Utility Analysis of API Economy Based on Multi-Sided Platform Markets Model

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API (Application Programming Interface) Economy

- API economy: service collaborations through APIs
  - Enables information processing and data provision
  - Expected to increase market value

Developers/consumers connect to the economy
- Developers supply services via APIs
- Consumers consume services via APIs

A Strategy for the platform provider
- Attract API evaluator = API evaluation revitalization the market
- Change the number of functions = activate API development

Market revitalization by incorporating API Evaluator (existence that evaluates API)

A Multi-sided Market Model

A market model with multiple customer groups
- The customer groups interact to increase the value of their products
- Customer groups: Classify from the method of using the platform
- E.g. developers, consumers, and API evaluators

Can analyze the interaction between customer groups

Our Market Model

A Beneficial effect from evaluators
- A Beneficial effect from evaluation

Cash flow
- Interactions between customer groups

Purpose and Approach

- Measure the impact of API evaluators
- Optimal strategy of the platform provider to maximize the utility

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Platforms

Platform provider
- B_a
- B_c
- B_d
- B_e
- B_f

Cash flow
- Interactions between customer groups
Platform provider perspective

- Provide a platform
  - Platform providers optimize the number of functions on their platforms
  - Developers use the functions to develop APIs
- Reward API evaluators to enter the market
  - Increasing revenue due to the increased number of developers and consumers

Interaction from Developer and Consumer

- Interaction
  - Increase in consumers affects increase in developers
  - Increase in developers = Improving service quality
  - Improving service quality affects increasing consumers

Interaction from API Evaluator

- Rewarded by the platform provider
  - Consumer: API evaluations motivate to use API
  - Developer: API evaluations motivate API provision

Utility

- Platform provider
  \[ U_p = \beta_1 y_p + \beta_2 y_t - \gamma_1 C_p - C(p) \] (1)
- Developer
  \[ U_d = \gamma_2 y_d + \beta_2 y_t - \gamma_1 C_d - (C(p) + c_p) \] (2)
- Consumer
  \[ U_c = \gamma_3 y_c + \gamma_4 y_t - \gamma_1 C_c \] (3)

Utility calculation:
- Marginal value that is associated with a developer
  - Marginal value that is associated with evaluators
  - Marginal value that is associated with consumers
- Heterogeneity of or utility that consumers get from developers
- Heterogeneity of development cost by developer's skill level
- Interaction
  - Developing service quality affects increasing consumers
  - Increasing consumers affects increase in developers

Numerical Examples

- Analysis of the benefits from API evaluator
  - Analysis by changing rewards for API evaluator \( y_c \)

Parameter settings:
- Marginal value that is associated with evaluator \( y_c \)
  - \( x = -0.4, r = 0.8 \)
  - The number of evaluations increases by rewards from the platform provider: \( E(x) = C(x) \)
  - \( c = 0.8, r = 1.0, 1.8, 2.5 \)
  - Platform cost \( C(p) \) and development cost \( C_d \)
  - \( K(x) \): The more functions the platform provider implements, the larger cost
  - \( K(x) \): The more functions the developer can use, the lower cost

Effect of \( y_c \) on Platform Utility

- When \( y_c \) is high, maximum platform utility is high
  - The reward for taking the maximum utility increases
  - Platform provider strategy: Give higher rewards in market when \( y_c \) is high
Effect of $E(y_e)$ on Platform Utility

- The platform utility increases significantly when the number of evaluators increases linearly with reward.
- However, the platform utility is sensitive to $y_e$.
- Platform provider strategy: Be careful not to make the reward too high when evaluators increase linearly.

![Graph showing the effect of $E(y_e)$ on platform utility](image1)

Compare with Utility by Changing Function

- The platform utility takes the maximum value $U_p = 0.0194$ (12% up) when the number of functions $F = 1.98$.
- Better to optimize the reward for API evaluators.
- Utility increases by up to 2.3% when changing the reward for API evaluators.

![Graph showing utility comparison](image2)

Summary and Future Work

- Summary
  - API Economy: service collaborations through APIs.
  - Make a multi-sided market model that consists of the platform provider, developers, consumers, and API evaluators.
  - Reveal the impact of API evaluators on the platform utility.
  - Analyze simulation results.
  - Give higher rewards in market when $y_e$ is high.
  - Be careful not to make the reward too high when evaluators increase linearly.
  - Better to optimize the reward for API evaluators than changing the number of functions.

- Future work
  - Consider the effect to market from another customer group other than API evaluator.
  - E.g., agency, mobile operator and so on.

![Graph showing utility of platformer](image3)