choice of the weight:
  - 6 months after the MNP introduction, 2% of subscribers switched their carriers.
  - Timing of choice: once 2 years
    - Subscribers purchase new mobile handsets every two years on average.
    - Those who switched carriers should be concentrated on soon after the MNP introduction
  - Our choices of weight are 8%, 6%

\[ w_{ij} = \begin{cases} \frac{1 - Q_S}{1 - H_S} & \text{if } j = h, \\ \frac{Q_S}{H_S} & \text{otherwise} \end{cases} \]
Findings in the estimation results

First stage:
- *Charge* is negative and significant.
- *SWITCH* is negative and significant.
- Docomo’s game function is superior to others.
- au’s music function is superior to others.
  - Consistent with discussion in Ishikawa(2006)

Second stage:
- $\lambda$ is between 0 and 1, but not significantly different from 0 and 1 at 95% confidence level for both 8% and 6%.
Effects of MNP on switching costs

- Calculation of switching costs
  - Switching cost without MNP:
    \[ s_{1f} = \frac{1}{\alpha_t} \left( \beta_0 + x^S_t \beta \right) \]
  - Effects of MNP on switching costs
    \[ s_{1f}^{MNP} - s_{1f} = \frac{1}{\alpha_t} \left[ \lambda \ln \left( 1 + \exp(\gamma_0 + x^M_t \gamma_1) / \lambda \right) \right] \]

Inclusive value w.r.t. the second stage

<table>
<thead>
<tr>
<th></th>
<th>(i) WESML(8%)</th>
<th>(i) WESML(6%)</th>
<th>(iii) ML(no weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>2057</td>
<td>2328</td>
<td>1145</td>
</tr>
<tr>
<td>S.E.</td>
<td>487</td>
<td>681</td>
<td>206</td>
</tr>
<tr>
<td>Switching cost (yen)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect of MNP (yen)</td>
<td>311</td>
<td>350</td>
<td>218</td>
</tr>
<tr>
<td>Rate of change (%)</td>
<td>17.8</td>
<td>17.7</td>
<td>23.5</td>
</tr>
</tbody>
</table>

Large standard error because of the large standard error of \( \lambda \)
Effects of MNP on consumer welfare

- Consumer welfare (Small and Rosen (1981)):

\[
\Delta E(CS_t) = \frac{1}{\alpha_t} \left[ \ln \left( \exp(V_{th}(\theta)) + \sum_{l \neq h} \exp(V_{tl}(\theta) + \lambda I_{tl}(\gamma, \lambda)) \right) - \ln \left( \sum_j \exp(V_{tj}(\theta)) \right) \right]
\]

<table>
<thead>
<tr>
<th></th>
<th>WESML (8%)</th>
<th></th>
<th>WESML (6%)</th>
<th></th>
<th>ML (no weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>35</td>
<td>S.E.</td>
<td>25</td>
<td>S.E.</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
</tr>
</tbody>
</table>

Large standard error because of the large standard error of \( \lambda \)
Switching probabilities

- Three types of consumers
  - Never switch (86.98 – 91.44%)
  - Switch only in the presence of MNP (2.42 – 2.77%)
  - Switch regardless of the presence of MNP (6.14 – 10.25%)

Table 7: Effects of MNP on switching probability

<table>
<thead>
<tr>
<th></th>
<th>(i) WESML (8%)</th>
<th>(ii) WESML (6%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>With MNP</td>
<td>13.02</td>
<td>8.56</td>
</tr>
<tr>
<td>Without MNP</td>
<td>10.25</td>
<td>6.14</td>
</tr>
<tr>
<td>Difference</td>
<td>2.77</td>
<td>2.42</td>
</tr>
</tbody>
</table>
Summary of this study

- Effects of MNP
  - MNP decreased switching costs by 18% on average.
  - MNP increased consumer welfare by 25-35 yen.
  - MNP increased switching probabilities by 2.44-2.77%.

- Future research
  - Efficient estimator by Imbens(1992)
  - Effects on competitiveness before and after the MNP introduction
    - Cf.Viard(2008, RAND)
  - Multiple choice
  - Dynamics of consumer switching