

Sustainability and Network Effects in Global Cities

Hiroshige TANAKA

Professor of Faculty of Economics, Chuo University,
Higashinakano 742-1, Tokyo 192-0393, JAPAN.

Abstract

Enlargement of global network enhances competition among cities as well as corporations. It is possible that a furious competition makes global society unstable. We must investigate the mechanism that competition confirms sustainability of global community. This paper argues that network effects are a major factor of competition and that the analysis on positive and negative stakeholders is effective to make clear the competitive mechanism consisted by cities and corporations. Network effects are caused by global market and by cooperation in the local societies to promote innovation. The countervailing power of stakeholders compensates the problems caused by extreme competition.

1.Introduction

The globalization since 1980s has promoted deregulation of economies and lowered various barriers in the world markets. Individuals and corporations could be accessible to the world markets with less interventions or permissions of governments. Many corporations have activated the production as well as the sale in overseas. The total amount of financial assets and consumption of the world has grown at a large scale. The world markets are supported by the global network of economies and societies. As the participants to the global network increase, the total expected profit in the market rises. However the furious competitions in the enlarged markets involve not only multinational corporations but the cities in the global network. In order to improve competitiveness multinational corporations must decide production sites among many alternatives all over the world. The cities must be selected by many multinational corporations to achieve their regional sustainability. The regional competition is mainly based not on the countries but on the cities in the global network ¹. The cities aim to obtain advantageous position in competition of others. In this paper we argue that the network effect in the cities is a

¹ Many others such as Geyh(2009),Koschitzky et al.(2001),Komninos(2008) discuss intensively the regional function in the globalized society.

source of innovation and competitiveness. As the popular cities in the global society could select the corporations suitable for regional sustainability among many others, the competitive corporations ought to locate the office in the appreciate place with a high cost required by the local community. In the global network the competition is expressed as the primary principle, but the cooperative governance is the important factor for sustainable cities. When even profitable corporations are suspected not enough to contribute to the local community sufficiently, they might be required to take an additional responsibility as a member of the community ².

Sustainable cities must construct cooperation with stakeholders including corporations and inhabitants. The network effect increases the regional benefit of cooperation and makes cities more sustainable. Tanaka (2004) constructs a framework to evaluate corporate social responsibility by classifying stakeholders into positive and negative stakeholders. Tanaka (2009) formulates the global business cycle model by using this framework and demonstrates that this model could explain the mechanism of the financial crisis 2008-2009. This paper extends the model to investigate the sustainable governance to prompt

² Hirschland (2005) explains that globalization enlarges the needs of corporate social responsibility.

innovation of cities in the global network.

This paper is constructed as follows. Section 2 explains the background of the theoretical model of stakeholders to consider sustainable and innovative regional governance. It is assumed that in the section 3 cities are stakeholders for the corporation and that the mechanism to control corporate contribution is presented. We argue in the section 4 that positive stakeholders activate network effect and that increased pressures of negative stakeholders sometimes threat the sustainability of community ³.

2.Social Cost of Corporation in the Stakeholder Society

Multinational corporations decide the production sites according to their own cost and benefit analysis. The costs and the benefits evaluated by the corporations are not necessary to include social costs and benefits in the local communities properly. Since the total profits are estimated to be extremely large in the global market, corporations transfer production sites to aim advantages in compititon. Some spatial features sometimes turn into advantages and bring great benefits to the adaptable corporation in the presence of furious global competition.

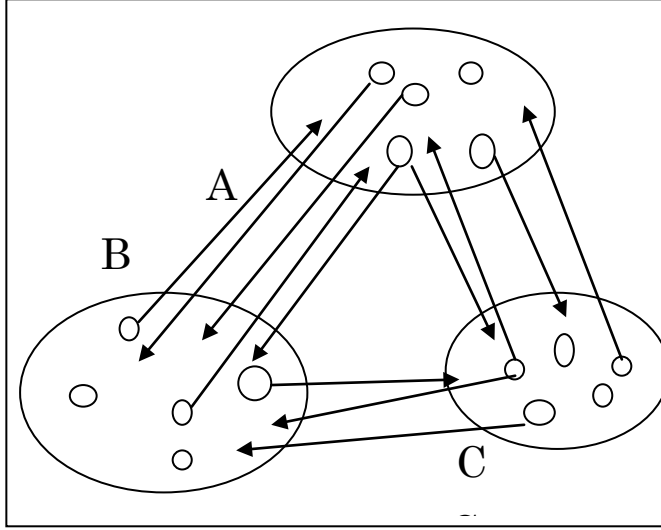
³ A part of this paper is the translation of Japanese paper Tanaka(2011).

The regional network effects could be an eminent factor to yield the relatively high profit to the entrants. The exceeding benefits are a source of the competition and accelerate the movement of production site. Frequent transfer of the corporation creates confliction with the local community such as employment problems and needs a large amount of social investment to satisfy the request of the newly entrancing corporation. The imbalances between the cost estimated by corporation and the actual social cost cause market failures. In the globalized society the governmental intervention to the markets becomes to be less effective than the before. The vitalization of network effects is an effective policy not only to prevent market failures but also to improve regional sustainability from the point of the both local and international concerns. This paper demonstrates this policy mechanism by employing a theoretical model of Tanaka (2004) and (2009).

In the global network society not the county but the city or region presents an advantage. Network effects are source of advantages and index of competition. Figure 1 exhibits the shaping process of the global city ⁴. Circles in the figure show the sites of corporation and arrows indicate movement of the sites seeking network effects.

⁴ Friedmann(1986) ,Taylor et al.(2007) and others focus on core function in the global network of cities .

The figure expresses that city B develops the function of core in global net work constructed by city A, B,C.



Source: Tanaka (2010)

Figure 1 Shape of global city

To start our investigation we introduce the model first. It is assumed that multinational corporations must decide production site in the multi-stakeholders communities. The number of stakeholders is supposed to be n . The stakeholders include regional governments, relating corporations and residents and others. The production activity and private profit of a corporation are denoted by x and $\Pi(x)$. Although the corporation aims to maximize profit, each stakeholder receives benefit or cost from the activity x . It is assumed that stakeholders influence the corporation for their own benefits by employing cooperative or hostile means such as advantageous industrial policies and boycott of consumers. The

corporation must inform and answer not totally but partially the needs of stakeholders to manage sustainably. It is supposed that the corporation spends payment t_i for each i out of n stakeholders. The total amount of payments t is denoted by

$$t = \sum_{i=1}^n t_i.$$

The stakeholder i seems to refer t_i as a payment. The stakeholder i decides correspondence to the corporation according to evaluation by i , $V_i(x, t_i)$.

The stakeholders are classified by positive stakeholders and negative stakeholders. The positive and negative stakeholders are defined to satisfy

$$\frac{\partial V_i}{\partial x} \geq 0 \quad \text{and} \quad \frac{\partial V_i}{\partial x} < 0.$$

The total social evaluation is expressed by

$$\sum_{i=1}^n V_i(x, t_i).$$

The total social evaluation influences the tax or regulative policies for the corporation. When the corporation knows the evaluations of stakeholders perfectly, it could manage the social risk effectively. However, asymmetric information is supposed to exist between the corporation and the stakeholders. The corporation is assumed to obtain the rate δ of the

valuation. δ is named by altruistic coefficient. The corporation should communicate with stakeholders seriously to obtain their evaluations. Publicity and accountability of the corporative management seem to improve δ , ($1 > \delta > 0$). If the condition of communication is arranged well, stakeholder i makes an effort y_i to contribute on increase of δ by arranging standard or code of the corporation directly. It is supposed that δ is increasing function of total contribution of stakeholders $y (= y_1 + \dots + y_n)$. If function δ is differentiable, inequality $\delta'(y) > 0$ is satisfied.

It is assumed that the corporation maximizes the social net benefit expressed by (1) to achieve sustainability. The expression (1) was formulated firstly by Tanaka(2004). α_i , ($\alpha_i > 0$) is the targeting evaluation value of the corporation with regard to stakeholder i .

$$NB = \Pi(x) + \delta(y) \sum_{i=1}^n \{V_i(x, t_i) - y_i\} - t - \sum_{i=1}^n \Phi_i(\alpha_i - V_i(x, t_i)), 1 > \delta > 0. \quad (1)$$

The corporation is supposed to decide the production activity x and payment t_i for stakeholders $1, \dots, n$ to maximize social net benefit. As Φ_i is a differentiable increasing function of $\alpha_i - V_i$, inequalities $\Phi'_i > 0$ ($1, \dots, n$) are satisfied. It is assumed that the following inequalities hold ⁵. $\Phi_i \leq 0$ for positive stakeholders, $\Phi_i > 0$ for negative

⁵ Tanaka(2009) define the risk coefficient by a positive

stakeholders.

The first order equations of social net benefit with regard to the corporation are stated by

$$\frac{d\Pi}{dx} = \sum_{i=1}^n -\left(\delta + \frac{d\Phi_i}{d(\alpha_i - V_i)}\right) \frac{\partial V_i(x, t_i)}{\partial x}, \quad (2)$$

$$1 = \left(\delta + \frac{d\Phi_i}{d(\alpha_i - V_i)}\right) \frac{\partial V_i}{\partial t_i}, i=1, \dots, n. \quad (3)$$

The conditions (2) and (3) imply following relations. Function Φ_i is given by the outside of the corporation. $\alpha_i - V_i$ represents an index of dissatisfaction of stakeholder i about the activity of the corporation. The larger the value $\alpha_i - V_i$ grows, the more conflicts between stakeholder i and the corporation are likely to happen. As $\alpha_i - V_i$ becomes a large value case, the corporation is trend to be sued by many groups such as citizens and laborers.

$\frac{d\Phi_i}{d(\alpha_i - V_i)}$ shows the weight to the variation of evaluation transferred as marginal cost or marginal benefit to the corporation. And $\frac{d\Phi_i}{d(\alpha_i - V_i)}$ is refereed as risk coefficient to notice the negative impact on social cost of corporation activities.

3. Corporate contribution to clear the requirements in

constant.

Cities

Corporation may not only have a possibility to vitalize cities but also burden large social cost of infrastructure, congestion and environmental problems. Global cities select globally suitable corporations among many applicants. Multinational corporations compete with others in location and decide the production site among many profitable cities. The optimal conditions (2) and (3) make clear relation of prosperity and decline of cities and transfer of production sites in multinational corporation.

Policies of cities to corporate contribution are investigated to some extent by considering (3) as follows. (3) is transformed into

$$\frac{\partial V_i}{\partial t_i} = \frac{1}{\delta(y) + \frac{d\Phi_i}{d(\alpha_i - V_i)}}, i=1, \dots, n. \quad (4)$$

(4) implies that increase of altruistic coefficient or enhanced risk coefficient lowers the value of (4) and induces corporation to offer more payments for stakeholder i . The corporation uses the risk coefficient as a signal to determine contributions to local communities. The risk coefficient is altered by both internal efforts and external changes of the corporation. Regulation and change of tax system transform the function Φ_i . On the other hand, that the corporation increases contributions to the regional communities increases the risk coefficient, and is effective

to lower marginal external cost.

Using (4) we can analyze local governmental policies to accept or to reject corporation. To simplify the analysis stakeholder 1 and 2 are assumed to be two cities where the corporation operates management. The two cities play different roles such as production core, research center and market. The corporation contributes t_1 and t_2 to communities of city 1 and 2.

The relation explained above is illustrated by Figure 2. In the first the right hand of (4) is given by the identical line BE. The contributions to city 1 and 2 are showed by the length BC and BD. City 1 dissatisfies that the contribution is low. It seems not to hope that the corporation continues activities. If the corporation recognizes the importance of city 1, it must accept requirement from local government such as tax burden and strict regulation or contribute voluntarily to alter the risk coefficient moving the line BE to FI. Consequently, the corporation increases contribution to FH which becomes greater than FG, contribution in city 2. As the difference between BD and FG in the contribution of city 2 is smaller than the counterpart in city 1, the corporation would not respond effectively on the introduction of city 2. The corporation clears the survival conditions of city 1 more successfully than city 2.

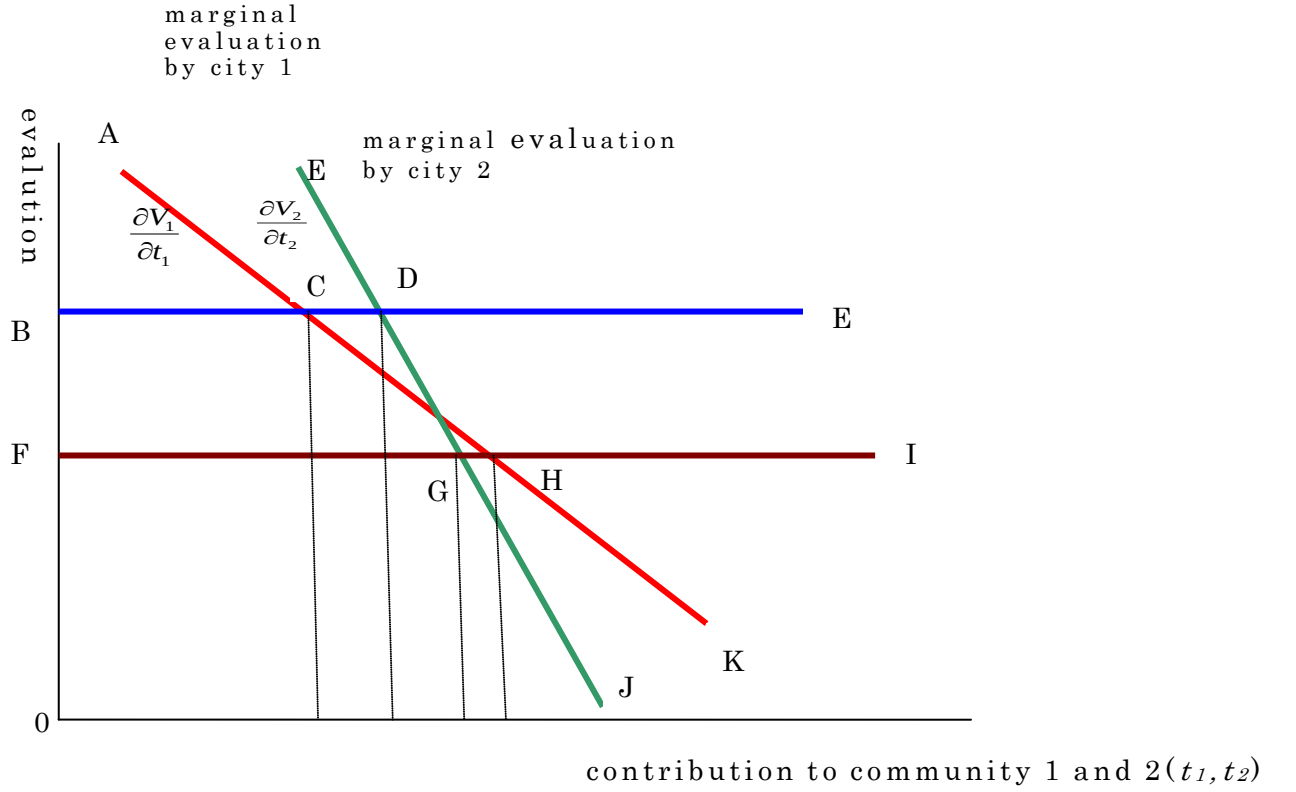


Figure 2 Contributions and communities

4. Inner and inter regional network effects

Multinational corporations search advantageous cities for their activities globally. Many cities compete with others to invite firms. This paper demonstrates that network effects in cities are key factors in the competition among cities by using a theoretical model. To consider network effects we need the following assumptions. n stakeholders in (3) are classified into n_1 negative stakeholders and n_2 positive stakeholders. (3) is replaced by

$$\frac{d\Pi}{dx} = \sum_{i=1}^{n_1} -(\delta + \frac{d\Phi_i}{d(\alpha_i - V_i)}) \frac{\partial V_i(x, t_i)}{\partial x} + \sum_{i=n_1+1}^{n_1+n_2} -(\delta + \frac{d\Phi_i}{d(\alpha_i - V_i)}) \frac{\partial V_i(x, t_i)}{\partial x}. \quad (5)$$

Reminding the definition of negative and positive stakeholders, the first term in the right hand of (5) is positive and the second term is negative. When n_2 is greater than n_1 , the city could vitalize the activity of the corporation. As the scale of city enlarges, diversity in interests of citizens tends to increase. In this condition, the number of negative stakeholders n_1 exceeds probably the number of positive stakeholders n_2 .

Global corporations could not restrict activities inside a particular city. While the corporations prevent negative stakeholders from increasing, they enlarge the cooperation with positive stakeholders inhabiting both inside and outside the city. The corporation utilizes effectively networks spreading globally. The network effects are formulated as follows. The corporation which locates core facilities in city j is supposed to obtain the network effect N_j . The network effect is the results by the cooperation of n_j positive stakeholders. The net positive stakeholders involved in the network effect are denoted by $i(= n_1 + n_2 + 1, \dots, n_1 + n_2 + n_j)$. The network effect is

defined by

$$N_j(n_j) = \sum_{i=n_1+n_2+1}^{n_1+n_2+n_j} -(\delta + \frac{d\Phi_i}{d(\alpha_i - V_i)}) \frac{\partial V_i(x, t_i)}{\partial x}. \quad (6)$$

When network effect works (5) is rewritten by

$$\frac{d\Pi}{dx} = NMC(n_1) + PMC(n_2) + N_j(n_j). \quad (7)$$

n_1, n_2, n_j are determined by the feature of city j . Each city has a distinct net work effect on machinery, food, financial industries and so on. $N_j(n_j)$ is given by the positive stakeholders outside of the corporation. Network effects arise from a limited area and large scale consumer markets. To distinguish the two types of network effect, we use inner network effect N_j^i or outer network effect N_j^o . The source of N_j^i is illustrated as traditionally accumulated knowledge in the particular region. Convenient access for the global market from the city shapes a source of N_j^o . The above relation is stated formally by

$$N_j = N_j^i + N_j^o.$$

$NMC(n_1)$ states marginal external cost evaluated by negative stakeholders. $PMC(n_2)$ exhibits the external benefit except for network effects by the positive stakeholders. The increasing scale of city enlarges both types of stakeholders but brings about many social problems such as environment, residential price, traffic congestion and deficient social capital. The social problem turns many indifferent citizens negative stakeholders and adds burden to the local government. The large scale cities

constrain seriously negative stakeholders. The activities of corporations in the large city are restrained, so corporations selected competitively by the local community. The corporation exhibiting great network effect takes advantage in the selection. But some small scale cities need not to care about increase of negative stakeholders relatively, but could estimate accurately contribution of particular corporation on the local community. The corporation emitting pollutants is induced to move out from large cities, but the local city evaluates contribution of budget and employment in local community accepts positively it.

The theory of stakeholders develops investigation on competition and network effect in cities. It is assumed theoretically that there is a set of n_1^*, n_2^* to minimize total marginal external cost (5). For city j , n_j, n_1^*, n_2^* are defined to satisfy

$$\frac{d}{dn} \{NMC(n_1^*) + PMC(n_2^*)\} = 0 \quad \text{for } n_j^* = n_1^* + n_2^*, \quad (8)$$

$$\frac{d}{dn} \{NMC(n_1) + PMC(n_2)\} < 0 \quad \text{for } n < n_j^*, \quad (9)$$

$$\frac{d}{dn} \{NMC(n_1) + PMC(n_2)\} > 0 \quad \text{for } n > n_j^*. \quad (10)$$

The definition (7) to analyze network effects illustrates competition and cooperation among corporations and

cities by Figure 3 and 4. The network effect N_j lowers the marginal external evaluation of positive stakeholders in (5).

Before the network effect arises, the social marginal cost of negative and the positive stakeholders are depicted by 0A and OF. Consequently, social net marginal cost is

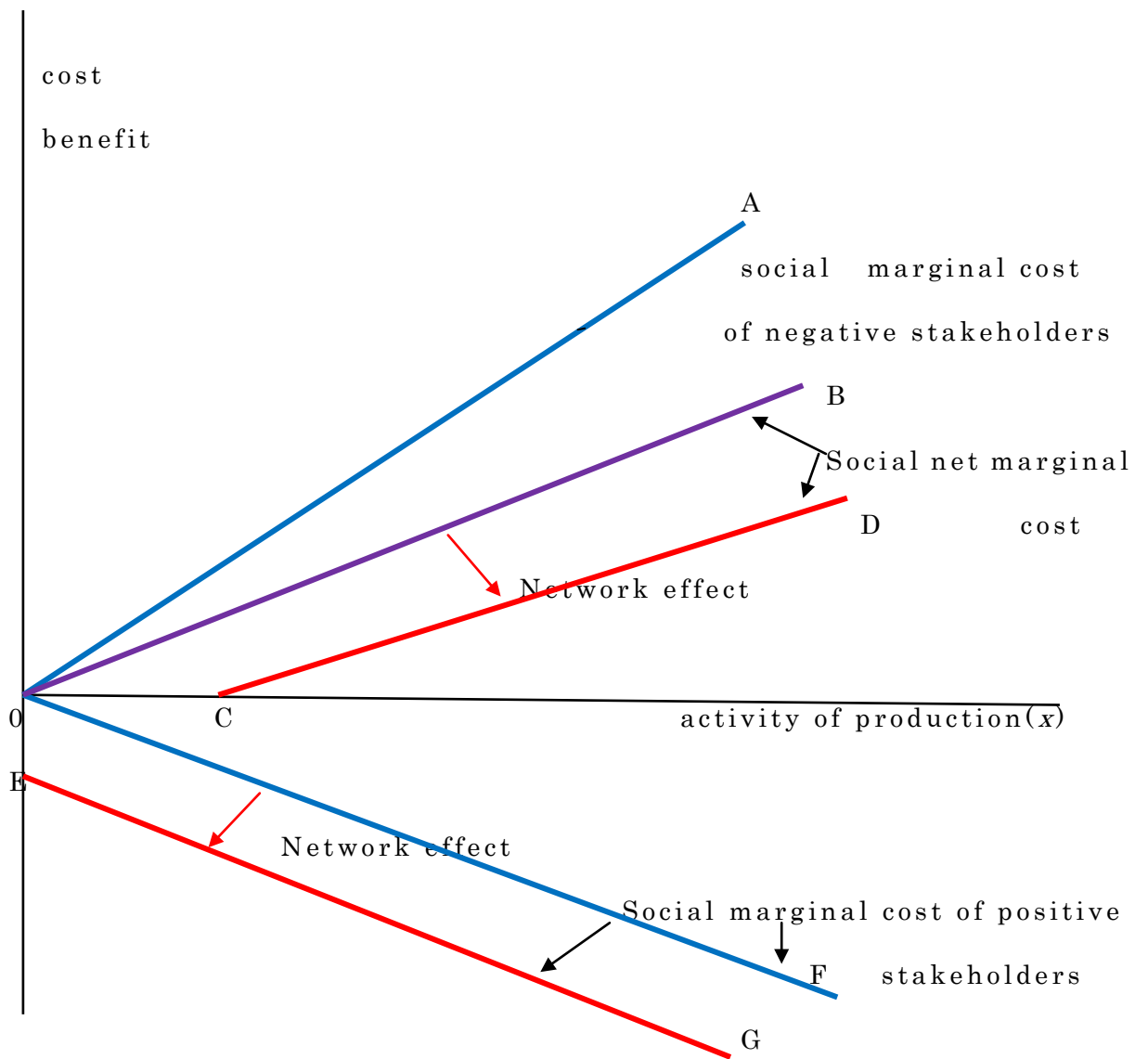


Figure 3 Marginal net external cost and network effects

showed by 0B. The network effect N_j moves the social marginal cost curve of positive stakeholders 0F to EG, so shifts social net marginal cost curve 0B downwardly to curve CD. Consequently we demonstrate the following proposition with regard to network effect by employing Figure 4.

Proposition 1. The corporation could have advantages in competition of location by utilizing the network effect.

We consider how network effects influence competition of corporation A and B. In any city of 1 or 2 Figure 4 exhibits the relation of network effects and competition of the two corporations. To simplify the analysis each city accepts one of the two corporations as the result of competition. Marginal benefit curves of A and B are depicted by CM and EL. Social net marginal cost at the particular city is supposed to be identical for the two corporations. A and B compete with each other for the location in the city. The network effect in the city brings about A increment of surplus by the area of G0KI. Surplus of B increases by the area of H0KJ. A takes advantage by surplus of area GHJI over B. A is expected to defeat B in the location competition of the city.

Although Tanaka (2011) considers many types of

network effects in the case of Tokyo, the simplified model of two corporation and two cities implies a theoretical analysis on the sustainability strategy of cities. Combining Figure 2 and 4 together, the simple model study makes clear a mechanism of competition and sustainability in cities.

The corporations are obliged to select one city between two cities 1 and 2. And we must consider the two cases. In the first city expressed in Figure 4 is city 1. Secondly, the city depicted in Figure 4 is city 2. We investigate the first case. Corporation A is willing to locate production cite in city 1 to attain network effects. Corporation B defeated by the competition with corporation A moves to city 2.

Responses of city 1 and 2 are illustrated by using Figure 2. At initial marginal evaluation BE city 1 disappoint at the contribution of A on the community expressed by point C. City 1 requires that A should accept the policy to rise the contribution to move point C into point H. Corporation A does not only need to defeat the rival corporation B, but also rise contribution to the requirement of city 1. On the contrary, city 2 is willing to accept B because contribution of B indicated by point D is permissible. On the high evaluation of contribution to the local community corporation B defeated by A in location competition of city

1 can construct firm production site in city 2.

In the second case corporation A makes advantages by locating in city 2 and corporation B is situated in city 1 by the competition. City 1 induces corporation A to increase contribution by lowering curve BE to FI. But the effect which is measured the gap between FG and BD is relatively small. At the first city 2 accepts corporation A reluctantly. However the increment of the corporations which are not enough to contribute on local community may causes the social cost in the future. Accumulating social cost increases the conflicts in regional governance. The city 2 become to own sustainable strategy independent of competition in the global market. That is city 2 restrains the activity of the corporation to prevent negative stakeholders from increasing. On the contrary policies of city 1 increase the contribution of corporation B by the relatively large gap between FH and BC. City 2 could construct a cooperative relation with less competitive corporation B to attain regional sustainability.

The above discussion we argue that Proposition 2 provides reasonable principles for regional sustainability.

Proposition2. In the long term sustainable regional policies aim to construct cooperative regional communities

in dependent of competitive mechanism. Policies to restrain increment of negative stakeholders require corporation to increase contribution on the local community.

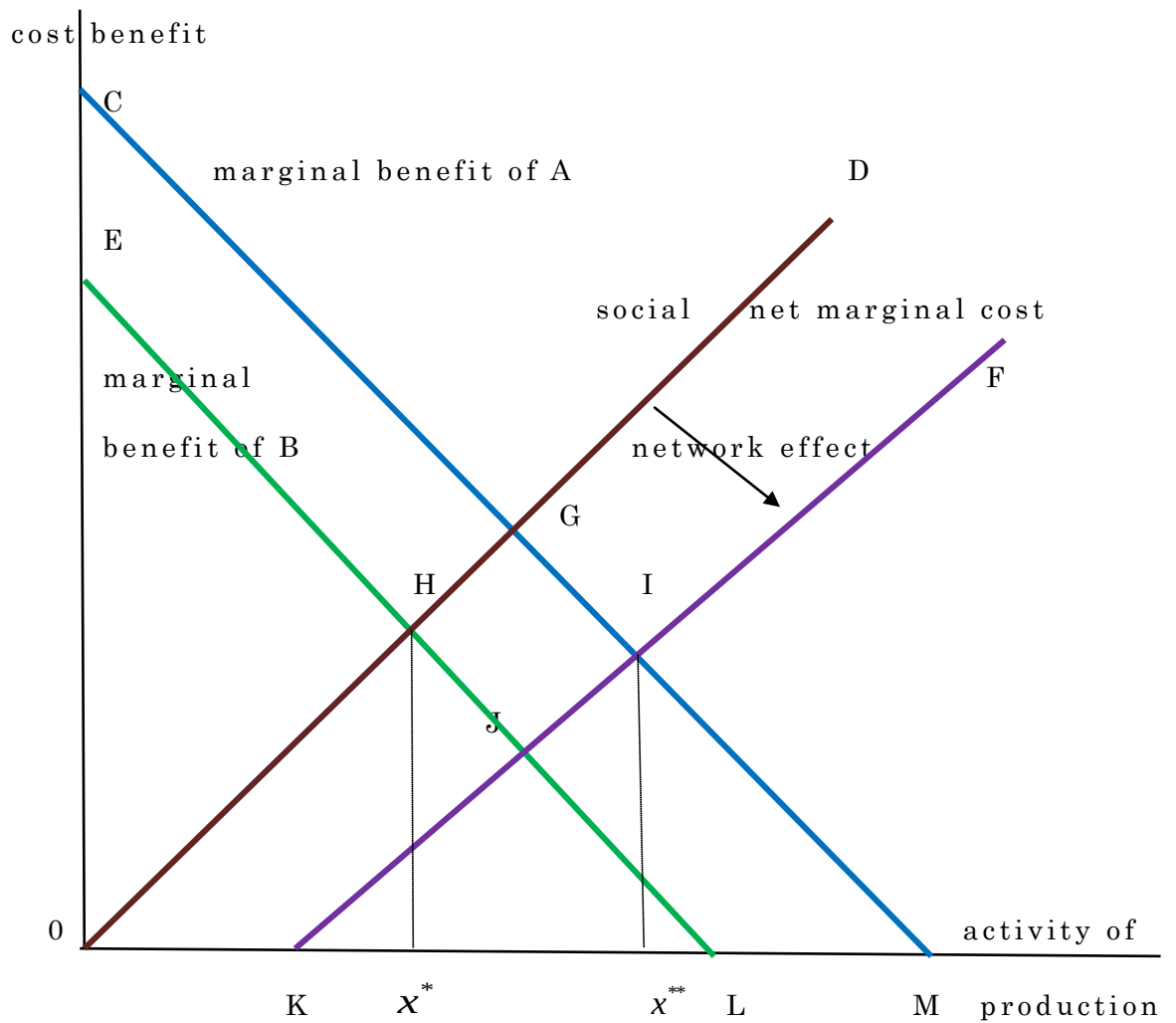


Figure 4 Competition of location and corporation

In the first case dominant city 1 in global competition is expected to obtain a large network effect which occurs in financial, intelligent and other industries. These

industries are supposed to exhibit both inner and inter network effects. In the second case shows that the win-win relation could not prevail eternally. The less competitive city 1 among cities is suitable for industries with limited network such as manufacture. This type of industry may express either of inner or inter network effects. Some sustainable strategies of regional governments appear to use the restricted networks to construct intensive cooperative relationships between public and private.

5. Concluding remarks

Global society is formed by two types of network, inter and inner network of cities. Enlargement of global network enhances competition involving corporations and cities. Financial and intelligent industries attain an exceeding profits by activation of large scale network. Competition in the global scale implies the promotion of innovation. Network effect in manufactures is important factor of innovation and adds the advantage to the city for entrance of corporations. Cities could not obtain sustainability only by the competition of market mechanism. Global network accumulates negative stakeholders in the city and causes indirectly large amount of burden to the city such as urgent needs of social capital and unemployment policies. Competitive

corporations are not necessary to contribute local community sufficiently. Market mechanism could not solve regional problems at once, and leaves intricate problems each regional community ⁶. Activation of network and to decrease the influence of negative stakeholders are significant indicators to attain sustainable governance in cities. The theoretical framework by Tanaka(2009) could provide effective tools for sustainable governance.

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