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An Analysis on the Economic Effects of Inter-Korea Forest Cooperation Project

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Abstract

For the last 10 years, there were also a lot of exchanges and cooperations between North and South Korea's local governments. Dealing with these exchanges more systematically, local governments had issued many regulations. But in the law level, the current laws regulating exchanges and cooperations between North and South Korea lacked care in the role of local governments in the course of Korea reunification. Therefore, it is necessary to redesign the legal system to support and promote the role of local governments in unification affairs. The purpose of this study is to seek answers to a question how the Inter-Korea forest cooperation project effect on regional economy compared with other forest sectors. Results of this study proved that Inter-Korea forest cooperation project effects on regional economy positively as 'plus investment', not negatively. Forest cooperation project will be resolve Inter-Korea conflicts more peacefully. So government should be supported continuously in the long run in order to raise the performance.

Key Words: economic effects, cooperation project, investment, inter-Korea

Introduction

South-North Korean forest cooperation project has a significance in many aspects such as political, economical, and social sectors etc. Primarily, it is helpful for the support targets of North Korean and North Koreans as well as for us who provides such assistance. In addition, at the level of South-North relations, the afforestation support for North Korea forest may be evaluated as positive. In other words, our reunification agenda is the three-step national community unification following reconciliation/cooperation, unification of South-North, and the foundation of unified country, among which the afforestation support for North Korean forest could be the important foundation to promote the reconciliation and cooperation of South-North. In particular, the afforestation support for North forest would

be necessary in the meaning to prepare the post-unification of South-North in the long run.

However, the past cooperation agenda has been of simple assistant projects and neglect of post management etc, which showed the disadvantages of economic loss and ineffectiveness. Accordingly, refraining from the value-justification project within the budget designated by the central government and by analysing the economic ripple effects and production-inducement value, and employment-inducement value etc, we have to campaign the agenda for coexistence.

This research purports to analyze the economic ripple effects and to establish the fundamental data for the integrated and efficient afforestation cooperation project of South-North, and to be used for the references to the South-North afforestation cooperation projects during the

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working-level talks between the persons in authorities, by reflecting the budgets and project terms etc of North Korean projects conducted by Gangwondo and Gyeonggi-do.

Materials and Methods

Overview of North Korean forest

North Korea has been aggressively using the forest and natural resources which accounted for 80% of the country since its foundation. In order to recover the damages from the Japanese regime and the Korean war, it directed to maximize the economic function of forest and to make use of its forest, and set up the system that the government and social organizations are to develop and use/manage the forest. However, the destruction of its forest has been accelerated due to the negligency in governmental supports for the development and management of the forest and the encouraged formation of mountain side fields caused from the shortage of farm lands. Moreover, since 1990s, the severe economic deterioration has fostered the development of small-area fields and for living and destroyed the forest in large scale by the indiscriminate harvest of firewood, which we think it has the limitations that such destruction may not be able to be restricted and restored by itself (Table 1).

South Korean's interest - who has been sharing the environment of the Korean peninsula - in the restoration of degraded North Korean forest is not only beyond the simple support for North Korea and to prepare the base of countermeasures against the energy and economy crisis of North Korea by breaking up the chain of forest degradation → farmland devastation → shortage of foods, but also to build up the foundation of pleasant environment of the homeland after reunification.

Even though there lie a lot of difficulties due to the uncertainty caused by the changes of South-North relationships, the characteristics of Gangwondo and Gyeonggi-do requires the leading roles to establish the directions for the development of the integrated forest/forestry for the Korean peninsula after reunification through the forest policy considering the restoration of the devastated forest in North Korea.

Status of the cooperation in forest between South-North

Recently, the interest and research on the forest project have been actively proceeded between South-North in order to improve the relations and cooperations of South-North. Our government has more interests in the support for the afforestation project of North Korea. For example, our government had executed in the amount of about 1.8 billion won out of the South-North cooperation fund for the support of the forest pest control in the vicinity of Pyongyang in 2007 (Ministry of Unification 2008). NGO's support for North Korean forest has also made, for example, in the name of the afforestation etc through the pacific forest, about 402 million won of inter-Korean-cooperation fund has been executed by 2008. Our local governments have interest in the afforestation of North Korea and supported a lot. Gyeonggi-do agreed with North Korea to promote the business of tree nursery foundation in the size of 9 hectors in the area of Gaepoondong, Gaeseong city in Sept 2007, which had been proceeded for 5 years from 2007 to 2011 and targeted to produce annual 1.5 million nursery trees enabling to plant the areas over 5 million hectors (Kim 2010). Gangwondo had also signed the cooperation agreement between South-North Gangwondo by the representa-

Table 1. Trends in the North Forest degradation through the satellite image analysis (Unit: 10000 ha)

| Classification | Forest area | Timber forest | Degraded forest | | | |
|-----------------------|-------------|---------------|-----------------|-----------------|--------------------------|-----------------|
| | | | Sub-total | Reclaimed hills | Grassland without forest | Unimproved land |
| 1999 | 916.57 | 753.40 | 163.17 | 97.20 | 53.35 | 12.62 |
| 2008 | 899.25 | 615.45 | 283.80 | 132.20 | 141.33 | 10.27 |
| Increase/decrease (△) | △17.32 | △137.95 | 120.63 | 35.00 | 87.98 | △2.35 |
| Ratio | △2% | △18% | 74% | 36% | 165% | △19% |

Source: Park Kyung Suk (2013). Status and policy of forest in North Korea, Korea Rural Economic Institute.

tives visiting Wonsan and Pyongyang, the joint pest control project was included in the South-North cooperation projects (Table 2).

Over the past 10 year, a total of approximately 8 billion won costs has been invested from the private level and local governmental level, however, no effects or policy proposals in accordance with such efforts have not been visualized.

Ripple effects of regional economies by the project propulsion

In order to analyze the economic ripple effects of forest resources in the areas of Gangwondo and Gyeonggi-do, I calculated the input output model by using the regional input output table of Bank of Korea in 2011, and through it, analyzed the production inducement effect, added value inducement effect, and employment inducement effect etc. Input output model is value-neutral different from the cost-benefit analysis and multiplier model, and the value evaluation is limited to the aggregation specification, and in connection with the national accounts, there is an advantage to use the high qualitative data out of the materials about the whole economy (Fletcher 1989).

In the input output model, the flow from i industry to j industry entirely depends upon total production of the in-

dustry, and in order to explain such relations, the amount inputted to produce 1 unit of product or service of j industry is to be shown as input calculation coefficient $a_{ij} = \frac{X_{ij}}{X_j}$, and such set of coefficients is to be displayed as input calculation coefficient matrix A . As the production amount of j industry is established its relationship with the intermediate inputs of the relevant industry (X_{ij}) and total demands in the household area (D_j), that is, as such relations against all j for $X_j = a_{i1}X_{1j} + \dots + a_{in}X_{nj} + D_j$, if it is shown as a matrix, it will be $(I - A)X = D$. Ultimately, the production amount to be produced in each industry could be shown as $(I - A)^{-1}D$. Herein, $(I - A)^{-1}$ is called as Leontief inverse matrix or multiplier matrix, and is the final demand vector.

Value added is the sum of remuneration that employees is to receive being engaged in the production activity (income) and the operation profit of the concerned enterprises, fixed assets depreciation, indirect taxes, and subsidies etc, and in the input out model, it will be the exogenous input sector, and the output multiplier means the calculated amount of the whole industry directly and indirectly caused in order to satisfy the final demand 1 unit for the output of a certain industry.

Production inducement coefficient is represented by

Table 2. Status of South-North forest cooperation project

| Classification | Project | Subject | Executed amount | Remark |
|--------------------------|---------------------------------|---|---------------------------|--|
| Private level | Afforestation project | Pacific forest | Total of 0.4 billion won | Inter-Korean cooperation fund |
| | | Korean Council For Reconciliation and Cooperation | Total of 1.3 billion won | |
| | | Korean's forest | Total of 2.55 billion won | |
| | Support for heating | Korean's shoulder to shoulder | Total of 0.63 billion won | |
| | | South-North Korean missionary | Total of 0.25 billion won | |
| | | Briquette sharing movement | Total of 0.32 billion won | |
| Local governmental level | Support for forest pest control | New millennial life movement | Total of 0.14 billion won | |
| | | Service for peace | Total of 0.12 billion won | |
| | Foundation of nursery trees | Gangwondo | Total of 2 billion won | Pine Gall fly control chemicals and material support (2001~2007) |
| | | Gyeonggi-do | Total of 0.36 billion won | Foundation of nersery trees in Gaeseong area along with mutual support movement of our nations (2007~) |

Source: Hwang Byung Il (2011), 10 years white paper of local governmental transactions with North Korea, Reunification research center of Ewha university.

$O_j = \sum_{i=1}^n b_{ij}$ and herein, b_{ij} means the element of multiplier matrix $(I - A)^{-1}$. Production inducement coefficient is configured of the sum of direct effects and indirect effect, and the direct effect is the sum of all the elements of the concerned sector column of technical coefficients matrix plus the initial change 1, and the indirect effect is the sum of the cumulative indirect changes to be calculated as the sum of the sector column corresponding to matrix $(I - A)^{-1} - (I + A)$.

Value-added inducement coefficient represents the change of final demands to a certain industry impacting the effect to value-added, the value-added inducement coefficient $V_j = \sum_{i=1}^n \frac{V_i}{X_i} b_{ij}$: herein V represents, i total value-added by the sum of the payment (income) of the employees engaged in the production activities of the industry and the operation profit of the concerned enterprises, fixed assets depreciation, indirect taxes, and subsidies etc.

Diagonal matrix of this value-added coefficient $\left(\frac{V_i}{X_i}\right)$ is multiplied by the production inducement coefficient to make the table of value-added inducement coefficient and to create the value-added inducement effect by industry.

Employment effect means the total employment change in the whole economy in accordance with the change of the employment 1 unit directly in a domestic production sector, and the employment multiplier (K_i^L) of a domestic industry is expressed as total employment effect $\left(\sum_{i=1}^n \frac{L_i}{X_i} b_{ij}\right)$ induced directly and indirectly from the change of the final demand 1 unit for j industry, and herein L_i represents the total employment amount of i industry sector.

Using the input output model and comparing the ripple effects by each area and other projects, the economic effect of South-North forest cooperation project is classified and analyzed into the production inducement effect, value-added inducement effect, and employment inducement effect, and was tried to be used as the justification and realistic countermeasure to face with the future South-North forest cooperation projects.

Anterior associative effect

In the industry associative effect, the assessment of anterior associative effect and posterior associative effect pro-

vides significant criteria to select the leading industry of a unit economy. In other words, the more industry has a big anterior and posterior associative effect, the bigger the change of such industry will affect the ripple effect on the whole economy. Anterior associative effect represents the effect on a certain industry when the final demand on the products of all industry sectors takes place in each unit, and it is represented as the sensitivity coefficient α_i , compared the sum of the column of production inducement coefficients in the industry with the average of the whole industry.

Sensitivity coefficient is the coefficient representing how much the anterior associative effect would be in the form of the relative size against the average of the whole industry, which is calculated by dividing the sum of the column of production inducement coefficients of the industry by the average of the whole industry.

$$\alpha_i = \frac{\frac{1}{k} \sum_{j=1}^k b_{ij}}{\frac{1}{k^2} \sum_{i=1}^k \sum_{j=1}^k b_{ij}} \text{ (sensitivity coefficient)}$$

but, b_{ij} : matrix element of production inducement coefficient

Numerator of above formula is the average element value of production inducement coefficient matrix of i , which represents if a the final demand on a random domestic production i industry is changed by 1 unit, how much the product of industry will be purchased by other domestic production industries in average. Denominator is the average value of all the elements of production inducement coefficient matrix, which represents how many intermediate input products an industry sells to other industries in average in terms of the whole economy.

Accordingly, sensitivity coefficient represents how much or how less the products of the concerned industry would be purchased as the intermediate input products of the other industries. If $\alpha_i > 1$ is, it means the products of such industry are more purchased as the intermediate inputs than those of average industry and to be classified as the industry having a big anterior associative effect. In general, the industries having big anterior associative effects are the industries of which products are widely used as the intermediate products for each industrial sectors such as food and beverage, textile and leather products, wood and paper

products, printing publication and replication, chemical products, non-metallic mineral products, metal products, general machinery, electrical and electronic precision instruments, furniture and other manufactures, and transportation and storage business etc.

Posterior associative effect

Posterior associative effect represents the effect on the whole industry when the final demand on the products of all industry sectors takes place in each unit, and it is represented as the influence coefficient compared the sum of the column of production inducement coefficients in the industry with the average of the whole industry. The influence coefficient β_j of a random domestic industry j can be obtained in associated with the sum of the sector column of production inducement coefficients matrix.

$$\beta_j = \frac{\frac{1}{k} \sum_{i=1}^k b_{ij}}{\frac{1}{k^2} \sum_{i=1}^k \sum_{j=1}^k b_{ij}} \text{ (Influence coefficient)}$$

but, b_{ij} : matrix element of production inducement coefficient

Numerator of above formula is the average element value of production inducement coefficient matrix of, which indicates if a the final demand on a random domestic production industry is changed by 1 unit, how much intermediate products an industry will in average buy the other domestic production industries to meet this. Denominator is the average value of all the elements of production inducement coefficient matrix, which represents how many intermediate input products an industry will in average buy from other industries in terms of the whole economy.

Accordingly, influence coefficient indicates how much more or less the concerned industry will buy the intermediate inputs from other industries compared to the average industries. If is $\beta_j > 1$, it means the industry buys the intermediate inputs from other industries more than the average industry and to be classified into the industry with big posterior associative effect.

In general, the influence coefficient becomes larger in the industries with big production inducement effect such as textile and machinery products, 1st metal, and general machinery etc.

Results and Discussion

Ripple effect on the local economy in Gyeonggi-do

Targeting 28 industry sectors by major classification, industrial LQ (Location Quotients) is obtained based on the number of employees in Gyeonggi-do area, and by using the input output analysis table based on SLQ method (Simple Location Quotient Method), the economic ripple effect was analyzed. Such required budget were distributed by industry (Based on the industry associative table, major classification 28 sectors) in accordance with the characteristics of expenditures. In case of South-North forest cooperation project in Gyeonggi-do, it is planned total of 18 billion won project budget will be invested from 2015 to 2018, and the transaction project of South-North forest cooperation is classified as the final demand of agricultural fishery and forest products (industrial classification 1). Production inducement coefficient indicated the production inducement effect in Gyeonggi-do as 69.9 billion won in size if 18 billion won will be invested for South-North forest cooperation project, the value added inducement effect indicated as 49.6 won in size. Employment inducement coefficient was shown, if 18 billion won will be invested, the employment inducement effect as 194 persons (Table 3).

Ripple effect on the local economy in Gangwondo

In case of South-North forest cooperation project in Gangwondo, it is planned that total of 10 billion won of project budget will be invested from 2014 to 2017, and same as in Gyeonggi-do, South-North forest cooperation project was classified into the final demand of agricultural, fishery and forestry products (industrial classification 1). The production inducement coefficient was shown that the production inducement effect was 38.8 billion won in size, and the value-added inducement effect was 27.6 billion

Table 3. Economic effect of South-North forest cooperation project in Gyeonggi-do (Unit: 1/10 billion own, person)

| Classification | Inducement coefficient | Ripple effect |
|-------------------------------|------------------------|---------------|
| Production inducement effect | 3.875096 | 698 |
| Value-added inducement effect | 2.755199 | 496 |
| Employment inducement effect | 10.79980 | 194 |

won impacting Gangwondo areas. The employment inducement effect indicated as 108 persons (Table 4).

As a result of comparative analysis on the ripple effects by industry using the forestry resources in the areas of Gangwondo and Gyeonggi-do, the economic ripple effect of South-North forest cooperation project was considered as the second highest to the restoration project of mountain line network. South-North forest cooperation project was shown its production inducement effect and employment

inducement effect represented high compared to the investment. When it comes to the forest cooperation project, through the long-term and constant investment as well as the support in terms of policy and continuity, the external South-North conflicts and economic ripple effects could be enhanced (Table 5).

South-North forest cooperation project has been set up based on the input output model, and its effect could be changed in accordance with the changes in policy or budgets etc. However, compared to the other general projects, this South-North forest cooperation project will be a great help for the local economy and development (Table 6).

In addition, in case of agricultural, forestry and fishery food industry in Gangwondo and Gyeonggi-do, the anterior and posterior associative effects were indicated as more than 1, and the ripple effect to the local economies were analyzed as great in the local afforestation project.

Table 4. Economic effect of South-North forest cooperation project in Gangwondo (Unit: 1/10 billion won, person)

| Classification | Inducement coefficient | Ripple effect |
|-------------------------------|------------------------|---------------|
| Production inducement effect | 3.875096 | 388 |
| Value-added inducement effect | 2.755199 | 276 |
| Employment inducement effect | 10.79980 | 108 |

Table 5. Ripple effect by the local economy project utilizing the forest sources

| Classification | Project title | Ripple effect | | | Industrial association table |
|----------------|---|---|--|---------------------------------------|--|
| | | Production inducement effect (1/10 billion won) | Value-added inducement effect (1/10 billion won) | Employment inducement effect (person) | |
| 1 | Fusion city park pilot project | 688 | 476 | 208 | Agricultural, fishery and forestry products (industry classification 1) |
| 2 | Mountain line network restoration afforestation | 2,850 | 2,502 | 732 | Agricultural, fishery and forestry products (industry classification 1) |
| 3 | Forest corridors | 394 | 438 | 105 | Agricultural, fishery and forestry products (industry classification 1) |
| 4 | Transaction project of South-North forest cooperation | 1,086 | 772 | 302 | Agricultural, fishery and forestry products (industry classification 1) |
| 5 | Activation of green healing cooperatives | 38 | 28 | 10 | Agricultural, fishery and forestry products (industry classification 1) |
| 6 | Urban type forest farm pilot project | 70 | 50 | 20 | Agricultural, fishery and forestry products (industry classification 1) |
| 7 | Urban green wind road project | 975 | 751 | 416 | Agricultural, fishery and forestry products (industry classification 1) |
| 8 | Private forest direct payment pilot project | 788 | 576 | 208 | Agricultural, fishery and forestry products (industry classification 1) |
| 9 | Soha river environmental dam pilot project | 47 | 40 | 30 | Agricultural, fishery and forestry products (industry classification 18) |
| 10 | Configuration of environmental disease healing bases | 470 | 396 | 247 | Construction, education and hygiene (industrial classification 26) |

Table 6. Local industries with great anterior and posterior associative effects

| Anterior associative effect (Sensitivity coefficient) | | Posterior associative effect (Influence coefficient) | |
|---|-------------------------|--|-----------------------|
| Industrial type | Sensitivity coefficient | Industrial type | Influence coefficient |
| Agricultural fishery and forestry products | 1.368021 | Agricultural fishery and forestry products | 1.047541 |
| Petroleum products | 1.340595 | Electrical and electronic machinery | 11.51773 |
| Food and beverage | 1.027341 | Furniture and other manufacturers | 7.058079 |
| Textile and leather products | 1.674002 | Chemical products | 5.276634 |
| Printing publishing and replication | 6.078320 | Non metallic mineral products | 5.218225 |
| Chemical products | 14.81909 | Metal products | 4.940681 |
| Non metallic mineral products | 1.751888 | General machinery | 4.744212 |
| 1st metal products | 1.684338 | Wood and paper products | 3.483934 |
| Metal products | 3.087435 | Wholesale and retail | 5.384341 |
| Electrical and electronic machinery | 2.012617 | Society and other services | 2.411136 |
| Transportation facilities | 2.209017 | Petroleum products | 2.237106 |
| Construction | 2.786337 | Textile and leather products | 2.059995 |
| Communication and broadcasting | 1.773182 | Food and beverage | 2.563842 |

Conclusions

North-South forest cooperation project showed high effects of production inducement, value-added inducement, employment inducement compared to the general forest projects of Gangwondo and Gyeonggi-do. The overall afforestation transactions between South-North may be difficult in securing its continuity due to the fluctuation of national relations and political situations. Moreover, impact on the confidence of North Korea is also regarded as one of critical obstacles for constant transactions. However, our country should pursue the green communication with North Korea with consistency and hearty interests. In this regard, it is considered that the regional level approach may be more efficient and raise the possibility of success starting from a small scale, like from the level of the goon or myun.

In addition, due to the climate change era caused by the global warming, the recent district forest devastation damages in North Korea as well as minimized damages of environmental contaminations which can't but be impacted regardless of countries, the necessity of establishing the cooperative system with North Korea has been raised. Even though there are lots of difficulties due to the uncertainty in accordance with the changes in the South-North relationships, however, the forest project in the consideration of restoration of the degraded forest in North Korea from the characteristics of Gangwondo and Gyeonggi-do adjacent to

North Korea would be believed to take the leading role to direct the development of the integrated forest and forestry industries at the level of the Korean peninsula.

South-North forest cooperation projects will be not only the challenge for bring the economic effect to the regions and country but also for realizing to move up the co-existence and cooperation level by strengthening the cooperation between South-North Korea starting from non-political areas, but also the opportunity for cultivating the pioneer capability to support North Korea in the areas of food, forest, climate change responses etc in the united era.

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