Title: Spatial distribution of the value added from seafood exports: a domestic value chain analysis for Korea

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Abstract

Production sharing (fragmentation) may occur to a much larger extent at the sub-national level than at the global level due to geographic proximity of firms engaging in trade among sub-national regions within a country. Yet, studies decomposing trade flows among sub-national regions within a country are rare, especially those decomposing the exports of natural resource products. This study decomposes the gross domestic exports of seafood by each of eight regions in the Republic of Korea (ROK), and examines (i) how much value added is created from a region's seafood exports, (ii) how it is distributed among different regions along the domestic value chains (DVCs), and (iii) how its spatial distribution changes over time. Tracing the value added along the DVCs for the inter-regional exports of raw and processed fish, this study finds, among other things, that some regions earn an enormous amount of value added through their active participation in the DVCs although they produce and export a very small quantity of seafood, and therefore do not earn much value added from their seafood exports.

1. Introduction

Production sharing (fragmentation)[1] characterizes modern international trade. In global trade literature, a myriad of studies address this issue, and develop frameworks for global value chain (GVC) analysis. Many of these studies decompose gross exports using multi-country input-output (MCIO) models (e.g., Hummels et al. 2001; Johnson and Noguera 2012; Wang et al. 2013; Koopman et al. 2014; Los et al. 2015; Timmer et al. 2013), and trace and quantify the value added[2] generated along the GVCs from global exports (or final demand). One important motivation for these studies is to correctly measure the value added from a country's exports earned by the country. This is because the total value of gross exports grossly overestimates the value added from the exports if production of the exports requires a considerable share of intermediate inputs sourced from foreign countries (double counting problem). For a review of the GVC studies based MCIO models see, for example, Wang et al. (2013), Meng et al. (2017), and Zhang et al. (2020).

Production sharing may occur to a much larger extent at the sub-national level than at the global level due to geographic proximity of firms engaging in trade among sub-national regions[3] within a country. Yet, studies decomposing trade flows among sub-national regions within a country are rare, especially those decomposing the exports of natural resource products. There

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[1] Fragmentation is defined as the disaggregation of the process of producing a final good into multiple steps undertaken by different suppliers that are located in different countries (locations), and produce components and parts needed to produce the final good.

[2] To produce a product, firms use inputs such as labor, capital, and intermediate inputs (such as materials, fuel, etc.). Value added is defined as the difference between total revenue from the sales of the product and the cost of intermediate inputs. The value added is distributed to labor and capital as workers' salaries, interest, rent, and profit. It also includes taxes paid by the firms. Value added generated from an industry represents the industry's contribution to GDP.

[3] In this study, the terms, region and regional, are used to refer only to a sub-national region within the ROK. Similarly, the terms, inter-regional and multi-regional, are used to describe the transactions occurring among the different regions in the ROK. In addition, the terms, imports and exports, are reserved for use to describe trade flows among the regions. For international trade, this study uses the terms, "foreign" or "global".

are only a few studies that analyze domestic value chains (DVCs) using a multi-regional input-output (IO) models (e.g., Meng et al. 2017). However, these studies do not focus on natural resource-based industries. None of the previous studies attempt to investigate the flows of value added from seafood industries among domestic regions within a country. The present study fills this void.

Fishery managers in a country are concerned with how domestic seafood exports by an individual region within the country contribute to the regional economy. Furthermore, they are often interested in how the economic benefit (value added) from the exports is distributed among the regions within the country. To address this issue, the present study adopts a DVC approach for domestic seafood exports in the Republic of Korea (ROK). In doing so, this study uses a multi-regional IO (MRIO) model for the ROK.

Specifically, the purpose of this study is to answer the following two questions. First, when regions produce seafood and export it to each other, how much value added is created and distributed among the regions? Second, how has the spatial distribution of the value added changed between 2005 and 2015? The type of information that this study produces to answer these questions would not be obtained from a conventional multiplier analysis, and will enable fishery managers to significantly enhance their understanding of how the value added from domestic seafood trade is generated and distributed across the regions.

In a GVC analysis, Koopman et al. (2014) decomposes the gross exports of a country into nine different value added components. However, the limitation of their approach is that it decomposes the gross exports at an aggregate level. To overcome this limitation, Wang et al. (2013) disaggregates the gross exports into sixteen different value added terms, and is advantageous because this approach can decompose exports at the sector- (industry-), bilateral-, and bilateral/sector-level. This advantage is important for the present study because it enables decomposition of the exports by individual sectors or industries, that is, raw fish production and seafood processing[4]. Therefore, this study uses the approach in Wang et al. (2013).

This paper is structured as follows. Section 2 briefly describes the fisheries of Korea and seafood trade flows among the regions. Section 3 presents the MRIO model for the ROK, and provides a short description of the decomposition method (Wang et al., 2013) used in this study. Section 4 presents and discusses the results. The final section summarizes the findings, and offers some concluding remarks.

2. Domestic seafood flows in Korea

Koreans have a strong preference for seafood. During the period from 2013 to 2015, the average per capita fish consumption was very high, about 58.4 kg. It is likely that Koreans will increase their fish consumption in the future, and will surpass 64 kg per capita in 2025 (FAO 2020). About 0.93 million tonnes of fish was caught from wild fisheries in 2017. Anchovy accounts for the largest share (22.8%, in weight) of all the fish catch from Korean waters, followed by Chub mackerel (11.2%), Hairtail (5.9%), Spanish mackerel (4.1%), Herring (3.5%), Yellow croaker (2.1%), and other species (50%). Aquaculture has grown as an alternative method of fish production in the ROK, producing 2.3 million tonnes of fish, which is equivalent to 62.2% of total fish production in 2017. Major farm-raised products are seaweeds (76.1%), shellfish (18.5%), and finfish (3.7%) (Ministry of Oceans and Fisheries, Fisheries Statistics, 2018).

[4] In this study, (raw) fish production includes both fish harvesting activity from wild fisheries and fish farming activity. Seafood processing includes both initial processing and re-processing.

Table 1 presents, for 2005, the geographic distribution of raw and processed seafood produced in each region among eight different regions in the ROK. The eight regions (Figure 1) include Seoul capital area (SC), Chungcheong (CC), Jeolla (JL), Gyeongsangbuk (GB), Busan (BS), Gyeongsangnam (GN), Gangwon (GW), and Jeju (JJ). Sales or distribution of seafood produced by the regions are shown in the columns. For example, SC produced 136.2 billion KRW (or about $133.0 million)[5] worth of raw fish in 2005. The raw fish producing industry in the region sells 0.1% of its total raw fish production to itself and 3.1% to the fish processing industry in the region. A large share (63.8%) of the raw fish is supplied to non-seafood industries (e.g., restaurants) in the country. 24.8% is sold to the final consumers in the region while 6.5% is exported to foreign countries.

Raw fish produced in a region is either processed within the region where the fish is produced or exported to other regions for processing. For example, 10.3% of GB-produced raw fish is processed within the region while 11.2% is shipped to BS for processing. In comparison, as much as 33.6% of BS-produced raw fish is processed within the region while 13.7% is processed in GN. It is notable that each non-SC region sells a substantial share of the raw fish to SC for its final consumption. For instance, a substantial portion (44.7%) of GW-produced raw fish is used as final consumption in SC whereas only 7.1% is used as final consumption in the region where the fish is produced. CC sells 30.2% of raw fish produced in the region to SC while only 15.4% is consumed within CC. The percentage of raw fish from each region sold to non-seafood industries (e.g., restaurants) that use them as intermediate inputs in all the eight regions combined ranges from 12.5% (BS) to 63.8% (SC).

[5] Korean Won (KRW) is the Republic of Korea's monetary unit. In 2005, one $US was equivalent to 1,024 KRW (yearly average). https://data.oecd.org/conversion/exchange-rates.htm

Fish processed in a region is either re-processed in the region or exported to other regions for further processing. JL, among other regions, re-processes 7.9% fish processed within the region. 2.4% each of the fish processed in BS and GN is re-processed in GW. As with raw fish consumption, SC again consumes a large portion of processed fish from each region. Notably, SC consumes 37.9% and 34.8% of the fish processed in SC and GW, respectively.

As indicated in Table 1, the inter-regional seafood trade in the ROK is complex. In addition, the MRIO data indicates that seafood industries in the regions use a large share of intermediate inputs from other regions. Therefore, in order to correctly measure the contribution of the seafood industries, it is important to compute the value added that each region earns by participating in the DVCs leading to the production of the final product.

3. Methods

3.1 Multi-regional input-output (MRIO) model and data

The MRIO model for the ROK can be represented by the following equation system:

$$\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_r \\ \vdots \\ X_G \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1s} & \cdots & A_{1G} \\ A_{21} & A_{22} & \cdots & A_{2s} & \cdots & A_{2G} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ A_{r1} & A_{r2} & \cdots & A_{rs} & \cdots & A_{rG} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ A_{G1} & A_{G2} & \cdots & A_{Gs} & \cdots & A_{GG} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_r \\ \vdots \\ X_G \end{bmatrix} + \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_r \\ \vdots \\ Y_G \end{bmatrix}, \qquad (1)$$

In the above model, $\mathbf{X_r}$ (r = 1, 2, …, G) is an (N x 1) column vector of industry output for region r where N is the number of industries in the region, $\mathbf{A_{rs}}$ an (N x N) matrix of interregional input (trade) coefficient matrix showing purchases made by region s of intermediate inputs from r, and $\mathbf{Y_r}$ an (N x 1) column vector of final demand for industry output produced in region r. Here $\mathbf{Y_r}$ includes the final demands from all regions in the ROK for commodities produced in r. The MRIO model can be solved for $\mathbf{X_r}$, and expressed more compactly as:

$$\boldsymbol{X} = (\boldsymbol{I} - \boldsymbol{B})^{-1}\boldsymbol{Y}, \quad (1)'$$

where **X** is an (NG x 1) vector of industry outputs for all G regions, **B** an (NG x NG) matrix of MRIO input coefficients, **Y** an (NG x 1) vector of final demand for all G regions, and $\mathbf{(I\text{-}B)^{-1}}$ the MRIO inverse (multiplier matrix).

This study uses 2005 and 2015 MRIO data for the ROK (Bank of Korea, http://ecos.bok.or.kr/) because the MRIO data for these two years identify the two seafood industries (raw fish production and fish processing) separately. This enables separate DVC analyses for the two seafood industries and an examination of the change in the spatial distribution of the value added between the two years. 2005 and 2015 MRIO data have different numbers of provinces and industries. The 2005 data have 16 provinces and 78 industries while the 2015 data have 17 provinces (the 16 provinces in 2005 data plus Sejong province) and 165 industries. Therefore, this study had to aggregate the 16 / 17 provinces into eight larger regions and 78 / 165 industries to 33 larger industries (Table A1 in Appendix A). The 33 industries include two seafood industries – raw fish production and fish processing industries. The eight regions (Figure 1) are Seoul capital area (SC), Chungcheong (CC), Jeolla (JL), Gyeongsangbuk (GB), Busan (BS), Gyeongsangnam (GN), Gangwon (GW), and Jeju (JJ).

3.2 Decomposing gross exports

This section provides a brief review of the method used to decompose exports. Details are found in Wang et al. (2013). Koopman et al. (2014) is the first to decompose a country's gross exports into different value added terms based on an MCIO accounting framework. The study breaks up the gross exports into nine different value added and double counted terms, depending on the source of value added, on the use (final use or intermediate use) of the exports, and on the origin (foreign countries or home country) of the final demand. However, one limitation of the method is that it can only decompose a country's aggregate exports, and fails to decompose the exports at the sector (industry), bilateral, or sector-bilateral level. Wang et al. (2013) overcame this limitation, and developed a method to disaggregate the gross exports into sixteen value added terms, and has the advantage of decomposing the exports at the sector (industry), bilateral, or sector-bilateral level. Wang et al. (2013)'s method can decompose, for example, the ROK's exports of Electrical products to US.

This study uses Wang et al. (2013)'s approach. The aforementioned advantage of Wang et al. (2013)'s method is important for the present study because this study analyzes DVC for several *individual* industries (i.e., raw fish producing and fish processing industries). Specifically, this study decomposes the domestic seafood exports by each of the eight regions to the other seven regions in the ROK for two years (2005 and 2015) using the MRIO model, and examines the change, occurring over the period (2005-2015), in the distribution of the value added among the regions.

In Wang et al. (2013), gross exports of a country are decomposed into sixteen terms. In comparison, this study decomposes the gross domestic exports by a region into seventeen terms, the sixteen terms as in Wang et al. (2013) plus one additional term that represents the foreign import content (FIC)[6] of the gross exports. In a manner similar to Wang et al. (2013), the sixteen terms are grouped into four components including (i) regional value added that is absorbed in other regions (RVO), (ii) regional value added that is first exported but returns to the home region (RRV), (iii) extra-regional value added embedded in the exports (EVA), and (iv) pure

[6] Foreign import content needs to be added in the analysis because the seafood industries in each region in the ROK import a certain amount of foreign-sourced inputs.

double counted terms (PDC). Including the seventeenth term (FIC) as the fifth aggregate component, there are a total of five aggregate components that are analyzed in this study.[7]

Suppose a region in the ROK exports goods (e.g., raw fish) to other regions in the country. Then, RVO is the value added created in the exporting region due to the exports that are used either as final goods or as intermediate goods in the importing regions. Note the RVO includes all the value added created in all the industries in the exporting region, including the industry producing the exports and the industries selling intermediate inputs to the first industry. RRV is the value added generated in the region from the exports that are used as intermediate goods in the importing regions to produce either final goods or the next-stage intermediate goods which are, in turn, imported back to the original region. EVA is the value added created in the other regions due to their exporting intermediate goods to the original region which are used in the region to produce the exports. PDC accounts for the double counted terms arising due to the intermediate goods crossing the regional borders multiple times. PDC may include value added created both in the original region and in the other regions. It can be considered to be an indicator measuring the extent to which production sharing occurs across the regions. Finally, FIC measures the value added generated in foreign countries due to their exporting intermediate goods to the original region in the country which are used in the region to produce the exports.

When only one region exports seafood to the other regions, there are only two sources of value added accruing to the region – RVO and RRV. Regional value added (RVA) in this case is the sum of these two components, and measures the total value added that the region earns when

[7] In Wang et al. (2013) where GVC is analyzed, the four components are (i) domestic value added which is ultimately absorbed abroad (DVA), (ii) foreign value added that is used in the production for the exports at home country (FVA), (iii) the portion of domestic value added that is initially exported but ultimately returned home by being embedded in the imports from foreign countries and consumed at home (RDV), and (iv) pure double counted terms (PDC) arising due to the back-and-forth intermediate goods trade.

only this region produces and exports the seafood. But when each of all the eight regions produces and exports seafood to each other, there is an additional source of value added accruing to each region, that is, EVA that the each region earns (receives) *due to the other regions' exporting seafood*, labeled EVA-IN in this paper.

Suppose that there are two regions, A and B, both of which produce seafood, and export it to each other. The two regions import intermediate inputs from each other for their seafood production. When, for example, A imports intermediate inputs from B that are used in A to produce its exports, B earns value added from producing the intermediates exported to A. From A's perspective, this value added (generated in B) is A's EVA. From B's perspective, it is EVA inflow from A, and is the value added that B earns (i.e., B's EVA-IN) in addition to the RVA that it earns by exporting seafood to A.

In sum, when all the regions engage in inter-regional exports of seafood as well as non-seafood commodities (including intermediates used in seafood production), the total regional value added (TRVA) that a region earns is (See Figure 2):

$$\text{TRVA} = \text{RVO} + \text{RRV} + \text{EVA-IN} = \text{RVA} + \text{EVA-IN} \qquad (2)$$

This study uses TRVA as a measure of the total benefit earned by a region engaging in inter-regional seafood trade.

4. Results and discussion

4.1 Year 2005

4.1.1 Decomposition of inter-regional seafood trade (Tables 2 and 3)

Gross exports of raw fish are first decomposed by region (Table 2). BS, JL, and GN are three regions that export the largest value of raw fish (Column 2). The raw fish exported by the regions is either used as final goods, processed in the fish processing industry, or used as intermediate inputs in non-seafood industries (e.g., restaurants) in the importing regions. The five components are reported as percent of gross exports (Table 2)[8].

46.8% of the total value of gross exports is accounted for by RVO engendered in SC (Table 2, Column 3) during the process of SC's production of raw fish exports, which is absorbed in other regions. JL has the largest RVO share (60.7%), followed by GN (60.2%) and CC (58.4%). Although SC's RVO share is the smallest among the regions, its RRV share is the largest (11.3%). Some portion of the raw fish exported by SC is used as intermediates in the importing regions to produce either final goods or other intermediate goods that are imported back to the original exporting region (SC). Results indicate that the value added created in SC stemming from its production of this portion of the exports accounts for 11.3% of the total value of its raw fish exports. Since SC has the biggest economy in the ROK[9], consuming the largest quantities of seafood and non-seafood commodities, it is likely that a large proportion of the commodities imported back to SC is seafood processed elsewhere in the ROK.

GW has the highest EVA share (36.7%) for its raw fish exports, followed by CC (26.6%) and JJ (25.9%). The highest EVA share for GW reflects the fact that its economy is one of the smallest economies in the country where most industries produce less than those in most other regions. The raw fish producing industry (as well as many non-seafood industries) in GW relies heavily on inputs sourced from other regions (mostly those from SC, Column 2, Table 4),

[8] Results for all the seventeen individual terms are available upon request.
[9] In 2015, SC produces the largest share (47%) of total ROK output (http://ecos.bok.or.kr/).

leading to the largest EVA share. GN has the smallest EVA share (16.0%), indicating that the region is the least dependent on imports of intermediates from the other regions.

All the regions earn only a portion of the total value of exports (RVA, last column) by exporting raw fish. The RVA share ranges from 52.4% (GW) to 62.7% (JL). JL earns the largest RVA share (62.7%) of the total value of its raw fish exports (687,310 million KRW, Table 2, Column 2) or 431,270 million KRW (Table 6, Column 3) from exporting raw fish. On average across all the regions, 57.5% of the total value of raw fish exports accrues to the exporting regions as value added. Although SC has the smallest RVO share, its RRV share is relatively large compared to some of the other regions (Table 2, last column).

RVO shares for processed seafood exports (Table 3) are lower for all regions, except for SC, than those for raw fish exports. The average RVO share for raw fish exports (56.0%, Table 2, last row) is much higher than that for the processed fish exports (50.1%, Table 3, last row). This suggests that, compared with the raw fish producing industries, seafood processing industries in a region in general use larger fractions of intermediates from other regions. One important factor contributing to this finding may be the fact that the seafood processing industries in many regions process some raw fish sourced from other regions (Table 1).

Thus, it is not surprising that the EVA shares for the processed seafood exports are much larger (Table 3, Column 5) than those for raw fish exports. The average EVA share for processed fish across the regions (35.6%) is considerably larger than that for raw fish (21.8%). Dependence of two regions (GW and CC) on the imported intermediates for their production of processed seafood exports is the strongest among the regions as evidenced by the largest EVA shares for these two regions (51.8% and 44.2%, respectively). In fact, GW is an interesting and extreme case where its EVA share for its processed seafood exports (51.8%) is so large that it exceeds its

RVA share (38.6%). This means that all other regions benefited more from GW's exports of processed seafood than GW did. This may concern GW policymakers and fishery managers because of a large portion of value added from its seafood exports flows out of the region.

JL is the region that is the least dependent on inputs from other regions for its seafood processing, with its smallest EVA share (29.0%) and earns the largest RVA share (60.0%) among the regions. The average RVA share for processed fish (51.1%, Table 3, last column) is much smaller than that for raw fish (57.5%, Table 2, last column). This may be due to the fact that processors in some regions process a large share of raw fish sourced from other regions (Table 1). Results indicate that the seafood processing industry's dependence on foreign inputs is weaker, compared to raw fish producing industry, with the FIC share ranging from 3.9% (GW, CC) to 6.5% (SC) (Tables 2 and 3). Results suggest that, on average, raw fish production involves a stronger production sharing among the regions (more frequent border crossings of intermediate inputs) than processed fish production, as shown by the average PDC values of 9.7 vs. 7.7 (Tables 2 and 3).

4.1.2 Decomposition of EVA by source region (Tables 4 and 5)

EVA shares by source region are presented in Tables 4 and 5. Note that the last column in these two tables presents the total EVA shares that are copied from the fifth column in Tables 2 and 3, respectively. Table 4 shows how the total EVA share for a region's raw fish exports is distributed among the regions from which the first region's EVA is sourced. For example, the second row in Table 4 shows that 5.8% and 3.7%, respectively, of the total value of SC's raw fish exports are created in CC and JL as value added where the sum of all the numbers in the row is equal to the total EVA share for SC's raw fish exports (18.8%, Table 4, last column).

Table 4 indicates that SC is the region from which the largest portion of each non-SC region's total EVA share is sourced for its production of the raw fish exports. For instance, CC's total EVA share for its raw fish exports is 26.6% (Table 4, last column), a lion share of which (25.3% of the total value of CC's raw fish exports, Table 4, second column) is generated in SC as value added with the remainder (1.3%) distributed among the other regions.

Results in the table highlight that SC is the top supplier of extra-regional value added (intermediate inputs) to the production of raw fish exports in all the non-SC regions. This is not surprising because SC's economy is the biggest in the country, and supplies the largest quantities of most of the inputs to the industries (including seafood industries) across the country. GW and CC depend more heavily on SC than any other regions for inputs to produce raw fish. 98.8% (= 36.2% divided by 36.7%, Table 4, second row) and 95.2% (= 25.3% divided by 26.6%, Table 4, third row), respectively, of the two regions' total EVA shares are accounted for by SC. Geographic proximity of the two regions (GW and CC) to SC (Figure 1) may be a factor contributing to this result. SC also leads in supplying intermediates to production of processed fish exports in all the non-SC regions (Table 5).

4.1.3 Spatial distribution of total regional value added (TRVA) (Tables 6 and 7)

As mentioned, when all eight regions produce seafood exports, each region earns value added that is generated from two different activities – (i) seafood exports by the region and (ii) seafood exports by all the other regions. In Section 4.1.1 above, only the regional value added (RVA) accruing to a particular region due to its exports (the first activity above) is calculated as a measure of the economic benefit from the region's exports. However, when all the regions produce and export seafood (the second activity above), purchasing inputs from (and selling them to) each other, RVA is an incomplete measure of the economic benefit that each region earns. Therefore, to accurately gauge the total economic benefit accruing to a region from both activities, this study also computes the total regional value added (TRVA) for each region which is defined as the sum of the RVA (from the first activity) and the EVA-IN (from the second activity) which is generated in the region due to the other regions exporting seafood.

This section reports and discusses results for TRVA for each region and its spatial distribution as well as other related results (Tables 6 and 7). Table 6 (for raw fish) is constructed based on Tables 2 and 4 while Table 7 (for processed fish) is based on Tables 3 and 5. First, short descriptions of several columns in Table 6 are needed. Columns 4 and 5, respectively, record the EVA (from Table 2) and EVA-IN for each region. For example, SC's EVA is 801 million KRW while its EVA-IN is enormously larger, 395,033 million KRW. Column 6 records the TRVA for each region, which is the sum of RVA and EVA-IN. Columns 7 and 8, respectively, present the ratios of RVA and TRVA to the total value of exports.

Table 6 shows that SC exports the smallest amount (4,262 million KRW) of raw fish to the rest of the country or about only 0.15% of total intra-national exports of raw fish (2,842,086 million KRW, Column 2). Furthermore, the region's RVA is 2,477 million KRW or only 0.2% of the total domestic RVA. Yet, the TRVA for the region is very large (397,510 million KRW, Column 6) or 17.6% of total domestic TRVA because of its considerably high value of EVA-IN (395,033 million KRW, Column 5). As a result, its TRVA is 93 times as large as (or 9,327.7% of) its total value of raw fish exports. Again, this occurs because the region actively partakes in the DVCs for seafood production despite its exporting a very small amount of raw fish.

While only one region (SC) earns more TRVA than the value of its raw fish exports (Table 6), three regions (SC, GB, and CC) earn more TRVA than the total value of their processed seafood exports (Table 7). The TRVAs for these three regions are 507.0%, 126.6%, and 105.5%, respectively, of the total value of exports of processed seafood. These results highlight that some regions benefit more per dollar of seafood exports than others from engaging in inter-regional seafood trade. Conventional multiplier analyses do not provide this type of information.[10] With this information, policymakers and fishery managers in the ROK will better understand how the benefit from inter-regional seafood trade is generated and distributed across the regions.

4.2 Changes over the period from 2005 to 2015

This section reports and discusses the changes in the magnitudes of the decomposed components that occur between 2005 and 2015. Results from the decomposition for 2015 are shown in Tables B1-B6 in Appendix B. Results in Tables 8-12 discussed in this section are obtained from comparing the results for 2005 (Tables 2-7) and those for 2015 (Tables B1-B6).

4.2.1 Change in the decomposed components (Tables 8 and 9)

Table 8 presents the change in the shares of the five major components and RVA for raw fish exports. RVA shares for five regions decrease over time while those for other regions increase. For instance, the RVA shares for GN and JJ decrease by 6.3 and 4.5, respectively. Given a very slight (or no) change in the FIC shares for these regions, this decrease is mostly driven by a significant increase in EVA shares for the two regions.

As the raw fish producing industry in the two regions becomes more reliant on intermediates from other regions, increasing their EVA shares, their RVA shares shrink

[10] A conventional multiplier analysis provides only the total effect of a unit increase in final demand.

accordingly. On the other hand, some regions shift their dependence on the inputs from other regions to their own regions or foreign countries. CC, for instance, reduces its dependence on inputs from non-CC regions (as shown by an 8.1% decrease in the EVA share), and instead increases its reliance on those from its own region (3.9% increase in RVO) or from foreign countries (3.3% increase in FIC share).

Several regions increase their reliance on inputs from other regions or foreign countries while others do not. Five regions increase their FIC share with GW increasing the share by the largest percentage (4.4%). While GW's reliance on foreign inputs increases, its reliance on non-GW domestic intermediates decreases as evidenced by a large decrease in its EVA share (8.1%). Overall, however, the average EVA and FIC shares across the regions do not increase significantly, only by 1.1% and 1.0%, respectively, although individual regions exhibit heterogeneous patterns of the magnitude and direction of the changes in the shares.

Table 9 presents the results for processed seafood. Compared to 2005, regions generally reduced their dependence on extra-regional domestic intermediates. The average decrease in EVA is 1.3%. In contrast, all regions increased their dependence on foreign inputs with an average increase of 1.8%. The extent of production sharing for both raw and processed fish production decreases over time with the average PDC for the former declining by 1.2% (Tables 8 and 9).

4.2.2 Change in spatial distribution of EVA (Tables 10 and 11)

Tables 10 and 11, respectively, present the changes in the spatial distributions of EVA for raw and processed fish exports. To compute the numbers in the tables, first, each number in a row in Tables 4-5 and Tables B3-B4 is divided by the row total (last column in these tables).

Next, the resulting numbers for 2005 are subtracted from those for 2015. The final numbers are shown in Tables 10 and 11. Non-SC regions' dependence on SC for intermediates is still strong in 2015 (Table B3), but is not as strong in general as in 2005. In 2015, all the regions except JJ become less dependent on SC for inputs, and diversify their sources across non-SC regions (Table 10). An example is CC which relies less on SC with its EVA share accounted for by SC decreasing by 12.6% (Column 2), and increases its dependence on, among other regions, JL and GB by 5.3% and 4.5%, respectively. Generally, regions tended to shift away from SC to regions such as CC, GB, and GN for their inputs.

While most non-SC regions' reliance on SC inputs for raw fish production decreased over time, the opposite is true for processed seafood (Table 11). All the regions in 2015, except BS, were more dependent on SC inputs for processing seafood while reducing their reliance on regions such as JL, GB, BS, and GN. Among the four regions (JL, GB, BS, and GN), BS and GN suffered the most; every region decreased its dependence on these two regions. It is striking that the drastic increase in GB's dependence on SC occured at the cost of a substantial reduction in its dependence on BS (-18.6%) and GN (-19.1%). Overall, for raw fish production, regions generally diversified the sources of their inputs whereas, for processing fish, their dependence on SC became stronger.

4.2.3 Change in the ratios of RVA and TRVA to exports (Table 12)

Table 12 shows how the economic benefit from seafood trade changed for each region between the two years in terms of the change in the ratios of RVA and TRVA to exports. Results indicate considerable differences across the regions in the magnitude and direction of the change in the two ratios for the two seafood industries. These differences arise due to the differences in the percent changes in exports, RVA, and EVA-IN.

For instance, while for a region (BS), the two ratios for both raw and processed fish exports increased consistently over time, for other regions (JL, GN, and JJ), these ratios decreased consistently. Overall, SC suffered the most in terms of TRVA-to-exports ratio for raw fish exports with the ratio decreasing by 7,557.4% while GW benefited the most with the ratio increasing by 17.3%. TRVA-to-exports ratio for the seafood processing industry in most regions (except for SC and BS) decreased with the ratio ranging from 1.5% to 30.4%. The magnitude and direction of the change in the two ratios are significantly different among the regions. This highlights the importance of considering the EVA-IN when measuring accurately the economic benefit from seafood trade.

5. Summary and Conclusion

Regions within a country may engage heavily in inter-regional trade in goods and services for use in production of intermediate and final goods. BOK (Bank of Korea) MRIO data indicates that raw fish production and seafood processing in a region in the ROK requires a large quantity of inputs from other regions as well as those produced within the region. Furthermore, the inter-regional seafood trade flows in the ROK is complex. Some portions of the raw and processed fish, once produced in a region, cross the regional borders, sometimes multiple times. In some cases, the intermediate inputs exported to the importing regions are used to produce next-stage intermediate inputs or final goods that are either used in the regions or exported to other regions.

In these circumstances, it is important to correctly estimate the value added that each region earns by producing seafood exports. Using a DVC approach, this study breaks up the gross inter-regional exports of seafood for each region, and examines where and how the value added is created and distributed along the DVCs, and how the spatial distribution of the value added changes over time.

Major findings are summarized in the following. First, in 2005, when considering each region's seafood exports in isolation from the exports by other regions, on average across the regions, only about 58% and 52%, respectively, of the total values of raw and processed fish exports accrue to the exporting region as value added with most of the remainder enjoyed by other regions in the country or by foreign countries. When considering all the regions' exports together, however, some regions (SC, CC, and GB) earn more value added than the value of their exports.

Second, related to the above, although SC's exports of seafood are very small, it earns an enormous amount of EVA income (EVA-IN) from other regions' exporting seafood via participating in the DVCs for seafood production in the country. Counting in its EVA-IN, in 2005, SC's total regional value added (TRVA) earned from all the regions' engaging in domestic seafood trade is over 93 times as large as (in case of raw fish trade) and over 5 times as large as (in case of processed fish trade) its values of raw and processed fish exports, respectively.

Third, in both 2005 and 2015, GW relies heavily on inputs from other regions for its production of seafood. In an extreme case, the region's EVA share for its processed seafood exports (about 52% and 47%, respectively, for 2005 and 2015) is larger than its RVA share (39% for both 2005 and 2015), meaning that all the non-GW regions combined benefit more than GW from GW's exports of processed seafood.

Fourth, regions exhibit very different patterns of change in the shares of the five major components over the period. On average, however, for raw fish exports, the RVA share decreases by only about 1% while both the EVA and FIC shares increase by merely about 1%. For processed fish exports, on average, both RVA and EVA shares decline while the FIC share increases. Notably, the FIC share for processed fish exports increase consistently across the regions.

Fifth, results show mixed evidence regarding the change in the seafood industries' dependence on SC. While most non-SC regions become less dependent on inputs from SC for their raw fish production, diversifying the sources of the inputs across non-SCA regions, the opposite is true for processed seafood. That is, most non-SC regions become more dependent on SC for their processed fish production.

Finally, there are substantial differences across regions in the magnitude and direction of the change over the period in the ratios of RVA and TRVA to exports (RVA/exports and TRVA/exports) for the two seafood industries. These differences arise due to the differences in the relative changes in exports, RVA, and EVA-IN. This finding highlights the importance of counting in the EVA-IN when accurately measuring the economic benefit that a region receives when all regions engage in seafood trade.

The ROK government is now trying to formulate an effective policy for boosting seafood industries (Ministry of Oceans and Fisheries, 2021). The government may make an investment in the infrastructure (e.g., seafood processing facilities) needed to enhance the productivity of seafood production in several regions. If this is the case, results from this study will help policymakers and fishery managers better understand where and how investments may benefit different regions, leading to a more effective and seafood production-enhancing policy.

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Table 1 Inter-regional flows of raw and processed fish (in % except for value of production in the third row. In 2005, one $US =1,024 KRW)

		Raw fish								Processed fish							
		SC	CC	JL	GB	BS	GN	GW	JJ	SC	CC	JL	GB	BS	GN	GW	JJ
Total production (billion KRW)		136.2	251.6	1,224.6	389.5	1,386.4	986.8	221.5	453.4	534.6	260.1	896.6	283.0	1,240.3	1,097.6	290.8	61.9
Raw fish producing industry	SC	0.1	0.1	0.1	0.0	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CC	0.0	0.7	0.3	0.1	0.1	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JL	0.0	0.1	4.3	0.0	0.2	0.2	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	GB	0.0	0.0	0.1	0.9	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BS	0.0	0.0	0.3	0.6	1.3	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	GN	0.0	0.1	1.4	1.2	0.3	0.6	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	GW	0.0	0.1	0.1	0.1	0.1	0.1	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JJ	0.0	0.0	0.5	0.0	0.1	0.1	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fish processing industry	SC	3.1	5.0	2.9	1.7	2.0	1.9	6.9	2.9	1.2	0.4	0.5	0.2	1.2	1.2	0.6	0.4
	CC	0.0	3.8	1.3	0.4	0.5	0.8	0.1	1.1	0.4	0.5	0.5	0.2	1.0	1.0	0.2	0.4
	JL	0.0	0.1	22.4	0.0	0.1	0.3	0.0	12.3	1.1	0.0	7.9	1.8	1.0	1.0	0.0	2.2
	GB	0.0	0.0	0.2	10.3	0.8	1.1	0.0	0.2	0.1	0.2	0.2	1.7	1.4	1.4	0.1	0.2
	BS	0.0	0.2	2.2	11.2	33.6	13.0	0.1	2.8	0.3	0.4	0.6	0.7	1.1	0.5	0.2	0.5
	GN	0.0	0.2	1.6	7.9	13.7	25.1	0.0	2.0	0.4	0.6	0.9	1.0	0.4	2.1	0.3	0.7
	GW	0.4	1.1	0.8	1.1	0.9	1.0	11.1	0.8	0.5	0.2	0.5	0.3	2.4	2.4	1.0	0.4
	JJ	0.0	0.0	0.4	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.1	0.1	0.0	0.0	0.0	3.3
Non-seafood industries in all regions		63.8	41.2	26.0	21.6	12.5	17.6	27.3	25.3	29.5	28.3	20.9	24.3	22.8	23.4	23.4	20.9
Domestic final demand	SC	24.8	30.2	16.8	10.3	11.8	10.4	44.7	16.8	37.9	20.1	17.9	11.6	21.2	21.4	34.8	14.8
	CC	0.2	15.4	3.1	1.7	2.4	2.2	0.6	3.1	2.9	12.9	3.8	2.3	3.5	3.6	3.1	3.1
	JL	0.2	0.3	10.4	0.1	0.4	0.4	0.0	13.7	2.2	4.8	12.3	2.4	4.3	4.3	2.5	4.0
	GB	0.1	0.3	1.0	26.3	2.9	4.4	0.0	0.8	1.6	3.0	2.7	18.4	5.8	5.9	2.4	2.2
	BS	0.0	0.1	0.5	1.8	5.7	3.7	0.0	0.6	2.2	4.0	4.0	6.3	5.5	2.3	2.8	3.4
	GN	0.0	0.1	0.6	2.0	2.9	9.4	0.0	0.7	2.6	4.6	4.7	7.4	2.9	6.7	3.3	3.9
	GW	0.4	0.7	0.6	0.6	0.5	0.6	7.1	0.5	0.8	1.0	0.4	0.6	1.3	1.3	5.4	0.3
	JJ	0.0	0.0	0.4	0.0	0.0	0.0	0.0	3.6	0.2	0.5	0.3	0.3	0.5	0.5	0.3	14.9
Foreign exports		6.5	0.2	1.6	0.0	7.1	6.2	0.5	2.0	15.9	18.6	22.0	20.5	23.5	21.1	19.6	24.4

Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note:
Total production measures the value of sales of raw or processed fish. Domestic final demand measures the value of the raw or processed fish purchased by households and national or regional governments within the ROK.

Table 2 Decomposition of raw fish exports by region for 2005 (% of gross exports except the value of exports in Column 2)

	Exports (million KRW)	RVO	RRV	EVA	PDC	FIC	RVA
SC	4,262	46.8	11.3	18.8	12.8	10.3	58.1
CC	155,098	58.4	1.4	26.6	5.3	8.2	59.8
JL	687,310	60.7	2.0	19.6	7.8	9.9	62.7
GB	201,706	49.7	2.9	18.0	14.7	14.8	52.5
BS	697,030	52.2	1.3	22.6	12.1	11.9	53.5
GN	541,456	60.2	2.0	16.0	9.5	12.3	62.2
GW	167,516	52.1	0.3	36.7	4.3	6.6	52.4
JJ	387,709	52.4	0.2	25.9	10.7	10.8	52.6
Average		56.0	1.5	21.8	9.7	11.0	57.5

Note: In 2005, one $US =1,024 KRW.

Table 3 Decomposition of processed fish exports by region for 2005 (% of gross exports except the value of exports in Column 2)

	Exports (million KRW)	RVO	RRV	EVA	PDC	FIC	RVA
SC	114,188	48.6	5.5	29.1	10.4	6.5	54.1
CC	143,173	45.0	0.6	44.2	6.3	3.9	45.6
JL	482,441	58.9	1.1	29.0	5.8	5.2	60.0
GB	134,338	48.4	0.8	38.2	7.3	5.3	49.2
BS	833,840	48.7	0.7	36.3	8.1	6.1	49.4
GN	729,731	50.8	0.9	33.4	9.1	5.8	51.7
GW	206,507	38.4	0.2	51.8	5.7	3.9	38.6
JJ	32,052	51.9	0.1	35.3	6.7	5.9	52.1
Average		50.1	1.0	35.6	7.7	5.5	51.1

Note: In 2005, one $US =1,024 KRW.

Table 4   Decomposition of EVA for raw fish exports by source region for 2005 (% of gross exports)

	SC	CC	JL	GB	BS	GN	GW	JJ	TOTAL
SC	NA	5.8	3.7	1.2	0.9	1.1	5.8	0.3	18.8
CC	25.3	NA	0.3	0.2	0.1	0.1	0.5	0.0	26.6
JL	13.9	2.3	NA	0.8	0.8	1.0	0.4	0.3	19.6
GB	10.5	1.5	0.2	NA	2.4	2.8	0.6	0.0	18.0
BS	12.5	2.3	0.6	3.0	NA	3.6	0.5	0.1	22.6
GN	7.9	1.5	0.4	3.2	2.6	NA	0.4	0.0	16.0
GW	36.2	0.4	0.0	0.0	0.0	0.0	NA	0.0	36.7
JJ	12.3	2.1	9.0	0.6	0.7	0.8	0.3	NA	25.9

Table 5   Decomposition of EVA for processed fish exports by source region for 2005 (% of gross exports)

	SC	CC	JL	GB	BS	GN	GW	JJ	TOTAL
SC	NA	7.1	4.9	3.7	5.0	5.9	1.9	0.5	29.1
CC	24.2	NA	5.4	3.5	4.4	5.2	1.0	0.5	44.2
JL	16.1	3.2	NA	2.2	3.2	3.7	0.3	0.2	29.0
GB	15.5	2.9	2.7	NA	7.4	8.7	0.7	0.3	38.2
BS	19.9	3.3	3.9	5.1	NA	2.6	1.1	0.4	36.3
GN	18.6	3.1	3.6	4.8	1.8	NA	1.1	0.3	33.4
GW	37.3	3.2	2.5	2.5	2.8	3.2	NA	0.2	51.8
JJ	17.3	3.5	4.3	2.4	3.4	4.0	0.3	NA	35.3

Table 6 Spatial distribution of TRVA from raw fish trade for 2005 (million KRW except for the ratios in the last two columns)

	Exports	RVA	EVA	EVA IN	TRVA	RVA/ Exports	TRVA/ Exports
SC	4,262	2,477	801	395,033	397,510	58.1	9,327.7
CC	155,098	92,759	41,309	52,476	145,234	59.8	93.6
JL	687,310	431,270	134,589	42,294	473,564	62.7	68.9
GB	201,706	105,990	36,354	46,595	152,585	52.5	75.6
BS	697,030	372,828	157,454	27,034	399,862	53.5	57.4
GN	541,456	336,621	86,807	41,231	377,851	62.2	69.8
GW	167,516	87,862	61,523	11,642	99,504	52.4	59.4
JJ	387,709	203,905	100,286	2,820	206,725	52.6	53.3
Total or Average[a]	2,842,086	1,633,711	619,123	619,123	2,252,834	57.5	79.3

a In the last row, numbers in Columns 2-6 are totals while those in the last two columns are average shares.
Note: In 2005, one $US =1,024 KRW.

Table 7 Spatial distribution of TRVA from processed fish trade for 2005 (million KRW except for the ratios in the last two columns)

	Exports	RVA	EVA	EVA IN	TRVA	RVA/ Exports	TRVA/ Exports
SC	114,188	61,734	33,205	517,159	578,893	54.1	507.0
CC	143,173	65,303	63,298	85,742	151,045	45.6	105.5
JL	482,441	289,375	139,795	82,354	371,729	60.0	77.1
GB	134,338	66,124	51,309	103,931	170,055	49.2	126.6
BS	833,840	412,129	302,893	57,505	469,634	49.4	56.3
GN	729,731	377,579	243,619	73,587	451,166	51.7	61.8
GW	206,507	79,667	106,962	23,193	102,860	38.6	49.8
JJ	32,052	16,687	11,315	8,925	25,612	52.1	79.9
Total or Average[a]	2,676,270	1,368,598	952,396	952,396	2,320,994	51.1	86.7

a In the last row, numbers in Columns 2-6 are totals while those in the last two columns are average shares.
Note: In 2005, one $US =1,024 KRW.

Table 8 Change in shares of five components for raw fish exports (%)

	RVO	RRV	EVA	PDC	FIC	RVA
SC	-3.8	2.9	-4.2	1.3	3.7	-0.8
CC	3.9	0.6	-8.1	0.4	3.3	4.5
JL	-1.5	-0.6	0.4	-0.4	2.1	-2.1
GB	1.6	-1.5	6.0	-3.9	-2.3	0.2
BS	0	0.2	-0.8	-1.4	2.0	0.1
GN	-5.7	-0.6	6.0	0.3	0.0	-6.3
GW	0.9	0.3	-8.1	2.4	4.4	1.2
JJ	-4.4	0	7.3	-2.4	-0.4	-4.5
Average	-0.8	-0.2	1.1	-1.2	1.0	-0.9

Table 9 Change in shares five components for processed fish exports (%)

	RVO	RRV	EVA	PDC	FIC	RVA
SC	1.8	1.6	-4.9	0.7	0.7	3.4
CC	3.6	0.5	-7.6	0.4	3.2	4.1
JL	-1.9	-0.2	-0.7	0.4	2.4	-2.1
GB	-2.1	0.0	-0.7	0.7	2.1	-2.2
BS	6.0	-0.1	-7.8	0.1	2.0	5.8
GN	-0.3	-0.3	0.4	-1.2	1.4	-0.6
GW	0.2	0.2	-4.9	1.7	2.9	0.4
JJ	-2.4	0.0	2.2	-0.9	1.1	-2.5
Average	0.1	-0.1	-1.3	-0.4	1.8	-0.1

Table 10 Change in EVA Distribution: Raw fish exports (%)

	SC	CC	JL	GB	BS	GN	GW	JJ
SC	NA	16.0	-9.2	9.9	-0.6	0.1	-15.3	-0.8
CC	-12.6	NA	5.3	4.5	0.4	1.5	0.7	0.1
JL	-8.9	2.5	NA	6.2	-1.3	1.5	1.1	-1.2
GB	-0.6	3.9	3.8	NA	-8.4	-2.3	3.4	0.1
BS	-15.8	-3.9	1.5	0.9	NA	15.7	0.8	1.1
GN	-0.8	1.8	8.4	-3.2	-7.4	NA	0.5	0.3
GW	-24.0	8.7	2.6	8.0	1.9	2.8	NA	0.0
JJ	21.0	2.4	-26.7	3.0	-1.0	1.5	-0.1	NA

Table 11 Change in EVA Distribution: Processed fish exports (%)

	SC	CC	JL	GB	BS	GN	GW	JJ
SC	NA	3.0	11.4	11.8	-14.9	-10.6	-2.4	1.7
CC	27.1	NA	-7.7	-1.6	-8.9	-6.3	-1.8	-0.8
JL	16.9	-0.5	NA	1.7	-10.2	-9.0	0.8	0.5
GB	31.0	2.6	3.7	NA	-18.6	-19.1	-0.1	0.6
BS	-11.8	5.2	11.9	-0.8	NA	-6.9	0.6	1.6
GN	14.4	0.1	-1.5	-6.4	-4.7	NA	-1.8	0.0
GW	4.3	0.9	-0.7	1.0	-4.3	-1.0	NA	-0.2
JJ	27.3	-2.4	-8.4	-0.8	-8.5	-6.6	-0.6	NA

Table 12 Change in ratios of RVA and TRVA to exports (%)

	Raw fish exports		Processed fish exports	
	RVA/Exports	TRVA/Exports	RVA/Exports	TRVA/Exports
SC	-0.8	-7,557.4	3.5	365.4
CC	4.4	-1.3	4.1	-1.5
JL	-2.1	-4.8	-2.1	-9.6
GB	0.2	7.3	-2.2	-30.4
BS	0.2	2.9	5.8	0.6
GN	-6.3	-4.9	-0.6	-3.9
GW	1.2	17.3	0.4	-8.4
JJ	-4.5	-4.6	-2.4	-21.5

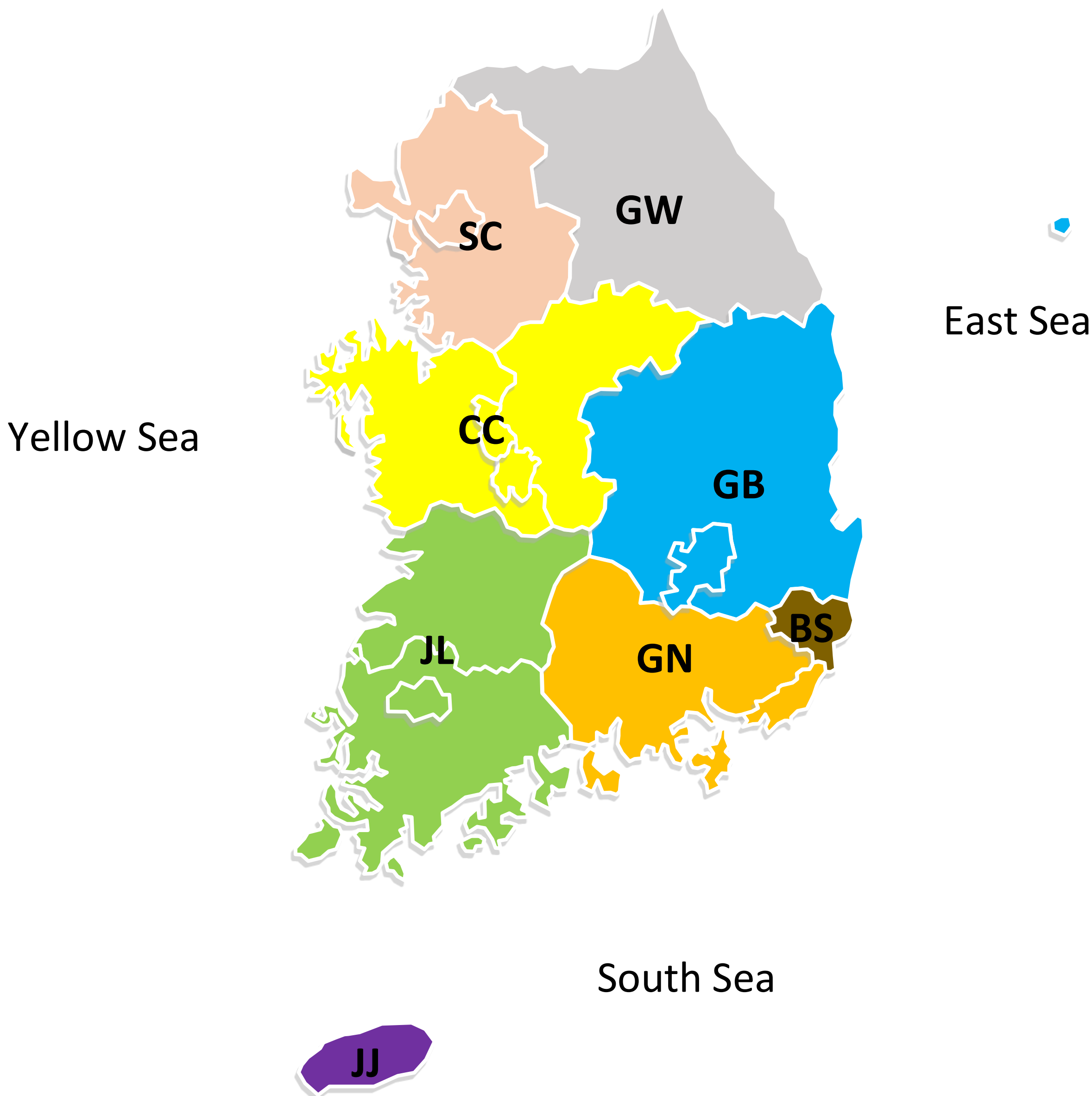

Figure 1 Eight Regions in the ROK

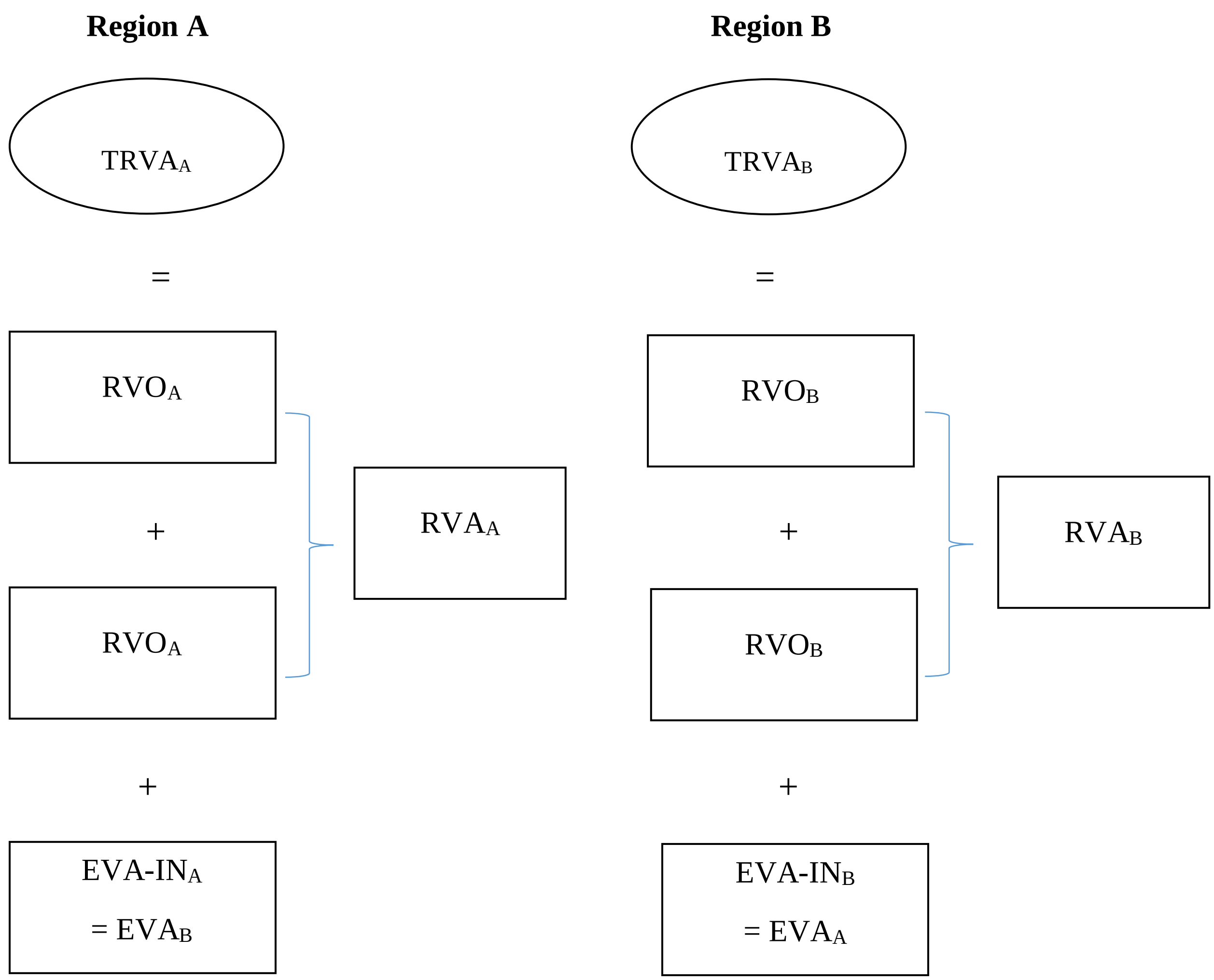

Figure 2 Calculating total regional value added (TRVA): a two-region case

Appendix A

Table A1. List of 33 industries

Sector number	Sector name
1	Agricultural and forest products
2	Raw fish
3	Mining products
4	Food and beverages
5	Processed seafood
6	Textile and leather products
7	Wood, pulp, and printing
8	Petroleum and coal products
9	Chemicals
10	Non-metal mineral products
11	Primary steel products
12	Fabricated steel products
13	Computers, electronic, and optical instrument
14	Electrical equipment
15	Machinery
16	Transport equipment
17	Other manufacturing products
18	Electricity, gas, steam, water, and sewage treatment
19	Construction
20	Trade
21	Transportation and warehousing
22	Eating and lodging
23	Communication and broadcasting
24	Finance and insurance
25	Real estate
26	Professional, scientific, and technical service
27	Business support service
28	Public administration and national defense
29	Education service
30	Health and social service
31	Sports and entertainment service
32	Other services
33	Other

Appendix B

Table B1 Decomposition of raw fish exports by region for 2015 (% of gross exports except the value of exports in Column 2)

	Exports (million KRW)	RVO	RRV	EVA	PDC	FIC	RVA
SC	33,928	43.0	14.2	14.6	14.1	14.0	57.3
CC	376,493	62.3	2.0	18.5	5.7	11.5	64.3
JL	1,444,863	59.2	1.4	20.0	7.4	12.0	60.6
GB	309,667	51.3	1.4	24.0	10.8	12.5	52.7
BS	488,230	52.2	1.5	21.8	10.7	13.9	53.6
GN	837,532	54.5	1.4	22.0	9.8	12.3	55.9
GW	120,525	53.0	0.6	28.6	6.7	11.0	53.6
JJ	627,327	48.0	0.2	33.2	8.3	10.4	48.1
Average		55.2	1.4	22.9	8.5	12.0	56.5

Note: In 2005, one $US =1,024 KRW.

Table B2 Decomposition of processed fish exports by region for 2015 (% of gross exports except the value of exports in Column 2)

	Exports (million KRW)	RVO	RRV	EVA	PDC	FIC	RVA
SC	92,338	50.4	7.1	24.2	11.1	7.2	57.5
CC	192,758	48.6	1.1	36.6	6.7	7.1	49.7
JL	879,818	57.0	0.9	28.3	6.2	7.6	57.9
GB	181,577	46.3	0.8	37.5	8.0	7.4	47.0
BS	549,024	54.7	0.6	28.5	8.2	8.1	55.2
GN	543,451	50.5	0.6	33.8	7.9	7.2	51.1
GW	644,293	38.6	0.4	46.9	7.4	6.8	39.0
JJ	135,866	49.5	0.1	37.5	5.8	7.0	49.6
Average		50.2	0.8	34.3	7.3	7.4	51.0

Note: In 2005, one $US =1,024 KRW.

Table B3 Decomposition of EVA for raw fish exports by source region for 2015 (% of gross exports)

	SC	CC	JL	GB	BS	GN	GW	JJ	Total
SC	NA	6.8	1.5	2.3	0.6	0.9	2.3	0.1	14.6
CC	15.3	NA	1.2	1.0	0.2	0.4	0.5	0.0	18.5
JL	12.5	2.9	NA	2.0	0.5	1.3	0.7	0.1	20.0
GB	13.9	2.9	1.1	NA	1.2	3.2	1.6	0.1	24.0
BS	8.6	1.4	0.9	3.1	NA	6.9	0.6	0.3	21.8
GN	10.7	2.5	2.4	3.7	1.9	NA	0.6	0.1	22.0
GW	21.4	2.8	0.8	2.3	0.6	0.8	NA	0.0	28.6
JJ	22.8	3.5	2.7	1.7	0.5	1.6	0.4	NA	33.2

Table B4 Decomposition of EVA for processed fish exports by source region for 2015 (% of gross exports)

	SC	CC	JL	GB	BS	GN	GW	JJ	Total
SC	NA	6.6	6.9	6.0	0.5	2.4	1.0	0.8	24.2
CC	29.93	NA	1.7	2.3	0.4	2.0	0.2	0.2	36.6
JL	20.48	3.0	NA	2.6	0.2	1.1	0.5	0.4	28.3
GB	26.87	3.9	4.1	NA	0.3	1.4	0.6	0.5	37.5
BS	12.25	4.1	6.4	3.8	NA	0.1	1.1	0.7	28.5
GN	23.71	3.2	3.2	2.7	0.3	NA	0.5	0.3	33.8
GW	35.81	3.3	1.9	2.7	0.5	2.4	NA	0.2	46.9
JJ	28.66	2.8	1.4	2.2	0.5	1.8	0.1	NA	37.5

Table B5 Spatial distribution of TRVA from raw fish trade for 2015 (million KRW except for the ratios in the last two columns)

	Exports	RVA	EVA	EVA-IN	TRVA	RVA/ Exports	TRVA/ Exports
SC	33,928	19,429	4,954	581,213	600,643	57.3	1770.4
CC	376,493	241,907	69,767	105,931	347,838	64.3	92.4
JL	1,444,863	875,763	288,871	50,641	926,404	60.6	64.1
GB	309,667	163,211	74,335	93,769	256,980	52.7	83.0
BS	488,230	261,878	106,531	32,415	294,293	53.6	60.3
GN	837,532	467,802	184,019	75,510	543,312	55.9	64.9
GW	120,525	64,620	34,507	27,827	92,447	53.6	76.7
JJ	627,327	301,906	208,192	3,870	305,777	48.1	48.7
Total or average[a]	4,238,565	2,396,516	971,176	971,176	3,367,694	56.5	79.5

a In the last row, numbers in Columns 2-6 are totals while those in the last two columns are average shares.
Note: In 2005, one $US =1,024 KRW.

Table B6 Spatial distribution of TRVA from processed fish trade for 2015 (million KRW except for the ratios in the last two columns)

	Exports	RVA	EVA	EVA-IN	TRVA	RVA/ Exports	TRVA/ Exports
SC	92,338	53,120	22,334	752,445	805,565	57.5	872.4
CC	192,758	95,729	70,581	104,697	200,425	49.7	104.0
JL	879,818	509,532	249,179	83,836	593,368	57.9	67.4
GB	181,577	85,392	68,156	89,294	174,686	47.0	96.2
BS	549,024	303,331	156,324	9,165	312,496	55.2	56.9
GN	543,451	277,894	183,887	36,910	314,804	51.1	57.9
GW	644,293	251,104	302,279	15,410	266,513	39.0	41.4
JJ	135,866	67,413	51,009	11,993	79,406	49.6	58.4
Total or average[a]	3,219,125	1,643,515	1,103,749	1,103,749	2,747,263	51.1	85.3

a In the last row, numbers in Columns 2-6 are totals while those in the last two columns are average shares.
Note: In 2005, one $US =1,024 KRW.