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The role of the capture fisheries and aquaculture sectors in the Korean national economy: An input–output analysis

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ABSTRACT

The aquaculture industry can meet food security needs and reduce the pressure on marine resources. The expansion of aquaculture allows the fisheries industry to restructure from hunting to farming, and thus drives the need for an analysis of the economic impacts of aquaculture industry in consideration of the interdependence between capture fisheries and aquaculture industry. This study attempts to analyze the economic impacts of two fishery sectors using input–output (I–O) analysis, with specific application to Korea. To this end, this study applies the I–O models to the Korean I–O tables generated by the Bank of Korea, paying particular attention to the two fishery sectors in Korea, considering them as exogenous, and then determining their impacts. Specifically, the production-inducing effects, employment-inducing effects, supply shortage effects, sectoral price effects, forward linkage effects, and backward linkage effects of the two fishery sectors are presented over the period 1995–2010. For example, the production-inducing effect of a KRW 1.0 change in fisheries investment is larger in the petroleum and chemical sectors than in other sectors. Moreover, the aquaculture sector has larger employment-inducing effects than the capture fisheries. Finally, the potential uses of the results of this analysis are presented from the perspective of policy instruments, and policy implications are discussed.

1. Introduction

During the past two decades, a global aquaculture production has continuously grown at an average annual rate of 8.0% from 16.84 million tons in 1990 to 78.88 million tons in 2010 [1], because of new and intensive aquaculture technologies [2]. On the other hand, during the same period, a global fisheries capture production has stagnated from 86.00 million tons in 1990 to 89.49 million tons in 2010 [1]. The Korean fisheries industry of which production ranked the 13th largest in the world in 2010 [1] has followed the global trend of aquaculture production increase. In Korea, the production of aquaculture (1.26 million tons) has exceeded that of coastal and offshore capture fisheries (1.11 million tons) since 2006 [3].

In regard of the fisheries, the expansion of aquaculture can be considered as the process of transition from fishing to farming, which has reached a pivotal point with almost 50% of the fish food supply coming from aquaculture [4]. Aquaculture production is expected to compensate for the depressed supply of seafood from capture fisheries and significantly contribute to feeding a growing population with valuable animal proteins [5]. In other words, aquaculture can meet food security needs and reduce the pressure on marine resources. However, on the other side, aquaculture raises some sustainability concerns [4]. The production of many aquaculture species depends on wild fisheries for the material in feed production, and this poses a potential sustainability problem for the aquaculture industry [6,7]. The aquaculture industry may create environmental problems via the markets for its input [2]. The interactions between aquaculture and capture fisheries are expected to be more important and deserve investigations from socio-economic and biological perspectives [4].

Such aquaculture growth drives the need for an analysis of the economic impacts of aquaculture industry. The analysis should entail comparative studies on capture fisheries and aquaculture with regard to the difference between the two industries. Generally, aquaculture is clearly different from capture fisheries in that the former has higher degree of control on the production process associated with stronger property rights [4,6]. In addition, given the increasing contribution from aquaculture to seafood supply, the analysis should reflect the interdependence between the two industries.

To sum up, researchers need to provide policy-makers with accessible and responsible information on the economic impacts

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of two fishery industries. Most of all, researchers need to provide a comprehensive description of two fishery industries and analyze the long historical series data to guide policy-makers since they play different roles at different stages of national economic growth. Thus, the objective of this study is to investigate the role of two fishery industries in the Korean national economy for the period 1995–2010 using a static input–output (I–O) approach in order to provide policy-makers with a preliminary indication of the role of each fishery sector. In I–O model based study, longitudinal analysis gives more comprehensive information on industrial structures than cross-sectional analysis as the former can explore the evolution of structural changes in sectors. However, only a few studies have used longitudinal analysis in the field of I–O model based study.

The remainder of the paper is organized as follows: Section 2 outlines the status of the fisheries industry in Korea as background information. Section 3 presents an overview of the static I–O model employed in this paper. The conventional I–O model's considerations such as the sectoral effects of fisheries supply investments by the two fishery sectors and inter-industrial linkage effects by the demand-driven model are reviewed. In addition, the sectoral fisheries supply shortage effects and sectoral impacts of a rise in fisheries product rates are discussed by each sector, using a supply-driven model and the Leontief price model. Section 4 explains the analysis results from the perspective of fisheries-based I–O models. Section 5 provides the potential applications of these results for fishery policies in Korea. Some concluding remarks are made in Section 6.

2. Current status of the fisheries industry in Korea

Fig. 1 presents in sequence the annual production trends according to the two fishery sectors. Recently, the transition from capture fisheries to aquaculture occurred in terms of production. During the past two decades, aquaculture production in Korea has increased 2.9% annually, from 0.77 million tons in 1990 to 1.36 million tons in 2010. However, capture fisheries production has decreased at an average annual rate of −1.3% from 1.47 million tons in 1990 to 1.13 million tons in 2010. Rapid growth trend of aquaculture production since 2000 comes from increase in the production of seaweed such as laver and sea mustard by incentive policies for aquaculture industry.

The fisheries industry in Korea has made a significant contribution both to the diet of the people and export earnings. Thus, the Korean Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF) has carried out various policies for the development of fisheries industry. Firstly, MIFAFF has conducted aquaculture development projects based on the second basic development plan on aquaculture industry [8]. In order to strengthen the competitiveness of aquaculture industry, the plan explicitly includes the development of eco-friendly aquaculture farms, the installation of open sea cultivation, the establishment of sea-farming areas, the expansion of insurance ranges against natural disasters, and the development of high technology regarding aquaculture. Secondly, the Korean government has tried to reorganize the fisheries industry and construct productive fishing villages [9]. The third master plan for fisheries industry development deals with various issues such as the shift to low-carbon green fisheries, the increase in the vitality of fishing villages, financial support, and the like.

3. Methodology

3.1. I–O analysis

The I–O model has been increasingly applied to various areas over the past four decades [10]. As its usefulness to deal with various resource issues has been recognized, it has been applied in fisheries-related contexts. Using a supply-driven I–O model, Leung and Pooley [11] estimated the economic impacts of the reduction in the Hawaii fisheries production. Cai et al. [12] also used the I–O model to evaluate the potential economic impacts of longline fishing regulations in Hawaii. Kwak et al. [13] implemented a comprehensive I–O model to explore the role of maritime industry including the fisheries industry in the Korean national economy. Through the I–O model, Kaplan and Leonard [14] investigated the potential effects of fisheries management options on the US West Coast. Moreover, Chen et al. [15] applied the I–O model to assess inter-industrial linkages of oyster farming industry in Taiwan.

As discussed above, the I–O model is quite useful for analyzing fisheries-related issues in the context of economic impacts as it

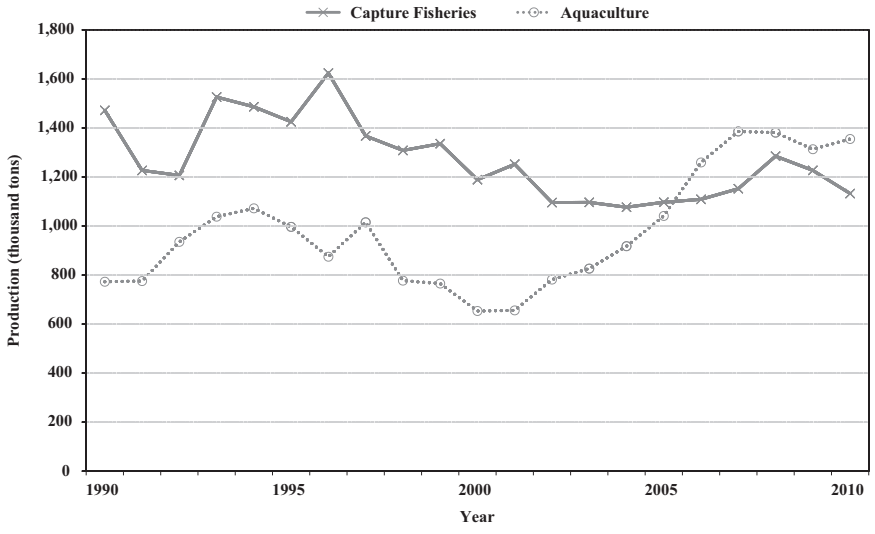

Fig. 1. Annual production by two fishery sectors.
Source: (Korea National Statistical Office [3])