Information Channel Effect in Consumer Behavior: an Agent Based Model

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The current development of information networks is increasing the number of interactive information channels and also the quantity and variety of information individuals can access and acquire. This enables customers to now select from a much greater number of alternatives than had been previously possible. Under these circumstances, however, phenomena known as winner-take-all phenomena can now be observed everywhere (Frank and Cook, 1995). Here, we define these phenomena as processes in which consumers' selectiveness is concentrated gradually on particular goods in certain markets. Examples of winner-take-all markets include telephone services and operating systems. One trait these markets share in common is the action of network externality. However, we observed winner-take-all phenomena in our research even in markets such as music or movie software, and action of network externality is not possible in these markets. To analyze the mechanisms of these markets, we focus on information channel characteristics and network structure and simulate a multi-agent model on consumer behavior in response to information acquired.

From the simulation results we obtained, we conclude that the ongoing development of information channels, i.e., the development of interactive information networks, tends to strengthen winner-take-all phenomena. We propose a scenario under which the society branches off from a diverse consumption or a concentrated consumption by interactive effects between the number of information channels and the ratio of consumers.

Diversification of information and concentration of consumption

Is the ongoing development of information networks bringing about a diversification of consumer selectiveness or a concentration of it? Intuitively, it can be said that development on the economic level should give rise to a wide variety of goods which consumers need. In turn, a wide variety of needs gives rise to production on a limited scale of a wide variety of goods and thus forms a basis for a one-to-one marketing.

Development of the Internet has increased and is increasing the quantity and variety of information that individuals are able to gain access to. This is changing society from one in which the mass media distributes information in a mono-directional manner to one in which individuals distribute it in a bi-directional information manner. As a consequence, even the needs of consumers in very small markets give rise to markets in and of themselves, enabling today's consumers to select from a wide variety of goods and information. Examples of such small-size markets are auction markets between consumers such as the eBay and Internet shopping malls such as the Rakuten in Japan. In short, it appears to us that the development of bi-directional (interactive) information networks is generating a society in which the scale of consumption is becoming ever-more widespread and varying.

On the other hand, a new economy known as the "digital economy" has emerged at the same time, through the development of information technology and information networks. According to Arthur(1996), the digital economy has its own set of unique economic laws. A winner-take all society has emerged as a byproduct of the digital economy, and this is a society in which particular winners monopolize almost all goods in a market. For example, NTT DoCoMo monopolizes the mobile phone market in Japan, and Microsoft with its Windows monopolizes the operating system market all over the world. These examples can be explained if one bears in mind that network externality is a prime factor in the digital economy. In addition, there is another winner-take-all phenomenon that occurs due to long-established physical economic laws. A well-known phenomenon in the full-scale economy is that the higher quantity of goods a firm can produce, the lower in price they are, and consequently the firm becomes a winner in the market it operates in. For example, McDonald's became a winner in the fast-food market through mass production and cost management.

From our point of view, some winner-take-all phenomena that affect neither network externality nor the scale of the economy can be observed in markets. For example, in the music and movie software markets, concentration of consumption is observed nowadays. To understand what behavior patterns consumers will follow in the future, we must analyze the development of Internet mechanisms that influence diversification or concentration of consumption, especially the role of information channels between individuals. Thus, we focus our attention on information channels between individuals in information networks. These channels provide communication links such as face-to-face communication, e-mail, and communication over the Web. We hypothesize that increasing the number of information channels will significantly influence winner-take-all phenomena in the music and movie software markets.

Against this background, we constructed a model of consumer purchasing and communication behavior to understand the manner in which an increase in the number of information channels influences consumer behavior.

Development of Consumer Behavior Model

We used knowledge of consumer behavior theory to develop the model (Rogers,1983)(Usshikubo and Ohtaguro, 1984). We classified consumers into four types: "Early Adaptor", "Trend Carrier", "Niche Leader", and "Follower". We modeled consumer behavior with "information retrieval" and "communication" axes. An "Early Adoptor" is one who actively undertakes information retrieval and communication. A "Trend Carrier" is one who actively undertakes communication but is passive in the area of information retrieval. A "Niche Leader" is one who actively undertakes information retrieval but is passive in the area of communication. A "Follower" is one who is passive in the areas of both information retrieval and communication. These consumer behavior patterns are compiled in Table 1.

Table 1: Principles of Agent Behavior

		Information retrieval	
		Active	Passive
Information dispatch	Active	Early Adoptor	Trend Carrier
	Passive	Niche Leader	Follower

We developed a multi-agent simulation model according to these principles. An "Early Adoptor" agent searches and purchases goods that match his own preferences, and sends information about the goods. A "Trend Carrier" agent purchases goods that nearly match his own preferences according to the information he received, and sends information about the goods. A "Niche Leader" agent searches and purchases goods that match his own preferences, but does not send information about the goods. A "Follower" agent purchases goods which are most fashionable at the time, and does not send information about the goods.

Computer simulation

In this section, we describe how we simulated consumer behavior by changing the composition of consumer agents and information channels in order to determine the relationship between an increase in the number of information channels and the winner-take-all phenomenon. We used a Gini coefficient to observe the latter. Figure 1 shows the relationship between an increase in the number of information channels and the winner-take-all phenomenon.. Case 1 is a society with many trend carrier consumers. Case 2 is a society with many follower consumers. Case 3 is actual consumer composition.

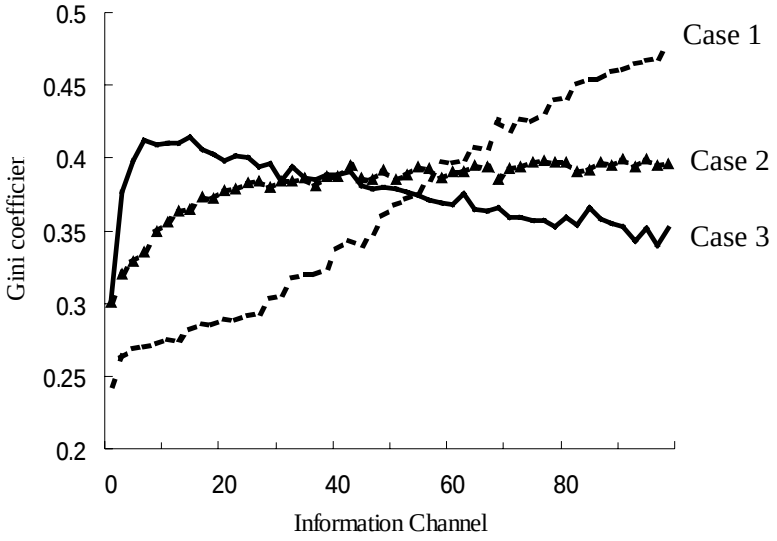

Figure 1: Information channel number vs. winner-take-all

In Case 1, when the number of information channels is small, the occurrence of winner-take-all rapidly rises as the number of information channels increases. As the number of channels increases further, consumer behavior becomes diverse. In Case 2, when the number of information channels is small, there are few consumers who circulate information into society, and agents purchase goods based on local information. Therefore, the overall consumption tendency varies and the Gini coefficient is low. As the number of information channels increases, everybody comes to purchase the same thing since fashion information circulates quickly throughout the whole society. The Gini coefficient becomes high in this case; this is winner-take-all society. In Case 3, the winner-take-all phenomenon becomes more pronounced as the number of information channels increases.

Conclusion

To answer the question of whether increasing the number of information channels in the information network society diversifies or concentrates consumption variety, we constructed a consumer behavior model which takes communication behavior into account. With the model we showed that the winner-take-all phenomenon occurs according to the relationship between consumer composition patterns and the number of available information channels, as follows.

1. In a market with many follower consumers, an increase in the number of information channels induces winner-take-all.
2. In a market with many trend carrier consumers, winner-take-all occurs when there are few information channels. However, diversification of consumption is induced as the number of information channels increases.

These results are summarized in Table 2.

Table 2: Diversification and centralization of consumption induced by the information channel

		Trend carriers	
		Few	Many
Information Channels	Few	diversification	centralization
	Many	centralization	diversification

References

[Frank and Cook, 1996] Frank, R., Cook, P., "The Winner-Take-All Society",Simon & Schuster, 1995.

[Rogers, 1983] Rogers, E., "Diffusion of Innovations: Third Edition", Macmillan Publishing, 1983.

[Usikubo and Ohtaguro, 1984] Usikubo and Ohtaguro, “The CORE as a concept of product development”, *“Diamond Harvard Business”*, Apr./May, pp.67-78, 1984.