Diffusion Process and Take-off Conditions of the Online Platform

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Outline

1. Motivation
2. The Model
3. The Data
4. Conclusion

Motivation - Introduction

Online Platforms

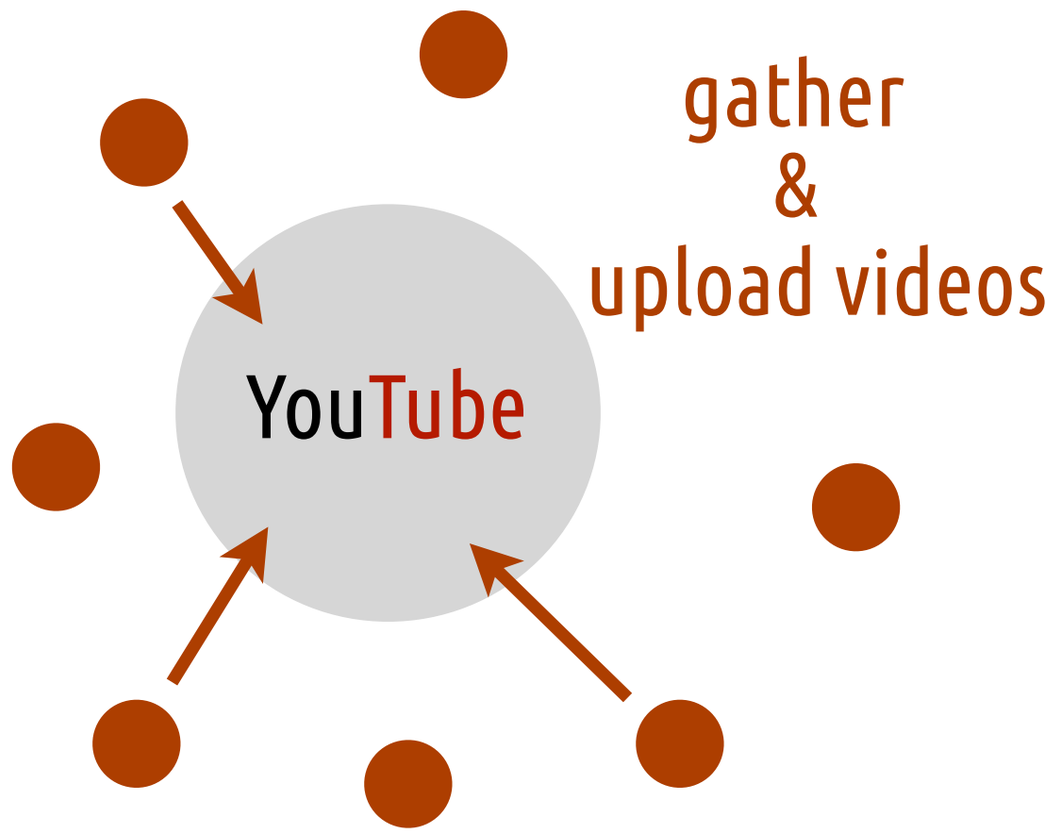
Place where people gather and share their contents in the Internet

Wikipedia

YouTube

Twitter

Facebook



This paper studies diffusion process of online platforms

Motivation - Related Literature : Diffusion Theory

Rogers (1962) : Sociology

Bass (1969) : Marketing

Ellison and Fudenberg (1995) : Word-of-mouth social learning

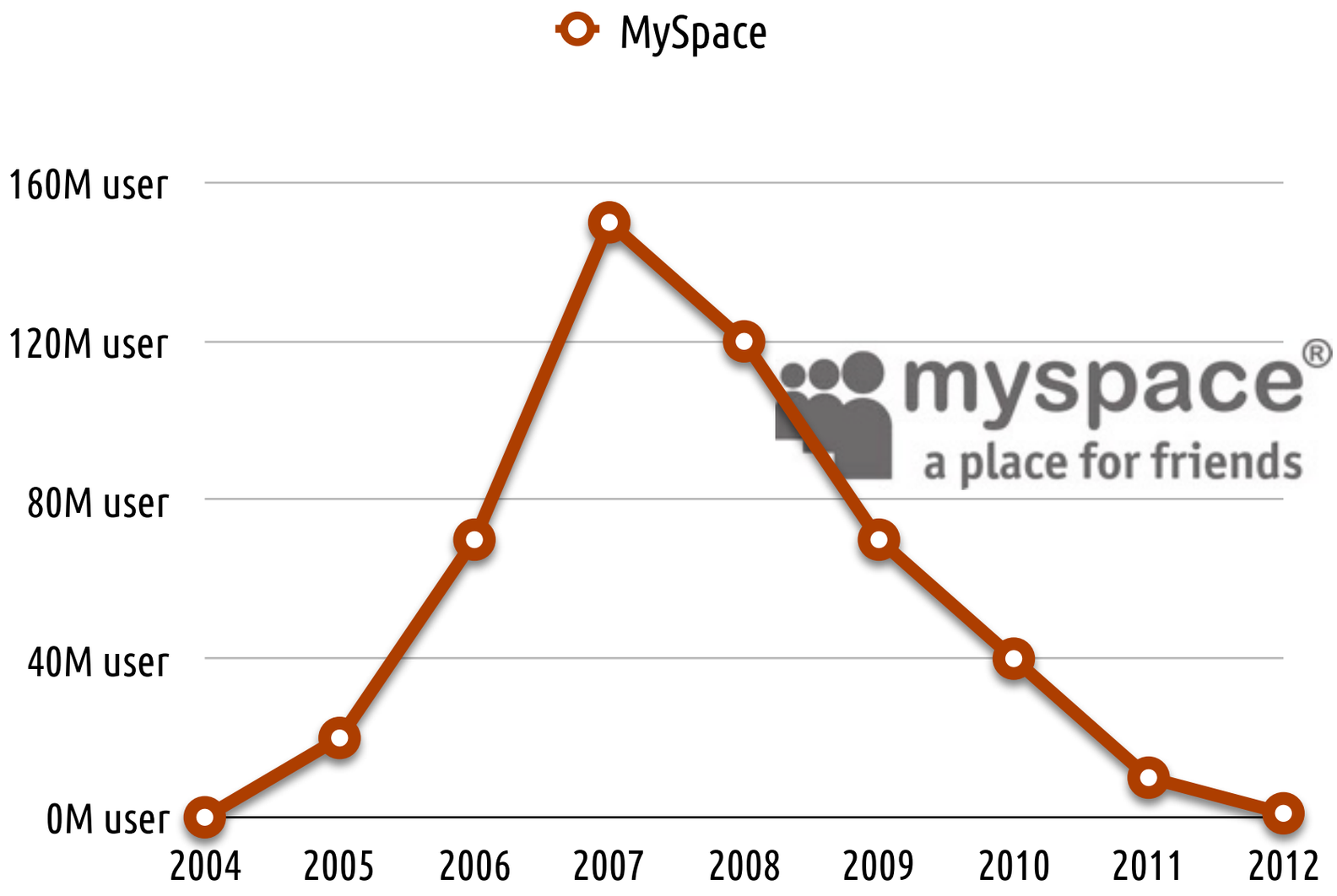
Morris (2000) : Contagion thresholds in networks

Young (2009) : Contagion, social influence, and social learning

Anthey and Ellison (2012) : Diffusion dynamics of open source software

Motivation - Limitation of the Existing Model

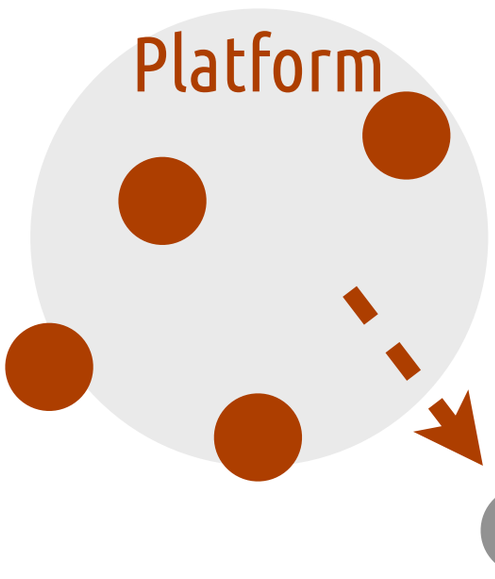
e.g.) MySpace - SNS (Social Networking Service) since 2003



Existing models cannot explain failure to take-off

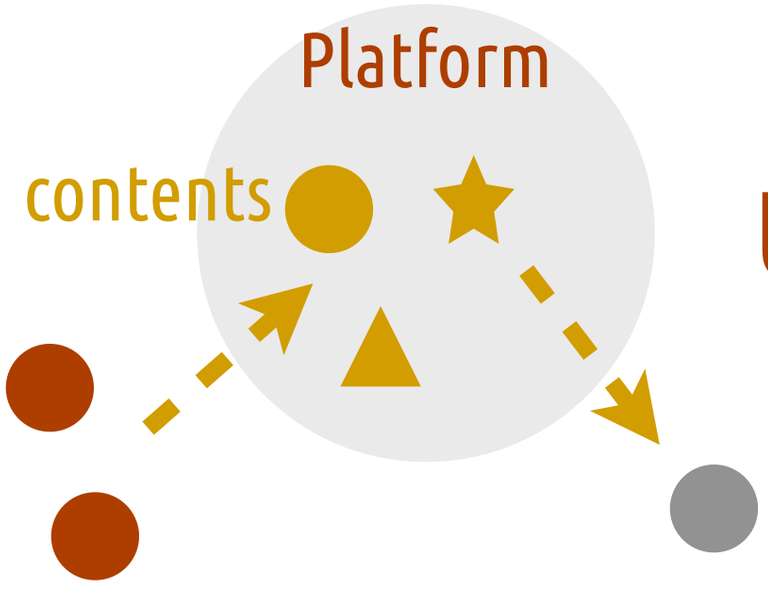
Motivation - Hypothesis

Young[9]s network externality



User ↑ ⇒ User ↑

Hypothesis : Another network externality



User ↑ ⇒ Contents ↑ ⇒ User ↑

Motivation - Main Results

1. If there exists another type of network externality, failed to launch occur.

Explain the phenomenon such as failure of MySpace and success of Facebook

2. Whether take-off or not depends on three factors.

Initial condition of quality, content per capita, and rate of decline

3. Simulation of the model can explain the real data

Can explain dynamics of active users and contents of platforms

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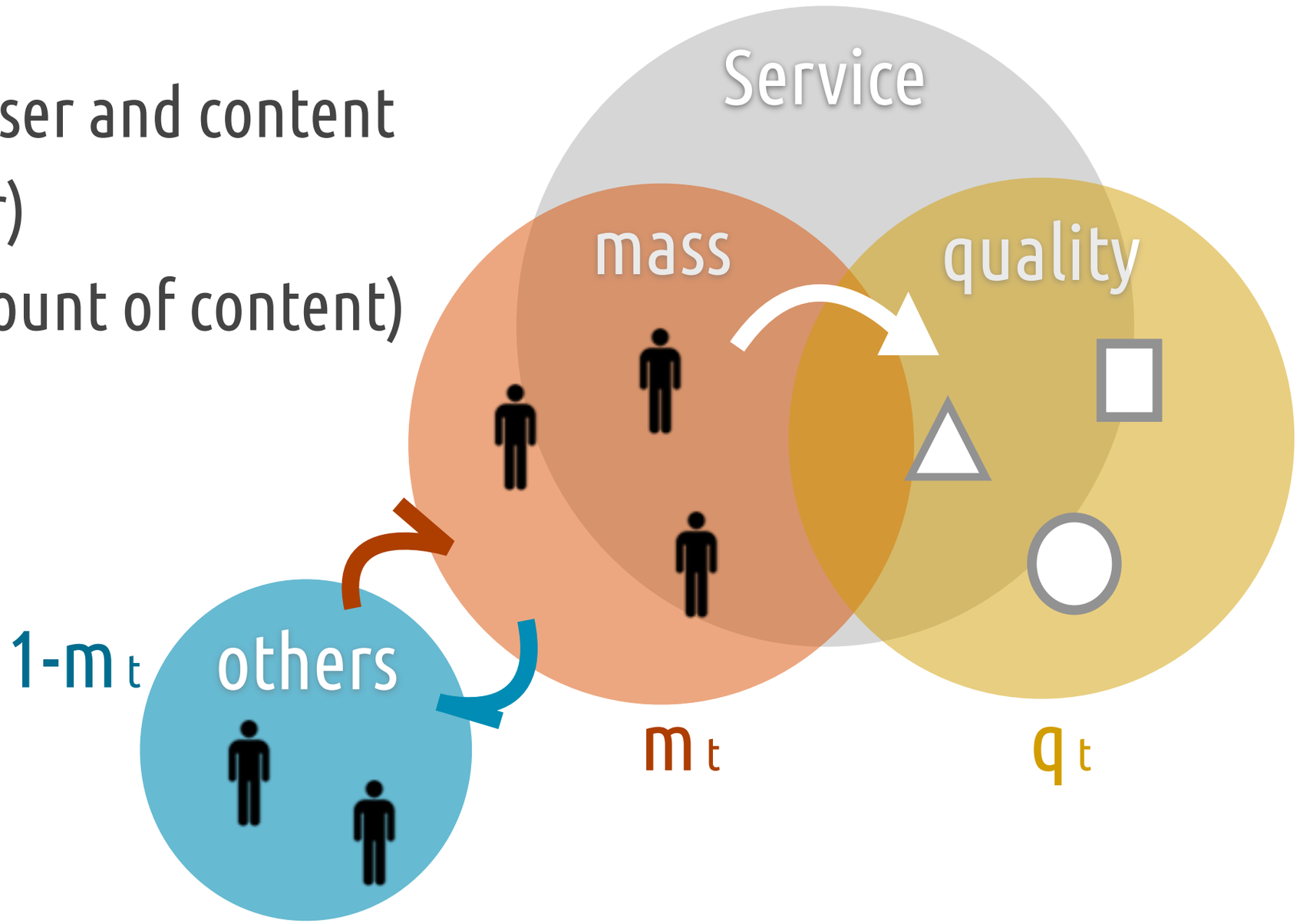
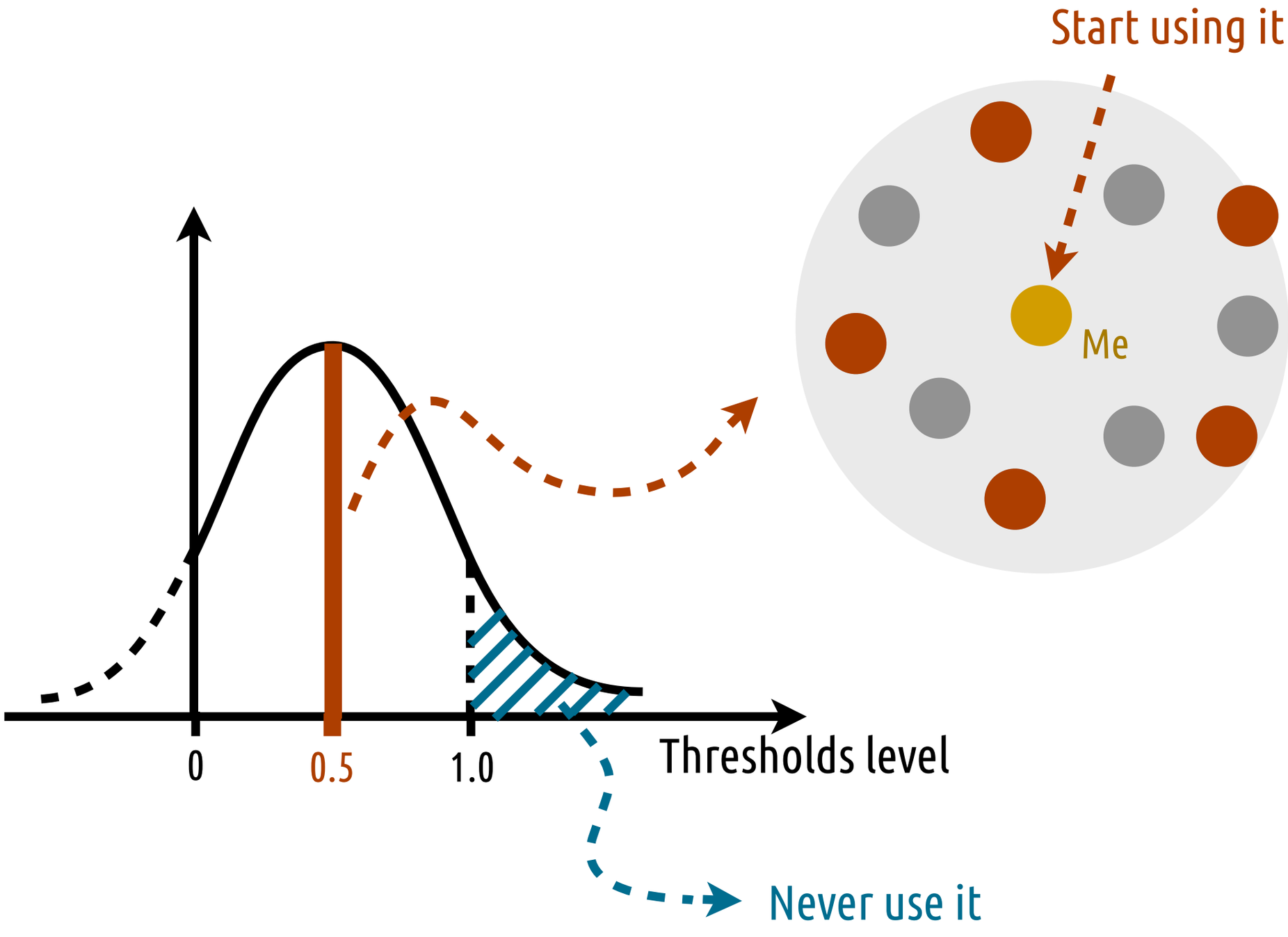
The Model - Model Settings

- A service has active user and content
- m_t : mass (active user)
- q_t : quality (total amount of content)

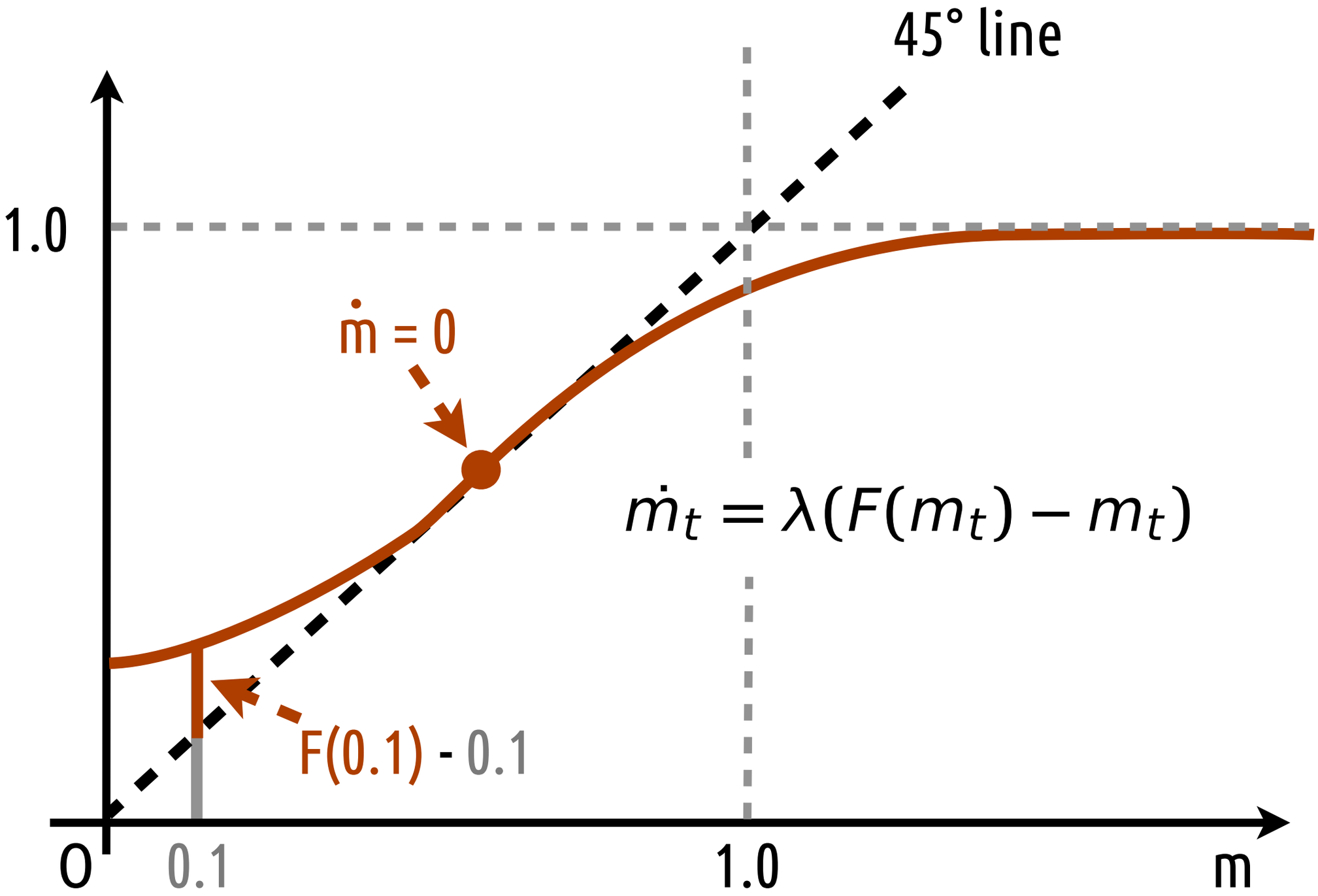
$$m_t \in [0, 1]$$



The Model - Thresholds



The Model - Mass



The Model - Quality

1. Quality depends on uploaded contents

e.g.) The quality of YouTube depends on videos uploaded by users

2. Quality diminish over time

e.g.) If nobody uploaded videos, the reputation of YouTube would decrease

3. Quality affects users' thresholds distribution

e.g.) The more YouTube has videos, the more users try to use it

The Model - Dynamics of Mass and Quality

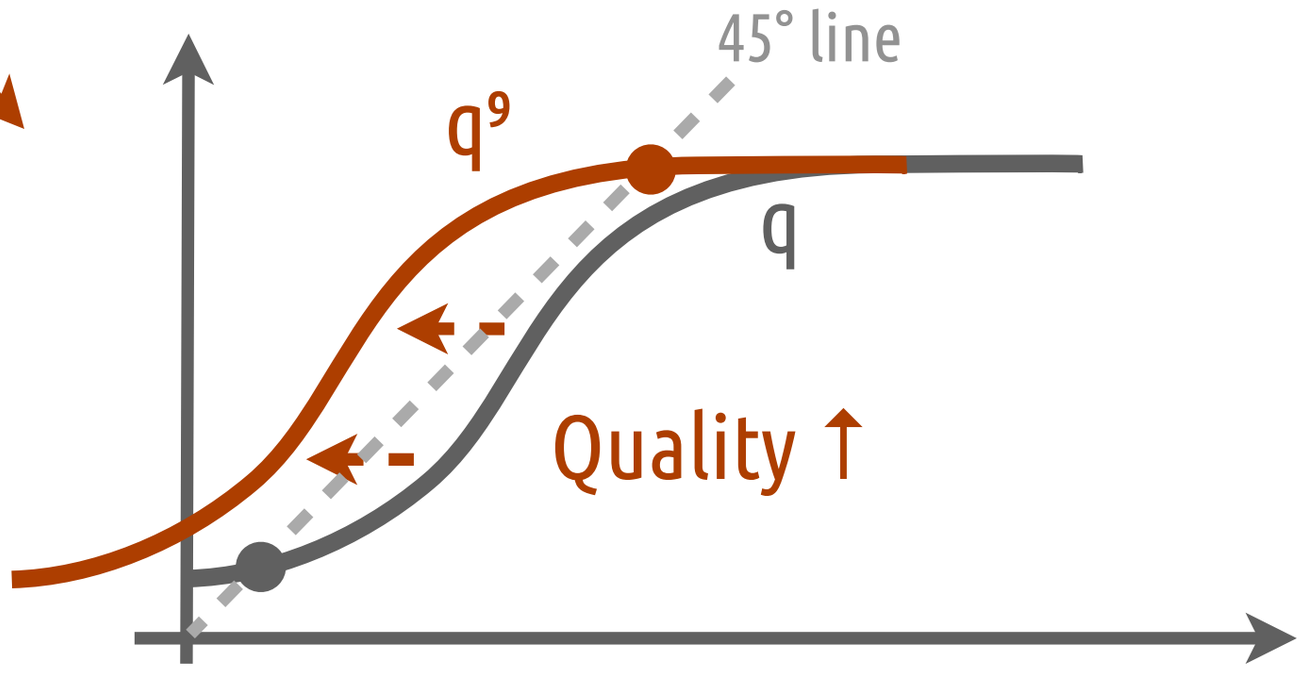
$$\dot{m}_t = \lambda(F(m_t|q_t) - m_t)$$

$$\dot{q}_t = cm_t - \beta q_t$$

Assumption 1

Assumption 2

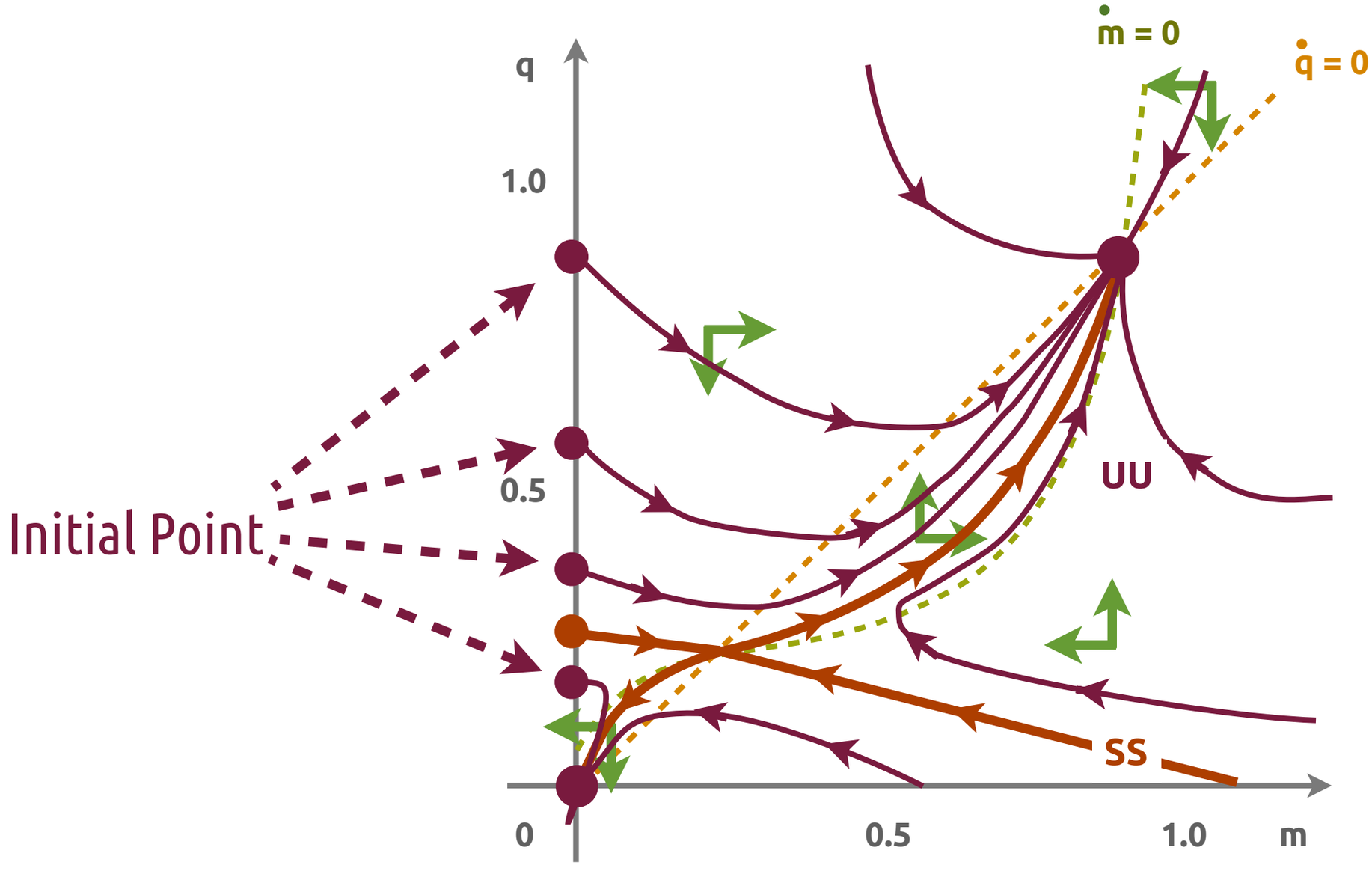
Assumption 3



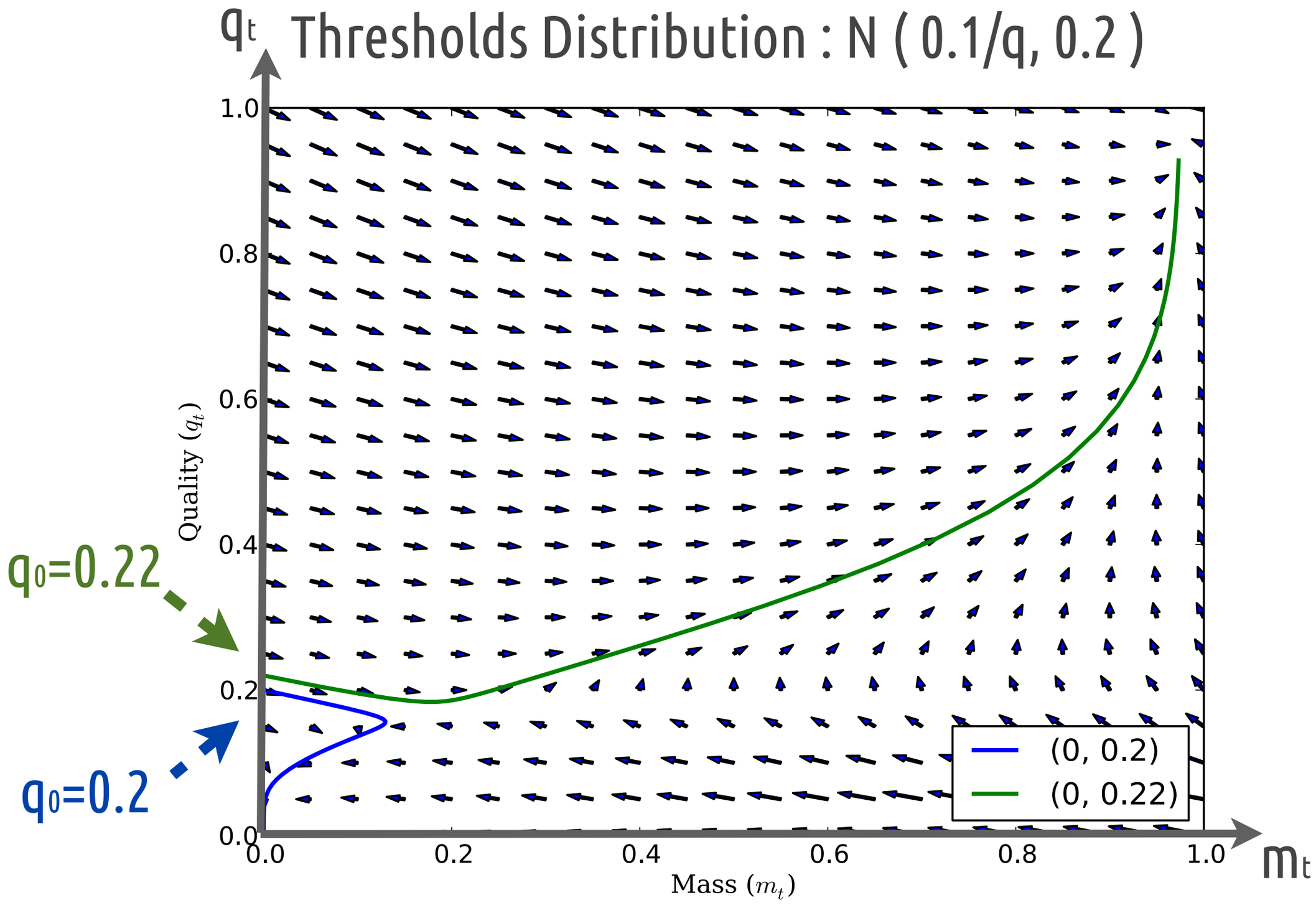
If $q^g > q$, then q^g has first order stochastic dominance over q.

The Model - Diffusion Process and Take-off Conditions I

Thresholds Distribution : N (μ/q, σ^2)

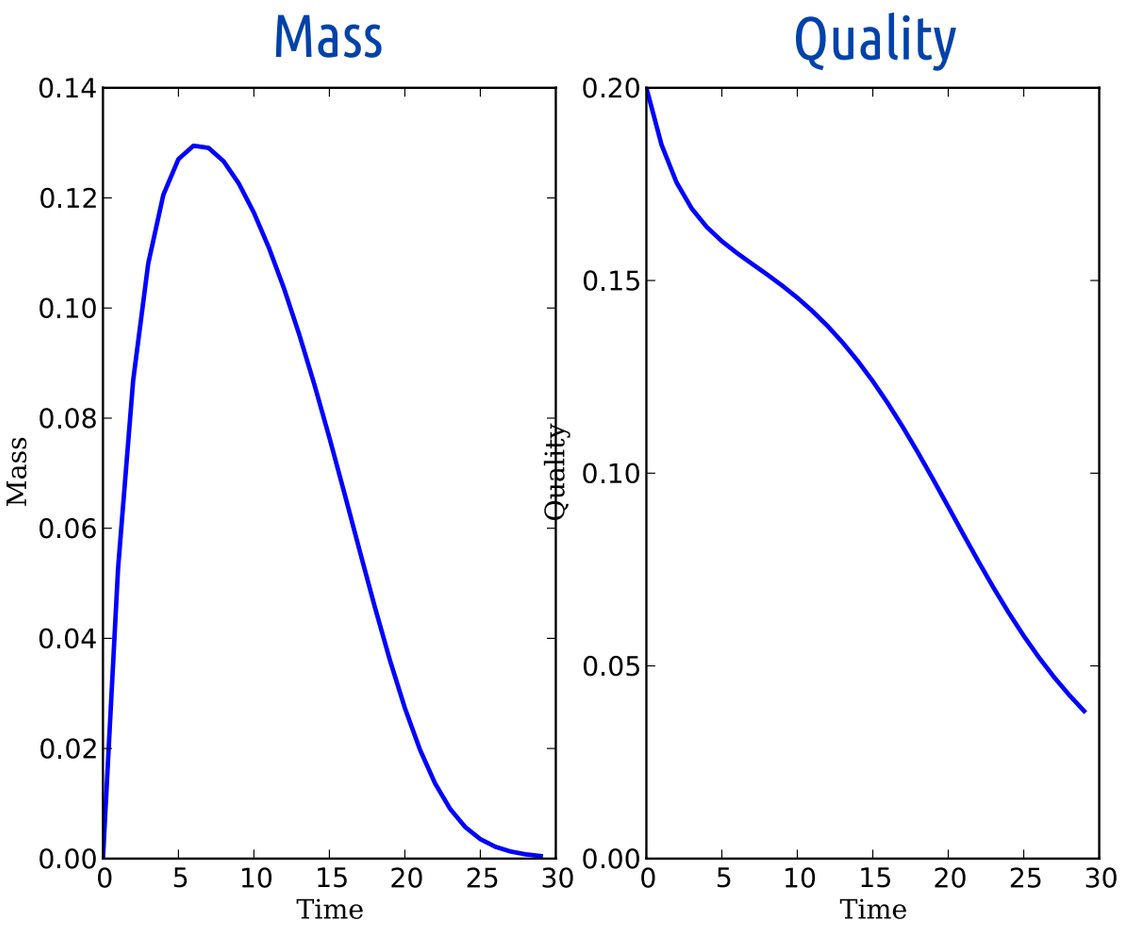


The Model - Diffusion Process and Take-off Conditions II

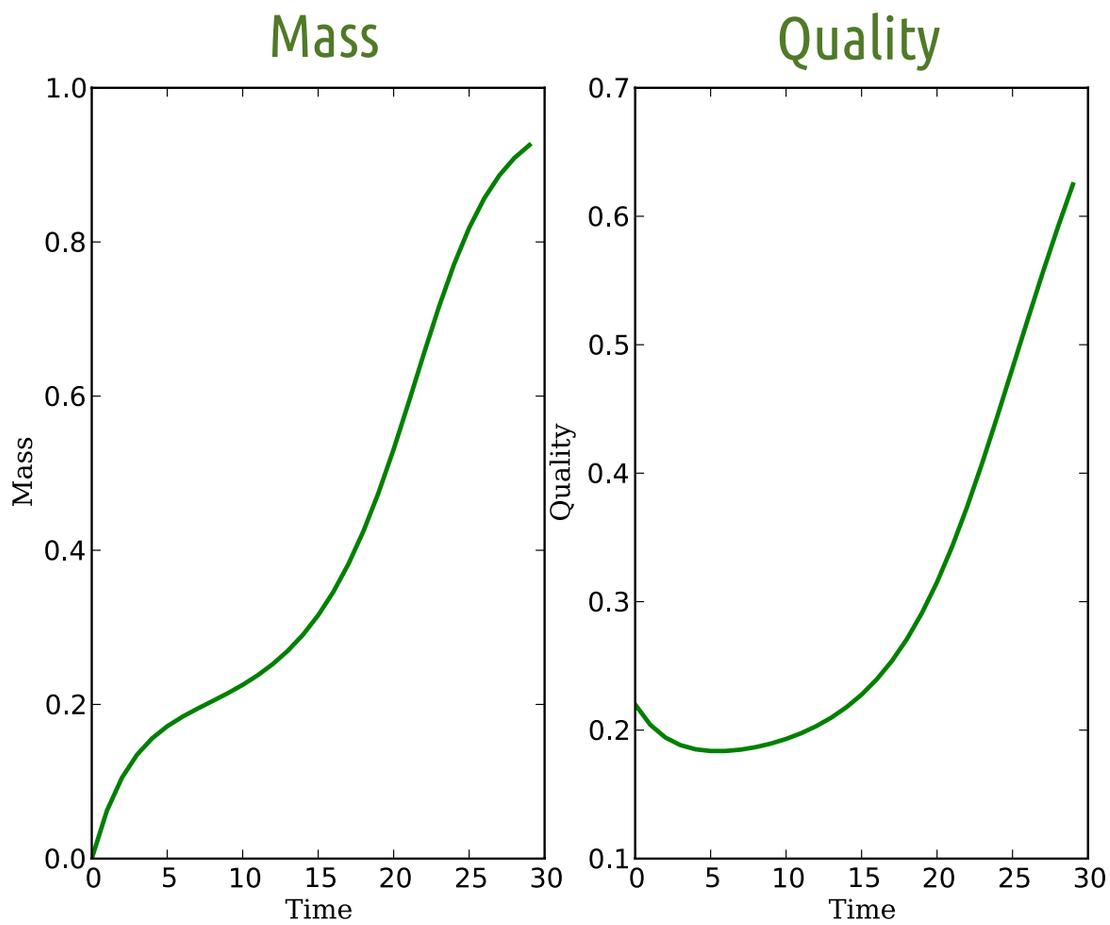


The Model - Diffusion Process and Take-off Conditions III

q_0=0.2 (Failed to Take-off)



q_0=0.22 (Take-off)

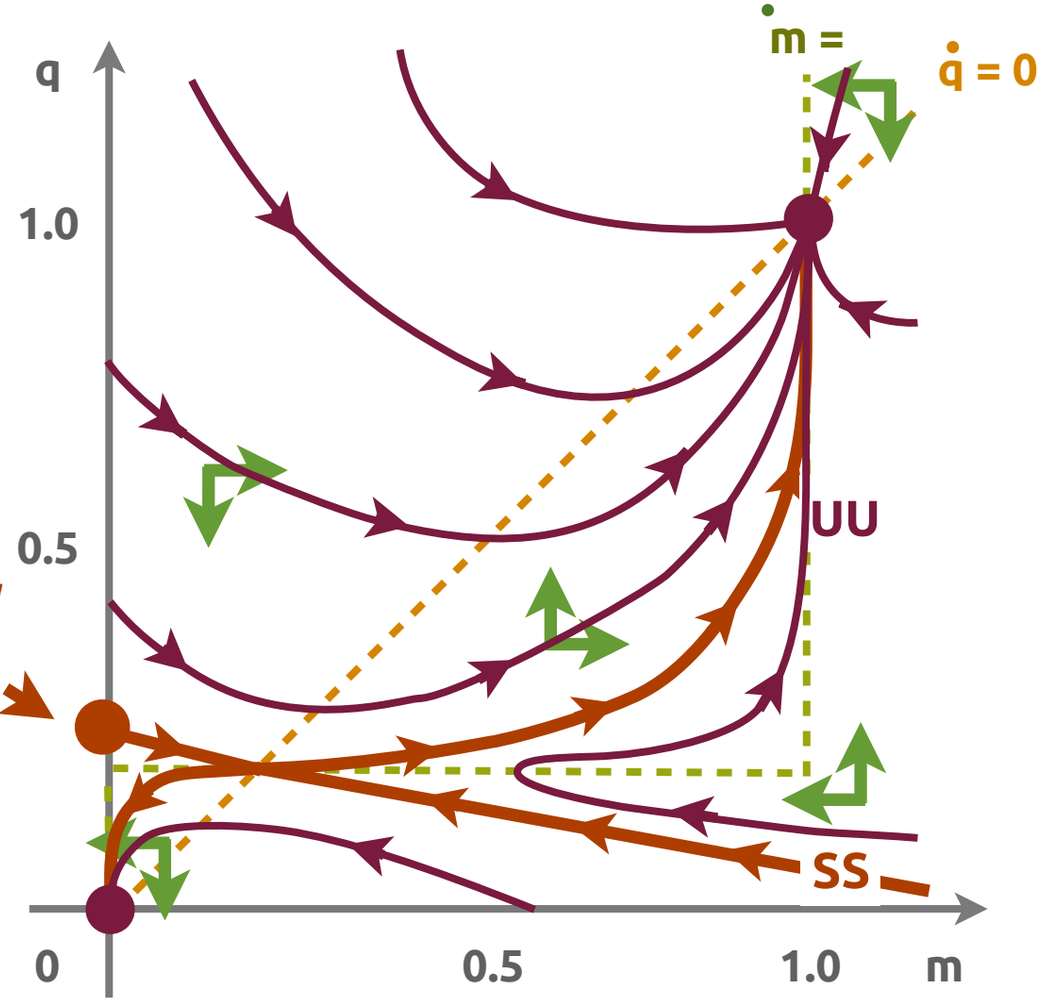


The Model - Critical Value of Quality

Definition

Critical value of quality is defined as the level of quality $\bar{q}$ such that if $q_0 \in [0, \bar{q})$ then $\lim_{t\to\infty} m_t = 0$ and if $q_0 \in (\bar{q}, \infty)$ then $\lim_{t\to\infty} m_t = m^*$ $(m^* > 0)$

Critical Value of Quality

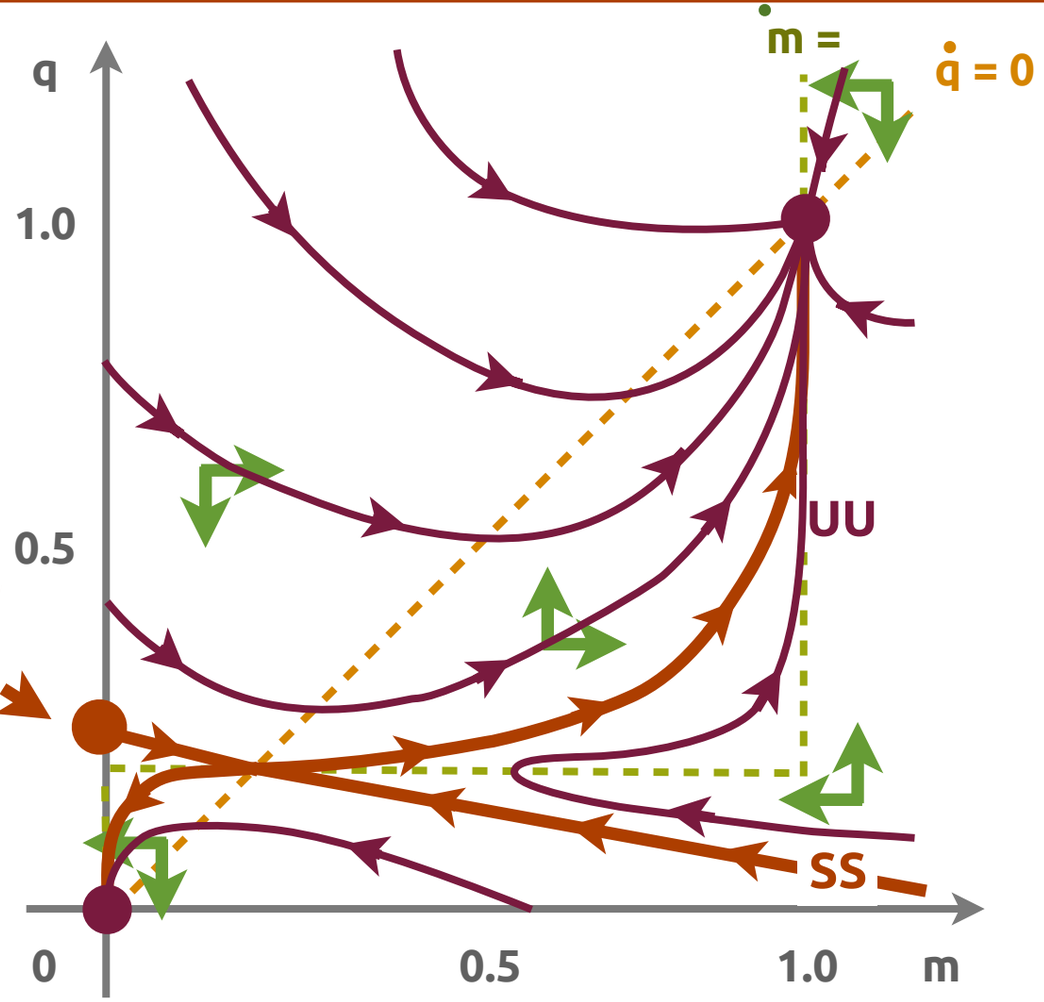


The Model - Proposition

Proposition

Thresholds distribution is given by $U(a/q_t - 1, a/q_t)$.
If $c/\beta > a$ and $\lambda(c/\beta - a)^2 \geq ca$ hold,
then there exists critical value of quality $\bar{q} \in [a, c/\beta]$

Critical Value of Quality



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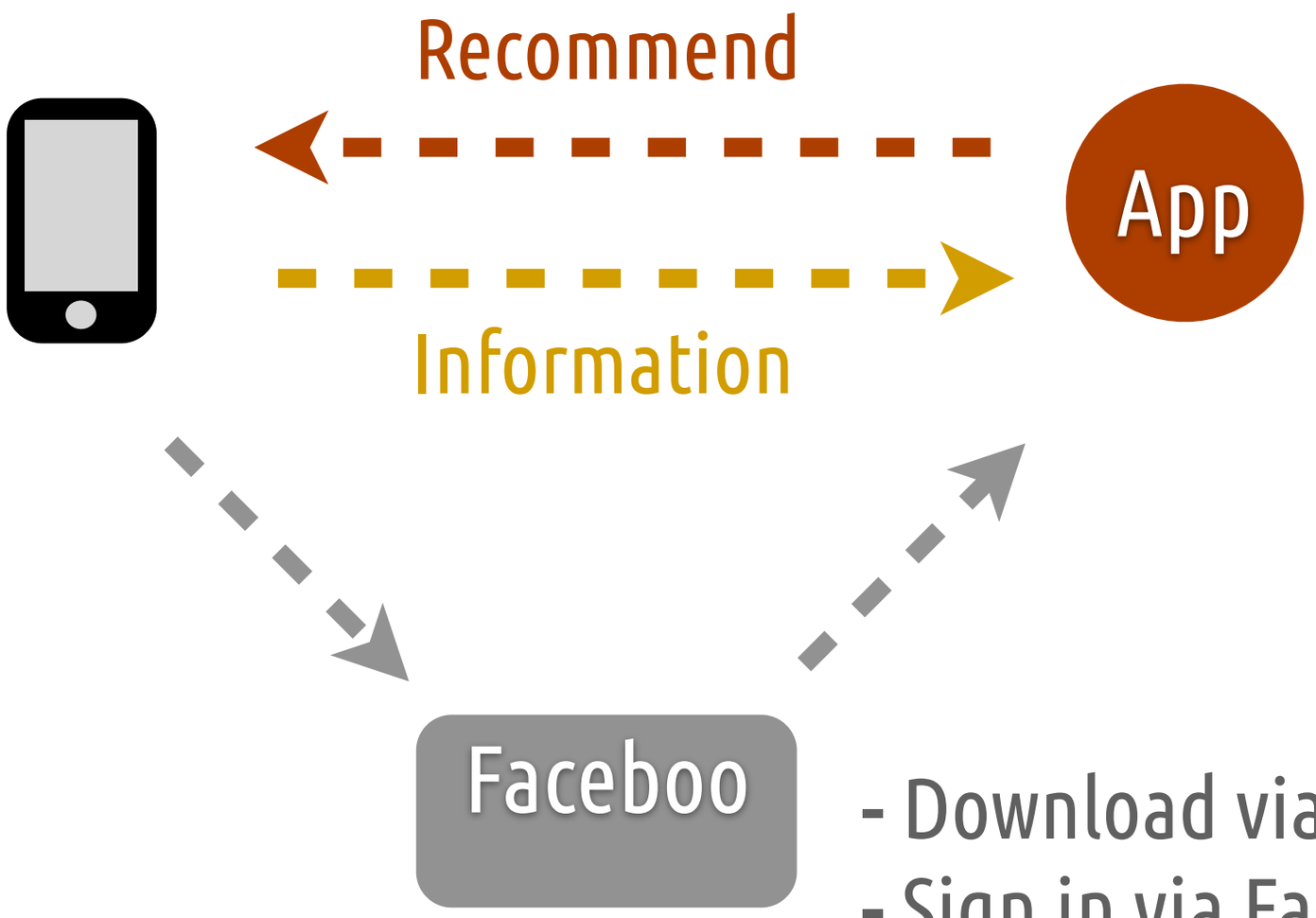
The Data - Music Platform App on iPhone

Populi - Social Music App

Released in June

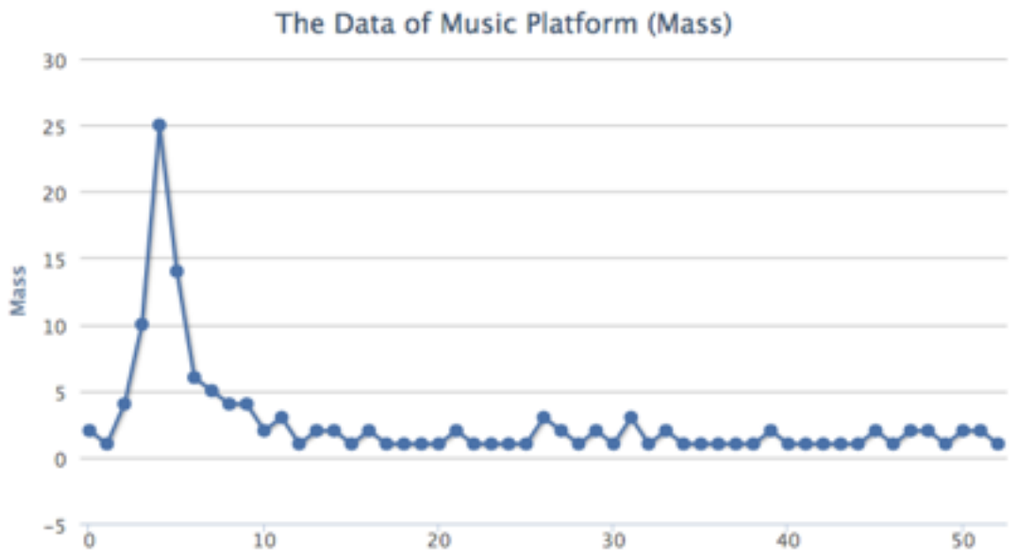
The Data - Detail of the App

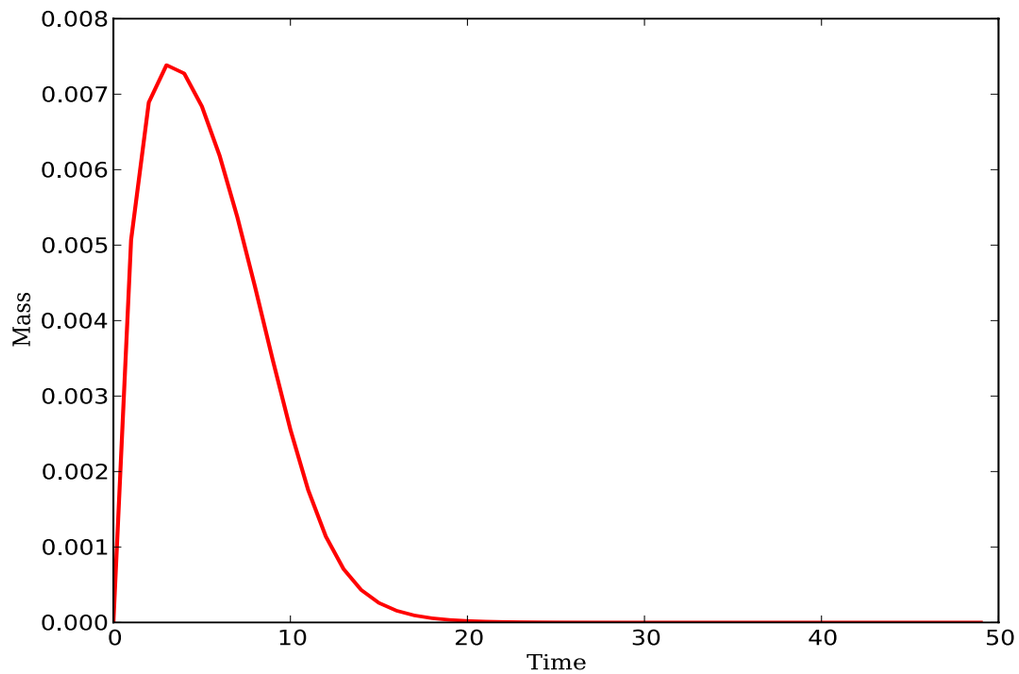


- Download via Apple App Store
- Sign in via Facebook
- Listen to music
- Friends⁹ favorite music
- Recommend music automatically

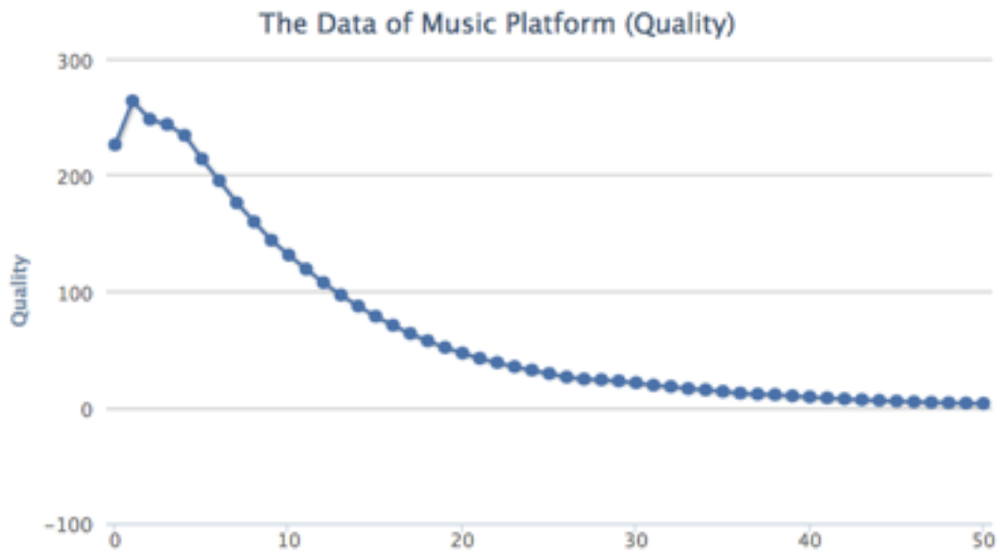
The Data - Simulation and the Data

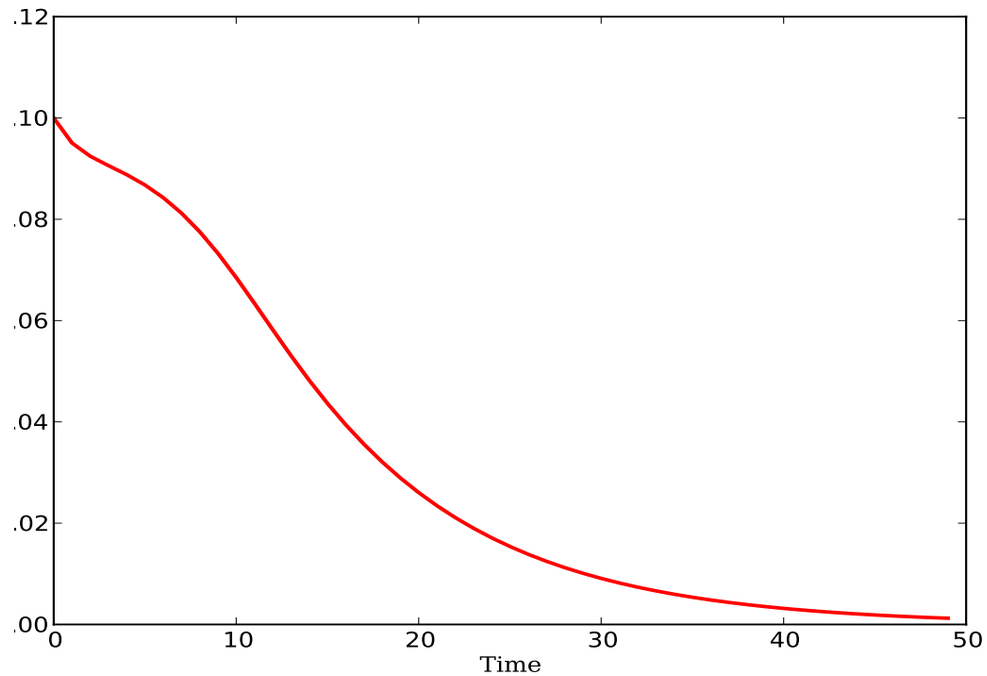
Mass





Quality





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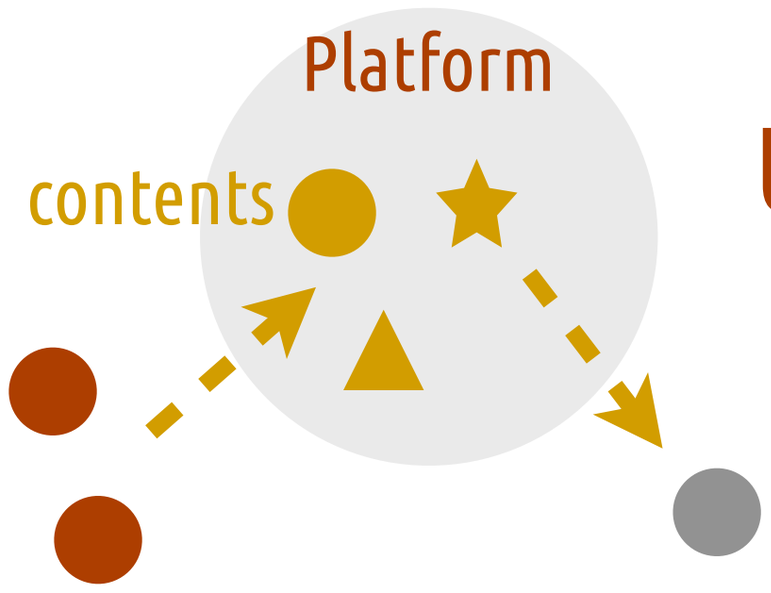
Conclusion - Intuitions of Diffusion Process

If quality depends on uploaded contents and also affects users decision, then there exists critical value of quality.

Intuitions

Platforms is affected by another type of network externality



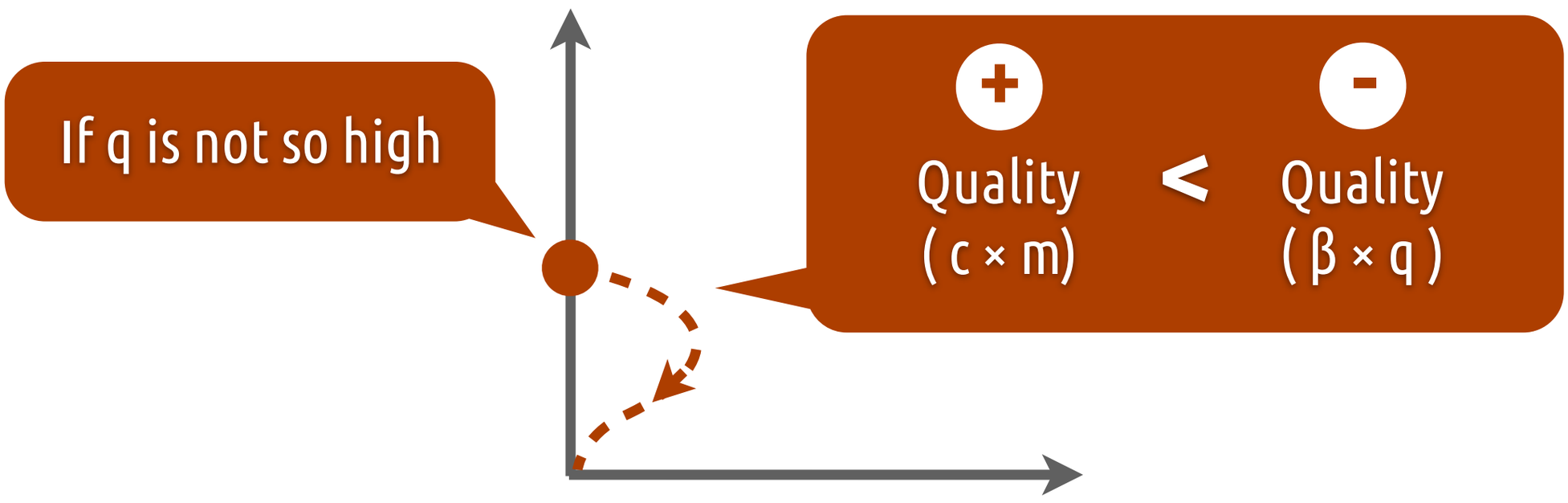
User ↑ ⇒ Contents ↑ ⇒ User ↑

Conclusion - Intuitions of Take-off Conditions

Whether take-off or not depends on
q_0 (initial quality) , c (content per capita), β (decline rate)

Intuitions

Although q_0 is not high, some user starts using.
However, increasing of quality is smaller than declining.



Thank you for your attention