

〔論 説〕

An Analysis Model on Marketing Channel Structures:
Information Cost by Advertising Effect and, Quantitative
and Qualitative Performance of Marketing Communication

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Abstract:

In this research, we focus on constructing an analysis model to analyze the structures of marketing channels theoretically to obtain important hypotheses. In order to derive testable hypotheses from our model, we assume a marketing communication network based on advertisement effect by manufacturers, and communication performance in quantitative and qualitative aspects as variables in the model.

Key words:

communication flow, information cost, analysis model, information, vertical market, communication performance, quantitative and qualitative performance, channel structures, communication network, advertisement, sales promotion, cooperative condition, markup

1. Purpose

In my previous study⁽¹⁾ we already constructed a modification model of marketing communication under a reasonable communication network and including communication density as well as communication cost as variables. In this paper we attempt the construction of a more realistic marketing communication model in a vertical market by the following variables. Concrete subjects to be discussed are (1) introduction of variables for advertisement effect by manufacturers, (2) introduction of variables for job performance in communication flows and qualitative aspect. Discussions will develop in this order.

2. Advertisement Effect and Information Cost

An important conclusion of the next section 3 titled the performance of communication flows is that when manufacturers leave their function of communication up to the middlemen communication function is not fully attained. This non-attainment part of the function, π_R , is expressed in eq. (25), which is:

(1) Nishimura (2007) : pp. 59-70.

$$\pi_R = (S_M qm + 2^n p m S_M) \left(1 - \frac{(\alpha + \beta)}{2} \right)$$

where α : achievement rate in quantitative aspects of communication

β : achievement rate in quantitative aspects of communication

A hypothesis here is that it is possible for manufacturers to use the part of or the whole π_R as the cost of advertisement or sales promotion actions for ultimate consumers. For example, it is used for nation-wide or regional advertisement or sales promotion actions for a national brand or a manufacturer brand.

This advertisement or sales promotion actions for ultimate consumers will have significant effect on communication actions between W_1 and N in the M - W_1 - N structure. Bucklin(1966) makes the following comment on the influence: "Propaganda may serve to reduce the extent of time required for negotiations: self-service in advertised brands, for example."⁽²⁾

In short, when advertisement or sales promotion actions for ultimate consumers are conducted in advance by manufacturers, certain communication effects are achieved in shorter contact time than the case without such activities. As such, the above actions by manufacturers contribute to lowering the cost of conducting the information function by middlemen. Based on this point, we correct the part of variable cost between W_1 and N labeled V_{W_1-N} in the M - W_1 - N structure model. From eq.(26) in my previous study⁽³⁾,

$$T_{W_1-N} = \frac{mS_M + n}{n} = 1 + \frac{mS_M}{n} \quad (1)$$

From eq.(28) in my previous study⁽⁴⁾,

$$V_{W_1-N} = p(T_{W_1-N})^n n = p \left(1 + \frac{mS_M}{n} \right)^n n \quad (2)$$

T_{W_1-N} is the average overlapped exchanges of information per link, in other words, the length of contact time. Therefore, according the above discussion, when individual manufacturer takes advertisement or sales promotion actions for ultimate consumers, that reduces the average contact time by middlemen, T_{W_1-N} .

Fig.1 shows the relationship between the volume of advertisement inputted by manufacturers, Z , and the reduced rate of contact time per link, i.e. unit reduction

(2) Bucklin (1966) : p.51.

(3) Nishimura (2007) : p.66.

(4) Nishimura (2007) : p.67.

rate, δ . The former is put in the horizontal axis and the latter is put in the vertical axis set 1.0 when there is no advertisement or sales promotion actions.

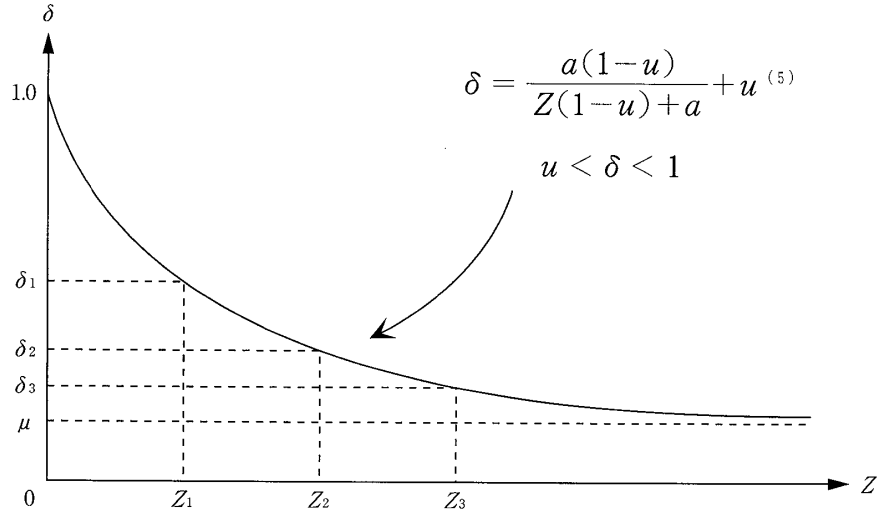


Fig. 1 Volume of Advertisement Z vs. Unit Reduction Rate of Average Contact Time δ

The value of δ decreases as the volume of advertisement increases but does not become lower than u . Therefore the following equation always holds:

$$\lim_{Z \rightarrow \infty} \delta = u.$$

Also in the real situation, it is impossible to make contact time with consumers zero even when the volume of advertisement increases tremendously.

So u is always necessary as the extreme value. Since the reduction rate does not become a half when the volume of advertisement becomes double, the curve indicates that the reduction rate of δ diminishes as Z increases. Here we set the following function as δ :

$$\delta = \frac{a(1-u)}{Z(1-u)+a} + u \quad (3)$$

a is a parameter indicating the slope of the curve and $a > 0$ and u is a parameter and $0 < u < 1$.

Then the V_{W_1-N} of eq.(2) can be rewritten as follows:

$$V_{W_1-N} = p \left\{ \left(1 + \frac{mS_M}{n} \right) \delta \right\}^n \quad (u < \delta \leq 1). \quad (4)$$

Therefore

$$V_1 = p \left\{ mw_{i1} \left(1 + \frac{S_M}{w_{i1}} \right)^n + n \left(1 + \frac{mS_M}{n} \right)^n \delta^n \right\} \quad (5)$$

(5) Besides this, the following equation holds:

$$\delta = (1-u)e^{-\lambda Z} + u \quad (\lambda > 0).$$

Hence

$$TC_{W_1} = (mw_{i1} + n)q + p \left\{ mw_{i1} \left(1 + \frac{S_M}{w_{i1}} \right)^\eta + n \left(1 + \frac{mS_M}{n} \right)^\eta \delta^\eta \right\}. \quad (6)$$

3. Variables for the Performance of Communication Flows

3.1 Problems about Cooperative Condition in the Basic Models

We had a certain assumption in our mind when we talked about the communication basic models⁽⁶⁾ such as Balderston(1958) model, Baligh and Richartz(1967) model and Naert(1970) model. The assumption is that the performance of communication for ultimate consumers is the same in either the $M-N$ structure or the $M-W_1-N$ structure.

In other words, the volume of communication flows is the same regardless of the type of market structure. But this assumption does not seem rational in the real situation. It is rather rational to think that the performance of communication flows varies among markets.

The second problem of the communication basic models in my previous study was the assumption of cooperative condition between manufacturers and the middlemen who try to enter the market. That is, manufacturers give the total socio-economic cost of communication function as margin with no condition to the middlemen trying to enter the market as far as manufacturers' profits remain the same⁽⁷⁾.

In other words, a question is that even if the first problem was not considered, that is, even if the performance or the quantitative effect of communication activities for ultimate consumers was assumed to be the same, would manufacturers admit middlemen to the market with no condition and give middlemen as markup (commission) the total communication cost spent in the $M-N$ structure? Between the $M-N$ structure and the $M-W_1-N$ structure manufacturers, would naturally expect different communication effect on ultimate consumers such as different human relations or different degrees of trust.

Now let us study briefly the above two points and take advantage of them for better communication function models.

3.2 Quantitative Aspects of Communication

As already mentioned in my previous study⁽⁸⁾, concrete actions of communication function included the transmission of goods price information, the transmission of goods information and order information, the collection of such information, negotiations and the persuasion based on the volume of information. In order to conduct the above actions the first question is how much communication should be inputted.

(6) Nishimura (1999) : pp.172-179.

(7) Nishimura (1999) : p.174.

(8) Nishimura (1999) : p.164

Nishimura (2007) : pp.64-65.

Our social and individual life can function by transmitting and exchanging thoughts between groups, between a group and an individual, or between individuals. We call the transmission or exchanges of thoughts communication. To clear the quantitative problem of communication seems to be one of the basic problems in order to facilitate the actions of groups, organizations and individuals and to make the actions keep going.

Paradoxically speaking, groups and organizations cannot exist without acquiring a certain volume of communication or our life will be uncomfortable. Thus the volume of communication has a significant influence on our social life and the appropriate volume of communication is inevitable for our individual or group social life.

In order to realize a target of demand-supply adjustment manufacturers would form an information organization in the $M-N$ structure or in the $M-W_1-N$ structure. Those organizations are, needless to say, a means for achieving their target and the appropriate number of people and the appropriate volume of equipment are inputted there. These organizations are managed by human beings and what we should note here is that human beings sometimes take imprecise actions. Therefore communication organizations would play the role of a pipeline transmitting the information of manufacturers' target to ultimate consumers or the order of ultimate consumers to manufacturers. That is, in general, each pipeline has two-way flows of information.

Therefore it is thought that if pipelines of communication work appropriately quantity wise, the first target of demand-supply adjustment by manufacturers could be met. But, as mentioned before, various mistakes will occur since human beings are operators of communication. Flows of pipeline may sometimes get narrow. Timing of flows may become inappropriate. Not only volume but quality of flows may be changed or chosen inappropriately. Or in some cases pipelines flows could be stopped. These mistakes are all caused by imprecise actions of human beings.

When middlemen enter between manufacturers and ultimate consumers in communication flows, a possibility of a decrease in the volume of communication or a possibility of an interruption of communication by noise or foreign substances will become higher. As a result, these cause inefficient information exchanges.

That is, too many people in communication actions could keep the communication network of manufacturers from functioning completely and diminish its value as an organization for its expected end. Therefore we need a standard for measuring how appropriate the volume of communication is. The measurement standard is the comparison between the volume of communication flows and cost, that is, the comparison between the performance of work achieved by a certain volume of communication and the cost spent for the work, which is called cost performance.

If communication cost is the same in the $M-N$ structure and in the $M-W_1-N$ structure, manufacturers would prefer the $M-N$ structure because there is a smaller

possibility of the lower volume of communication flows or delayed communication⁽⁹⁾.

In short, the more direct communication network is, the better the volume of communication is kept and the quicker information flows and manufacturers think such network helps to activate business activities.

Now we set the following assumption as to the first problem about cooperative condition of the basic communication models. That is, in the M - W_1 - N structure manufacturers do not expect the same performance of communication they obtained in the M - N structure. Therefore they do not give the total of TC_M expressed in my previous study⁽¹⁰⁾,

$$TC_M = mS_M(q + 2^n p) \quad (7)$$

to middlemen as markup with no condition. Instead, they evaluate middlemen's work as achievement rate, α . In other words, manufacturers give middlemen the following amount of markup:

$$TC_M = \alpha \times mS_M(q + 2^n p) \quad (0 \leq \alpha \leq 1). \quad (8)$$

Hence the cooperative condition here has changed from the one in the basic models of the previous chapter.

The assumption is set based on the idea that manufacturers can expect better communication effects on ultimate consumers in vertical markets when the middleman level is a few in number. Reversely what if we assume the distortion of information becomes less as the number of middleman in the same levels increases? For this case we assume that the level of commission (markup) paid from manufacturers to middlemen is decided after communication performance by manufacturers and by middlemen is compared.

Now we borrow the idea of physics to think about the performance of communication circuits. Communication flows begin with the transmission or exchanges of information and then negotiations start. But for the proceeding a certain force or economic energy is always necessary. In vertical markets the force is found for communication, which corresponds to $TC_M = mS_M(q + 2^n p)$. Hence the generation of economic energy in communication circuit is a premise when communication flows, either continuous or discontinuous, are generated in the circuit. Technical methods used in communication circuits by salesperson are telephone, documents such as DM and pamphlets, telex and fax.

Here economic energy creating communication flows can be compared to potential

(9) In a political system, for example, direct representative system is considered better than indirect representative system because of the same reason. The M - W_1 - N structure is less desirable for producers than the M - N structure if production fluctuates owing to the delay of orders and other things in the M - W_1 - N structure [Nishimura (1975) and Nishimura (1976)].

(10) Nishimura (2007) : see eq.(35) or p.68.

difference (V) in electrodynamics of physics and communication flows can be compared to electric currents (I)⁽¹¹⁾. Economic energy between two points in communication flow pipes such as M and N , M and W_1 or W_1 and N is proportional to communication flows. When a proportionality is R , the above relationship is expressed as follows:

$$V = IR \quad (9)$$

$$I = V/R \quad (10)$$

$$R = V/I, \quad (11)$$

which is called Ohm's law⁽¹²⁾. Hence communication flows of communication circuits is proportional to economic energy generated in the circuits and inversely proportional to the proportion constant of the circuits. The greater the value of R , the less communication flow is necessary to generate the same economic energy. R indicates how badly communication flows flow, which is called resistance in electrodynamics⁽¹³⁾.

In our vertical markets R is generated by human factors that interrupt communication flows. Furthermore some R is the resistance of the circuit, in which middlemen appear in its several stages and some are not.

We cannot forget the resistance of pipelines themselves. Not only middlemen but communication pipelines interrupt communication flows. In other words, each middleman and pipeline has its own resistance. This is called intrinsic resistance in electrodynamics⁽¹⁴⁾. For our study intrinsic resistance for middlemen is set as a constant, R_w , regardless of market structure or the ability of middlemen. As for pipelines, their intrinsic resistance depends on their length and cross section⁽¹⁵⁾. But in our study intrinsic resistance of all pipelines are set as a constant, R_p , that is, the total resistance of a pipeline is R_p regardless of its length and cross section⁽¹⁶⁾. In other words, the resistance of a pipeline or a link is assumed as R_p regardless of distance. If necessary, R_p can be a function of distance by introducing a distance variable, which will be mentioned in my next study⁽¹⁷⁾. But for the moment the factor of distance is neglected.

By the concept of electric circuits of electrodynamics⁽¹⁸⁾ in the M - N structure, in

(11) Yamada (1966) : pp.136-137.

(12) Yamada (1966) : p.137.

(13) Yamada (1966) : p.137.

(14) Yamada (1966) : p.139.

(15) Yamada (1966) : p.139.

(16) As well known in electromagnetism, when a conductor with specific resistance P has cross section S and length l , we have $R = P(l/S)$. In short, R is proportional to length l and inversely proportional to cross section S [Yamada (1966) : pp.140-141.].

(17) When the distance in the M - N structure is D_0 and the number of levels in middleman is L , we have $D_L = D_0/(L+1)$. Therefore D_L times R_p gives the total resistance of pipelines in the M - W_1 - N structure.

(18) Yamada (1966) : pp.151-152.

which the total information exchange density is $2^\eta m S_M$, resistance R_M is

$$R_M = \frac{R_p}{2^\eta m S_M}. \quad (12)$$

In the $M-W_1-N$ structure the total information exchange density between M and W_1 is, from eq. (5)

$$\left(1 + \frac{S_M}{w_{i1}}\right)^\eta m w_{i1} = (T_{M-W_1})^\eta m w_{i1} \quad (13)$$

and that between W_1 and N is, from eq. (5)

$$\left(1 + \frac{m S_M}{n}\right)^\eta \delta^\eta n = (T_{W_1-N})^\eta \delta^\eta n. \quad (14)$$

Therefore the total or combined resistance of the $M-W_1-N$ structure, R_{W_1} is

$$R_{W_1} = (m w_{i1} + n)q + p \left\{ m w_{i1} \left(1 + \frac{S_M}{w_{i1}}\right)^\eta + n \left(1 + \frac{m S_M}{n}\right)^\eta \right\} \quad (15)$$

$$= \frac{R_p \left\{ n (T_{W_1-N})^\eta \times \delta^\eta + m w_{i1} (T_{M-W_1})^\eta \right\}}{(T_{M-W_1} \times T_{W_1-N} \times \delta)^\eta} + \frac{R_W m n (T_{M-W_1} \times T_{W_1-N} \times \delta)^\eta}{m n w_{i1}}. \quad (16)$$

Then how about the performance of communication in the two kinds of communication channels, one with resistance R_M and another with resistance R_{W_1} ? Those performance corresponds to “electric power” in electrodynamics. When electric power is W^* ⁽¹⁹⁾,

$$W^* = V \times I. \quad (17)$$

Applying Ohm's law to the above we get

$$W^* = V \times \frac{V}{R} = \frac{V^2}{R}. \quad (18)$$

Therefore the performance of communication in the $M-N$ structure, W_0^* , is

$$W_0^* = \frac{(TC_M)^2}{R_M}. \quad (19)$$

And the performance of communication in the $M-W_1-N$ structure, W_1^* , is

$$W_1^* = \frac{(TC_M)^2}{R_{W_1}}. \quad (20)$$

(19) Yamada (1966) : pp.159-160.

Hence, when manufacturers leave communication function up to middlemen, the rate α of the middlemen's achievement recognized by the manufacturers can be expressed as follows:

$$\begin{aligned}
\alpha &= \frac{W_1^*}{W_0^*} \\
&= \frac{\frac{(TC_M)^2}{R_{W_1}}}{\frac{(TC_M)^2}{R_M}} \\
&= \frac{R_M}{R_{W_1}} \tag{21}
\end{aligned}$$

where $0 \leq \alpha \leq 1$.

3.3 Qualitative Aspects of Communication

Now let us consider the second problem of the basic communication models. It was whether manufacturers expect the same quality of communication in the $M-N$ structure and in the $M-W_1-N$ structure when these two vertical market structures have the same quantity of communication, that is, $W_0^* = W_1^*$.

Manufacturers may think the $M-N$ structure creates better effects on or better human relationship with ultimate customers than the $M-W_1-N$ structure. This is because manufacturers not only transmit information to ultimate consumers but also expect them to respond to the communication by purchase action. The best response for manufacturers is on unconditional one by ultimate consumers. Inappropriate communication will cause delayed response or misunderstanding, which is characteristic of human beings. To avoid them, trustful relationship needs to be formed or common practices between transmitter and receiver of information need to be set through communication. Good human relationship is inevitable for appropriate communication. The better the relationship between a sender and a receiver of information the more unconditionally the receiver responds to the information.

In the real world we see that manufacturers try to put communication channels under their control. The more fierce competition in a horizontal market becomes the better control is necessary to the end of marketing channels. Otherwise manufacturers will be kicked out of the market. Hence manufacturers would want more direct communication with ultimate consumers to have enough information exchanges.

Considering the above point, manufacturers do not want to pay the total communication cost in the $M-N$ structure to middlemen when they leave communication function up to middlemen. To pay the total cost to middlemen was assumed as the cooperative condition in the basic models of the previous chapter. But if manufacturers have to pay the total, they would prefer the $M-N$ structure, in which direct communication is likely to form better relationship with ultimate consumers.

Hence it is rational to think that manufacturers would work with middlemen considering the condition that only ratio β of the total communication function cost in the $M-N$ structure is paid to middlemen as margin. Then let us define the degree of qualitative achievement of communication by middlemen, β .

When the merits of direct relationship between manufacturers and middlemen in the $M-N$ structure is H_0 , and the merits of indirect relationship between them in the $M-W_1-N$ structure is H_1 , then

$$\beta = \frac{H_1}{H_0} \quad (22)$$

where $0 \leq \beta \leq 1$.

Since quantitative achievement ratio of communication by middlemen was α in the previous section, the total margin which manufacturers can give middlemen is

$$\frac{TC_M \times \alpha + TC_M \times \beta}{2} = \frac{1}{2}(\alpha + \beta) TC_M. \quad (23)$$

Therefore the amount of marking up, TC_M , after introducing α and β is⁽²⁰⁾

$$TC_M = mS_M(q + 2^\eta p) \frac{(\alpha + \beta)}{2} \quad (24)$$

where $0 \leq \frac{\alpha + \beta}{2} \leq 1$.

Investment cost is neglected here. Now we may be able to make an important conjecture. As also mentioned in section 2 where advertisement was discussed, because of the assumption that the total communication function cost necessary to manufacturers in the $M-N$ structure is not given to middlemen in the $M-W_1-N$ structure, manufacturers keep the following amount, π_R , in their hand.

$$\pi_R = mS_M(q + 2^\eta p) \left(1 - \frac{(\alpha + \beta)}{2} \right). \quad (25)$$

So we assume the total or the part of π_R is spent on the following cases. One is the case that π_R will be spent to make up for the imperfectness of communication function by the middlemen since π_R originates in the imperfect achievement. This is, for example, manufacturers' cost of advertising and taking actions to improve sales of their brands.

Another is the case that the total or the part of π_R is spent on a bonus for

⁽²⁰⁾ This equation is very much similar to the formation pattern of the model by Baligh and Richartz (1967), which introduces the rebate variable. But they consider the rebate as middlemen's cost of entry or participation, which is different from the idea of this study [Baligh and Richartz (1967) : pp.29-31].

middlemen. In Japan this bonus is called rebate⁽²¹⁾, which is paid from manufacturers to middlemen based on the relationship between the two (this indicates how loyal middlemen are to manufacturers) or annual sales by middlemen (this indicates how well middlemen communicate with consumers).

Unfortunately we cannot verify the above two conjectures. But they seem quite reasonable in the real situation.

4. Conclusion

Hypothesis for the developed model of the communication function are listed below. Hypothesis numbers (1) to (3) were discussed in the process of the model construction. Theoretical hypothesis (4) was derived from the developed model itself.

(1) In a communication network the more levels of middlemen who enter the market, the lower the quantitative effect of communication activities there than in the $M-N$ structure and, furthermore, the qualitative effect of human relationships between manufacturers and consumers lessens.

(2) If manufacturers' profit in the $M-N$ structure is assured, they would admit middlemen to the market unconditionally and do business cooperatively. But the amount of margin to middlemen paid by manufacturers depends on the performance of middlemen's communication activities.

(3) A margin for middlemen is reduced, according to their performance of communication, by a non-attainment rate constant to the total socio-economic cost, or the total margin, in the $M-N$ structure. The rest of the margin is likely to be used by manufacturers for advertisement, sales promotions and rebates for middlemen.

(4) Advertisement and sales promotions by manufacturers increase the equilibrium number of middlemen and levels in middleman since they shorten the average contact time of middlemen and decrease the average number of information exchanges.

5. References

- [1] Nishimura, F.T. 1975 and 1976, "Problems of Dynamic Characteristics of the Vertical Market Structure; No.1 and No.2", *Chiba Shodai Ronso*, 13(2) and 14(1).
- [2] Nishimura, F.T. 1999, *Ryutsu Kozo Kaisekiron* (An Analysis of Distribution Structure) Doyukan.
- [3] Nishimura, F.T. 2007, "An Analysis Model on Marketing Channel Structures: Rational Modification and Cost of Communication Network in Vertical Market." *Chiba Shodai Ronso*, Chiba University of Commerce, 45(2) : 59-70.
- [4] Yamada, Naohei 1966, *Electromagnetism*, Society of Electricity : 136-137.

⁽²¹⁾ Between the concept of rebate in the above footnote (20) and that in here are different. The rebate in this study is bonus like, given to middlemen by manufacturers.

- [5] Bucklin, L.P. 1966. *A Theory of Distribution Channel Structure*. Univ. of California (Special Publications).
- [6] Balderston F.E. 1958. "Communication Networks in Intermediate Markets." *Management Science* 4(2) : 154-171.
- [7] Baligh H.H. and L.E. Richartz. 1967. *Vertical Market Structures*. Allyn and Bacon.
- Baligh H.H. and L.E. Richartz. 1964. "An Analysis of Vertical Market Structures." *Management Science* 10(4) : 667-689.
- [8] Hall M. 1971. "The Theory of Wholesale Distribution." In Moller W.G. and D.L. Wilemon (eds.). *Marketing Channel: A Systems Viewpoint*. Irwin : 165-173.
- [9] Naert P.A. 1970. *Mathematical Models of Vertical Market Structures*. Unpublished Ph. D. Dissertation, Cornell University.

[抄 録]

流通構造の解析モデルの研究 —広告効果とコミュニケーションの量的・質的成果による情報伝達費用—

西 村 文 孝

本研究は、流通構造の解析モデルを構築し、そのモデル構築のプロセス及びモデル自身からの導出される重要な理論仮説を提示することにある。そこで今回は、2つの面から基本モデルの改良を行う。第1は、製造業者による最終消費者向けの広告宣伝活動が、中間業者による最終消費者とのコミュニケーションのための時間を減少させるため、中間業者の情報伝達費用を減じ、最終的に均衡中間業者数に変化をもたらす。第2は、①M-N構造とM-W-N構造では、コミュニケーション・フローの仕事の成果が同じではない。つまり、コミュニケーション・フローは、市場構造に依存すると考える。また、②製造業者は参入中間業者に対して協働条件として、中間業者によるコミュニケーション活動の量と質の問題から、M-N構造のときの情報伝達費用額の限定した割合しかマークアップしない。よって、製造業者は、コミュニケーション・フローの成果に基づき中間業者にマージンを与えることになるので、均衡中間業者数に変化を生じる。