Analysis of Japanese Loyalty Programs Considering Liquidity, Security Efforts, and Actual Security Levels

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Outline

- **Introduction**
  - **Loyalty Programs**
  - **Security Incidents**
- Japanese Loyalty Programs
- Security-Liquidity Implications
- Conclusion

Loyalty Program (LP)

- Marketing activity that **encourages customers' loyalty behaviors by rewarding them**.
  - The rewards usually take the form of ***Reward currency*** or *Point*.
  - Locates ***between online games and Bitcoin***.

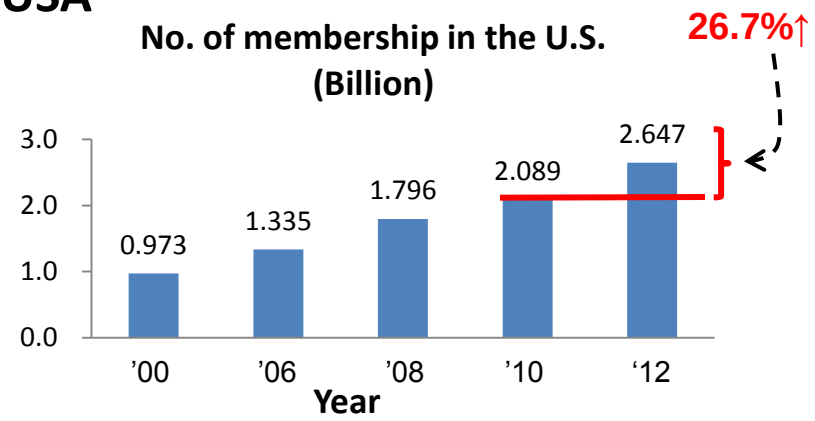
- Liquidity of reward currencies is increased when LP operators cooperate with their business partners.
  - Allow their customer to exchange points between different LPs.

etc.

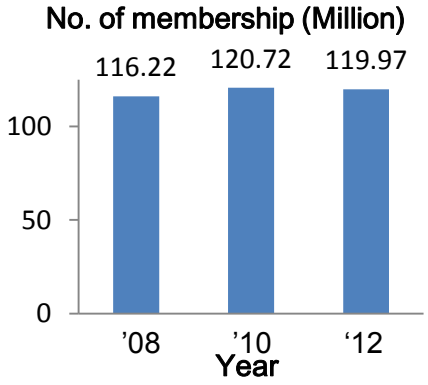
The Trend of Loyalty Program

North America

USA

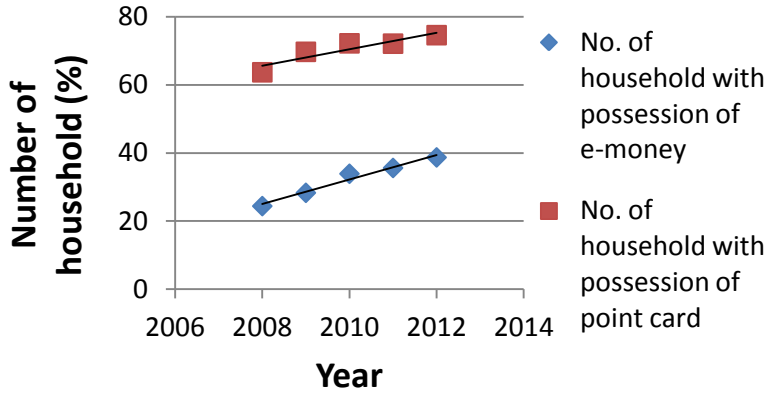


Canada



Slightly decrease due to demographic factors.

Japan ← has more than 200 LPs



Europe ← Newbie to LP

- 80% of European customers belong to at least one LP.
- One-third of customers are likely join two or more LPs.
- (In GB) 95% of UK customers join at least one LP.

Security Incidents and Concerns

North America

USA

- Announcement about phishing and security incidents related frequent flyer program (FFP) on alert sites from
  - U.S. airways
  - Delta airlines

Canada

- Scamming case in which the suspects used fraudulent credit cards.
- This scam included illegal redemption of the credit card point for gift cards.

Japan

- Unauthorized access and illegal redemption at many LPs such as
  - G-Point
  - T Point
  - Rakuten point
  - JAL

Europe

- Malicious expense of Tesco's gift voucher .
- Announcement about phishing and security incident related to FFP from British airways.

Objective

- **Investigate Japanese LP systems** with focuses on their
  - Liquidity
  - Operating firms' security efforts
  - LP systems' actual security levels

- Consider a model to derive **security-liquidity implications**
  - Linear regression analysis

Outline

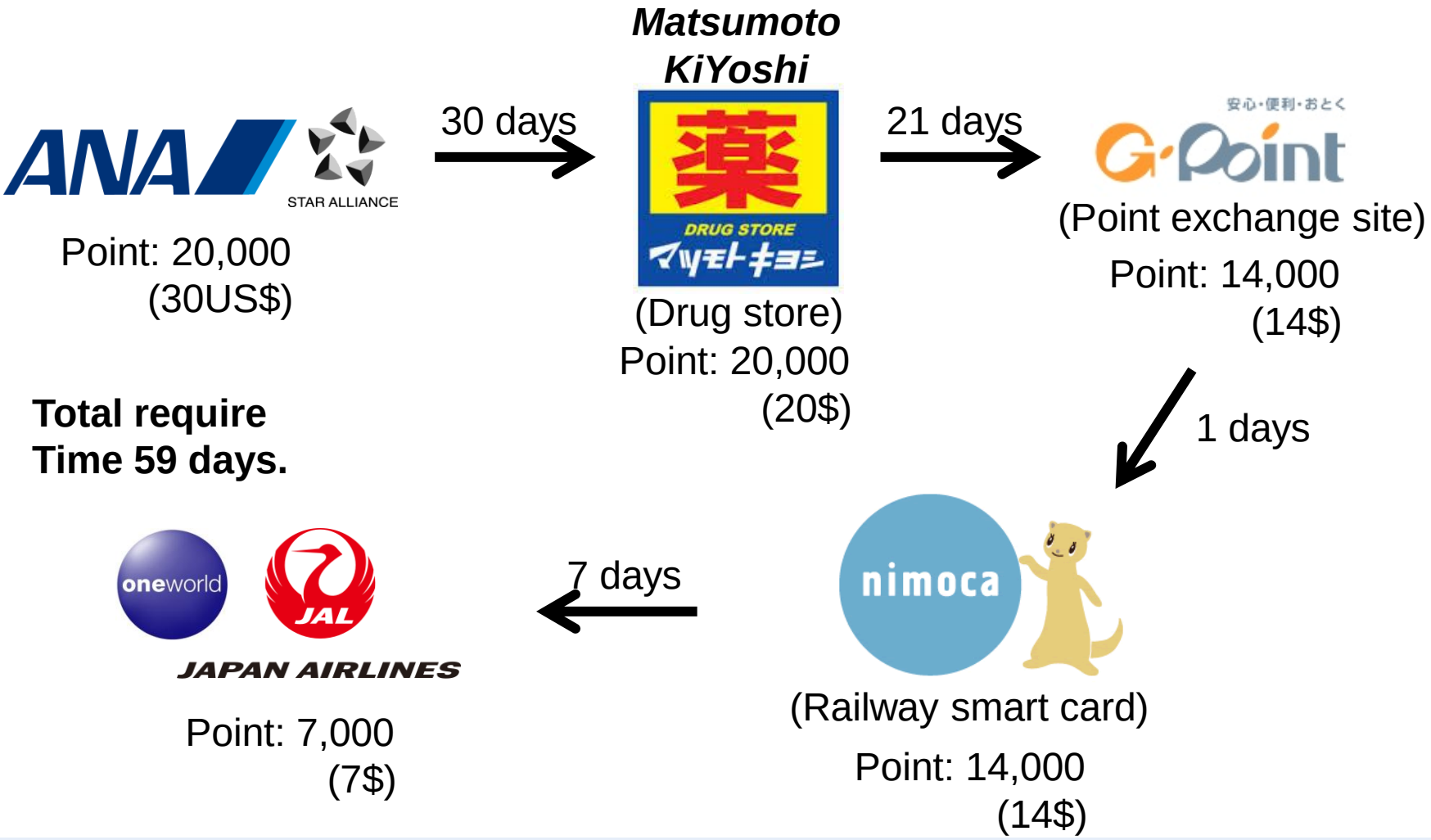
- Introduction
- **Japanese Loyalty Programs and Their Network**
  - **The Network of Japanese LPs**
  - **Liquidity of the Japanese LPs**
  - **Security-related Data of LP Operating Firms**
- Security-Liquidity Implications
- Conclusion

Japanese LP systems

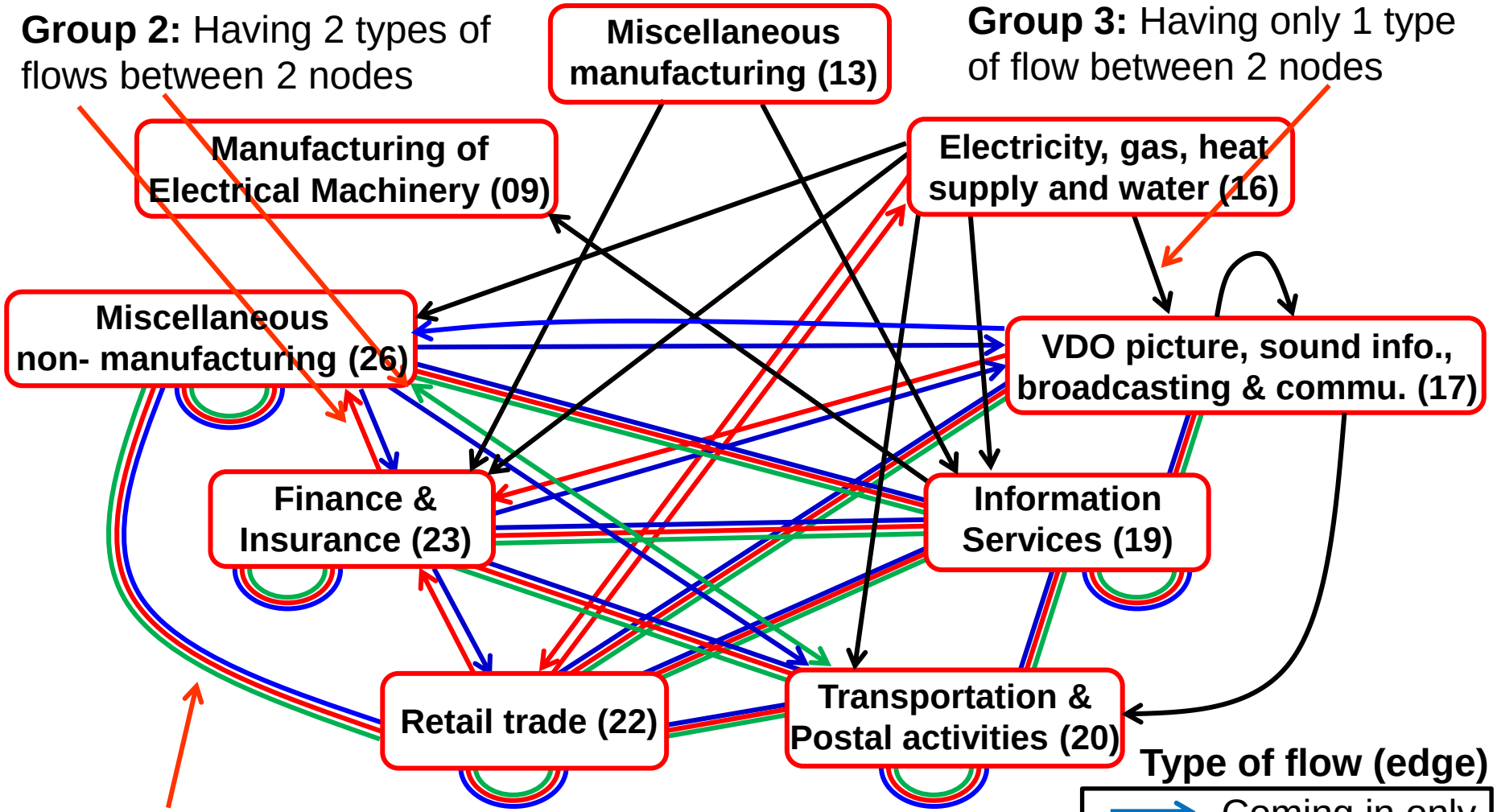
- Refer to point exploration website, “poitan.net”
  - **Information of existing LPs** in Japan
  - **Estimated real-currency values** of LP Points
  - **Exchange/conversion rates** between systems
  - Query of **possible routes**
  - **Required duration** for exchange process
- More than 200 LPs are operated by Japanese operators
  - **From 9 industries** (refers to METI’s list of industries)
  - Industries with **high interaction with customers**

METI : Ministry of Economy, Trade and Industry

Example of Query at Poitan.net



Japanese LP Network
The Connections between Industries



Liquidity of the LPs

Ability that customer can exchange their points between different loyalty programs.

- To calculate **Liquidity score**, we consider
  - No. of corresponding type of edge (x)
  - Average no. of partners (y)
  - Then separate the score into 4 levels
    - $0 \leq xy \leq 15$: Low (L)
    - $15 < xy \leq 23$: Medium-Low (ML)
    - $23 < xy \leq 30$: Medium-High (MH)
    - $30 < xy$: High (H)

Liquidity and Security in Industry Level

Would high liquidity imply…

larger security effort?

larger damages from security incidents at the LP?

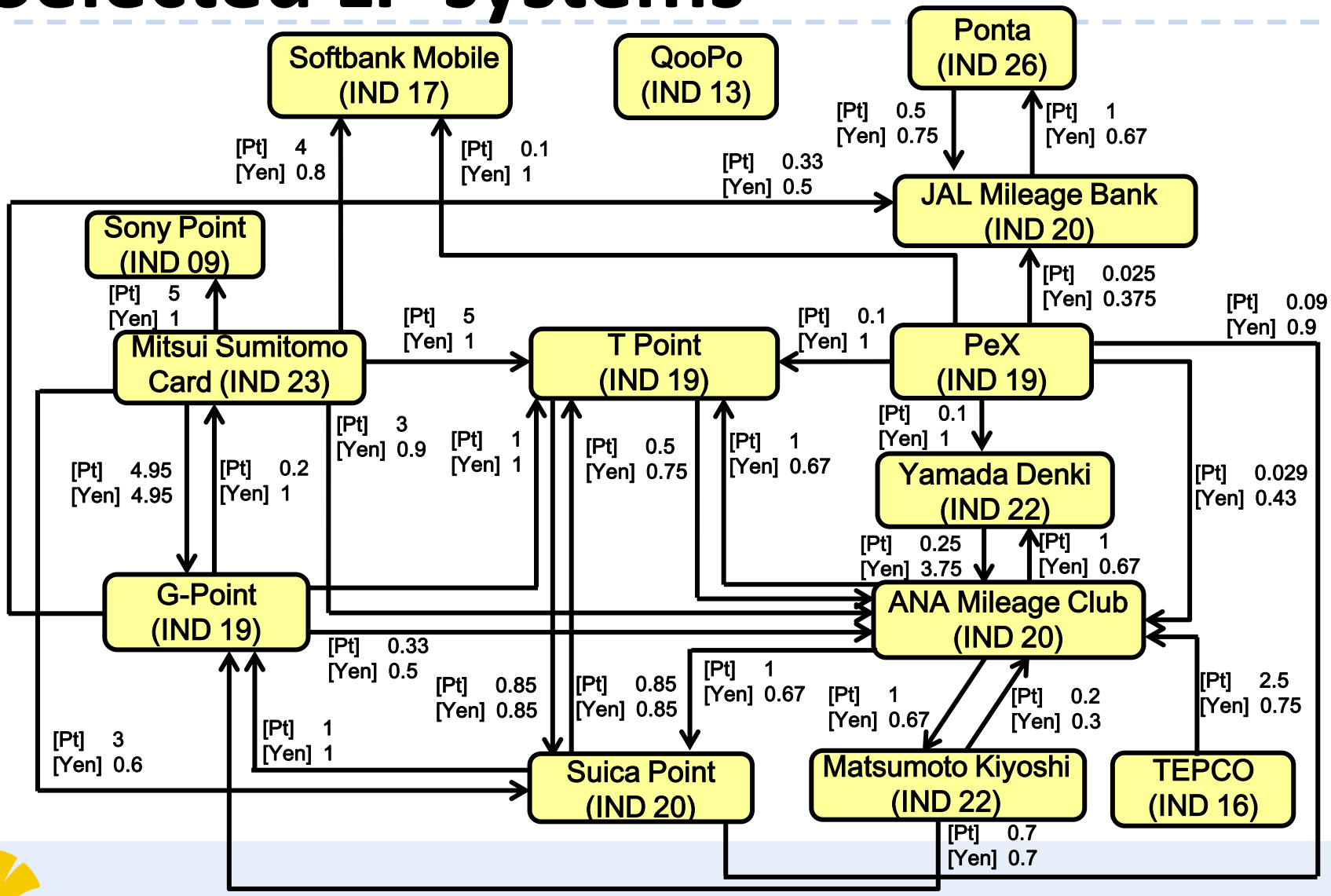
better actual security level at their system?

Liquidity and Security-related Data

Industry (ID)	Liquidity of LPs	Average size of damage from security incidents	Average size of expense on countermeasure
Manufacturing of electrical machinery (09)	L	12,740$ (0.04%)	70,970$ (0.20%)
Miscellaneous manufacturing (13)	L	4,696$ (0.03%)	74,118$ (0.45%)
Electricity, gas, heat supply, and water (16)	L	2,450$ (0.01%)	112,006$ (0.26%)
VDO picture, sound information, broadcasting & communication (17)	H	2,940$ (0.02%)	70,155$ (0.51%)
Information services (19)	MH	47,367$ (0.43%)	151,341$ (1.38%)
Transportation & postal activities (20)	H	7,525$ (0.05%)	47,753$ (0.31%)
Retail trade (22)	ML	8,003$ (0.05%)	40,286$ (0.26%)
Financial & insurance (23)	MH	12,658$ (0.02%)	235,716$ (0.32%)
Miscellaneous non-manufacturing (26)	ML	2,975$ (0.03%)	60,422$ (0.62%)

% in () is percentage of the average size to average capital size.
Data of 2012 by Ministry of Economy, Trade and Industry (METI).

Selected LP systems



Actual Security of the Selected LPs

Registration

- Generally require basic personal information
- Only LPs from industry 09 (*MH*) and 19 (*L*) implement *CAPTCHA*.

Authentication

- *Similar requirements*: username & password

Back-up Authentication

- Found *no established* heuristic back-up authentication.

The answer…

Would high liquidity imply…

larger security effort?

larger damages from security incidents at the LP?

better actual security level at their system?

If we want to answer such questions,
we **need a rigorous analysis** rather than
a simple observation.

Outline

- Introduction
- Japanese Loyalty Programs
- **Security-Liquidity Implications**
  - **Linear Regression Analysis**
  - **The Results and Implications**
- Conclusion

Data for the Analysis

- **METI data**
  - Average size of **expense** on security countermeasures
  - Average size of **damage** from security incidents
- **Poitan.net**
  - **Rank of Japanese LPs** (April 2014)
  - **Number of partners** belongs to each LP
  - Exchangeable **type of flow** (belongs to each LP)
- Official site of **82 Japanese LPs**
  - Investigate **security-related requirements in 3 processes**
    - Registration
    - Authentication (Login)
    - Back-up authentication (Password recovery)

Proxy Variables

Impact from security incidents

Liquidity

Security score

Impact from incidents ($impact_i$)

$$impact_i = damage_{INDi} * rank_i$$

where

i	the index of each selected LP (i = 1,2,…,82)
IND_i	the industry ID of the industry LP_i belongs to
$damage_{INDi}$	the average amount of damage from incidents in industry IND_i
$rank_i$	the ranking score of LP_i

- Since illegal exchanges originate from compromised LP accounts, we focus on the “Origin LP” ranking.
- ***Origin LP*** is the LP which acts as source node where points are exchanged to its partner system.

Liquidity ($liquidity_i$)

$$liquidity_i = xy$$

where

x the edge types between LP_i and 9 industries where only the 82 selected LPs are considered

y number of exchange partners of LP_i

Security score ($secscore_i$)

$$secscore_i = \frac{\text{\# of satisfied requirements in } LP_i}{\text{\# of requirements about which we can obtain data regarding } LP_i}$$

- Focus on the important requirements in 3 processes:
  - Registration
  - Authentication (login)
  - Back-up authentication (password recovery)
- Use normalized value of the security score by using above equation.

Security score (Data collection)

	Registration			Login	Back-up authentication	
	Trusted information	Physical card or account	Implementation of security techniques	Data which increases difficulty	Trusted information	Physical card or account
LP_1	1	1	1	0	1	1
LP_2	0	1	n/a	0	0	1
LP_3	0	0	0	0	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮
LP_n	0	1	0	n/a	n/a	n/a

Note: n/a means that data is unavailable.
1 indicates that the corresponding requirement is satisfied.
0 indicates that the corresponding requirement is not satisfied.
Trusted info : certified information, security code, etc.
Data which increase difficulty : mobile number, system generated ID, etc.

- Example of the calculation of security score

LP_1 → secscore1 = 5/6 = 0.83

LP_2 → secscore2 = 2/5 = 0.40

Hypotheses

Hypothesis 1

The **impact** from security incidents on an **origin LP** would be **reduced if the LP operator implements stronger security requirements** in registration, authentication (login), and back-up authentication processes.

Hypothesis 2

The **impact** from security incidents on an **origin LP** would be **increased if the LP has higher liquidity**.

Linear regression model

$$impact_i = \beta_0 + \beta_1 expense_i + \beta_2 liquidity_i + \beta_3 secscore_i$$

$impact_i$	impact from security incidents
$expense_i$	average size of expense on countermeasures in the industry LP_i belongs to. (industry-wise value)
$liquidity_i$	LP-wise liquidity score
$secscore_i$	security score of the LP_i

Very low correlation coefficients among explanatory variables

The Result

- *secscore* with "-" sign
  - **Satisfying more security requirements would reduce the impact** from security incidents
  - Support our Hypothesis 1.
- *liquidity* with "+" sign
  - **Higher liquidity would increase the impact** from security incidents.
  - *p*-value is extremely low.
  - Support our Hypothesis 2.

Variable	Coef.	*p*-value
Intercept	4311.9120	0.6401
expense	0.1938	0.0027***
liquidity	643.6897	$3.49e^{-09}$***
secscore	-30138.18	0.0115**

p-value tells significance of the data.
** indicates significance at 5% level
*** indicates significance at 1% level

Explanatory variables are significant.

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Conclusion

- *Liquidity* is an important factor when we investigate implications regarding security efforts.

- More *security efforts* particularly to *satisfy strong security-related requirements* in the LP system is recommended to LP operators.

Thank you for your attention

Questions?