

Impact of Port and Port Related Industries on Busan Regional Economy

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항만과 항만관련산업이 부산지역경제에 미치는 영향**

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Key Words: Busan, port, regional economy, port related industries

Abstract

Generally and also specifically in Busan the port and port related industries influence regional economy directly and indirectly. In the case of Busan the regional I-O model shows the port and port related industries account for more than one fifth of regional production, more than one fifth of value added and more than one seventh of employment at least. The port and port related industries are the most important sector in Busan economy as well as other major ports such as Rotterdam and Singapore. The impact estimation of port and port related industries is compared by the previously held survey study. The compilation of regional I-O table makes more diverse analysis on regional economic variables available and a few sample cases are reported in this paper.

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I . Introduction

It is widely recognized that port and port related industries do influence the regional economy where the port is located more or less. However in a large port city like Busan with 3.7 million population the impact of the port on the regional economy is hard to find unless it is estimated empirically. In a geographic context, a large port is for the national usage purpose and not for the region at stake. But the port really matters for the regional economy in every aspect. The regional economy should be affected by the share and activities of port and port related industries and policies of regional and national government.

Until 1990s trials to estimate the impact of port on regional economy by a survey method had been made in foreign countries. Yochum and Agrawal(1984) tried to find the economic impact of Virginia's ports on the Common Wealth by cost and benefit analysis assuming without the port. But the method relied on the questionnaire survey asking the degree of dependence of the port on the regional economy. Kitakyushu Maritime Administration(1981) tried to estimate the impact of Kitakyushu port on regional economy. Their method was focused to decide the dependency ratio of an industry or firm on the port by survey or telephone and then calculate the economic impact by the dependency proportion.

In Korea, Lim(1989) tried to estimate the impact of port and port related industries on the Busan regional economy by statistical data, on-site survey and questionnaire survey. Following the classification method of Virginia study by three categories: port related, port directly dependent and port indirectly dependent industries, he used the statistics of regional output, value added and employment. For the sectors and ports which had no statistical data, the on-site survey and questionnaire method were tried to collect appropriate data. Since the port indirectly dependent industries are not entirely dependent on the port for their business operation the portion of dependence degree was asked by survey and the dependency ratio was calculated by average method.

The above method was robust but had problems of data collection, of course. If the regional input-output(I-O) table had been available the estimation would have been more accurate and scientific.

Recently regional I-O tables have been made for a specific region along with multi-region I-O table in Korea. Korea Maritime Institute(2002) tried to estimate

the impact of port and port related industries by multi-regional I-O table. However the number of sectors of the I-O table was only 34 with only one port industry and thus it could not disaggregate the port related industries and could not distinguish a specific region. KMI(2004) tried again to estimate the impact by the national I-O table. Since it used the national I-O table the impact of all ports in Korea in aggregate on the national economy was possible but not for an individual region.

This paper reports the impact of port and port related industries on Busan regional economy by using the Busan regional I-O table which was established in 2004. The Busan regional I-O table is composed of 170*170 sectors without disaggregated port related industries. Therefore 12 port related industries were added for the estimation purpose and at the same time some application by the I-O table for the regional industries are reported. The comparison between the result of 1989 survey method and the 2005 regional I-O table method is made too. As an introduction process the position of port and port related industries in Busan economy is discussed at the beginning to test the causality between the regional economy and the port related industries. Conclusion and further consideration follows at the end.

II. The Relationship between Port and Port Related Industries and the Busan Regional Economy.

It is known that a major port of a country plays an important role for the national economy. However the relationship between the port(activity) and national economy may be different by countries. A certain port(activities) like Singapore influences the national economy but the direction would be unilateral. Other ports like Rotterdam belong to the former case but the magnitude and direction may be different from the former case. Both ports rely on trans-shipments of cargo and on the activity of distribution park. In the case of Busan port the relation between national economy and port activities belongs to a bilateral case more or less. The case of Shanghai port which carries the domestic cargos and plays the role of distribution center is the same as Busan. The rapid growth of Korean economy required the expansion of port facilities and port related activities of Busan and the enhanced port related activities influenced the national economy. The

relationship would be defined as unilateral where the national economy regulates the port activities for its own sake. The same logic can be applied in the Shanghai case.

If we turn to the regional economy the relationship would be reversed. In the case of Busan port the relationship flows from the port activities to the regional economy. The port like Busan exists for the national and global purpose, not for the region itself.

<Table 1> O D of Loaded Container through Busan Port (2006)

(unit: TEU)

Area	Export		Import		Total	
	TEU	ratio(%)	TEU	ratio(%)	TEU	ratio(%)
Seoul area	1,049,317	30.6	1,072,945	31.8	2,122,262	31.1
Busan	408,068	11.9	199,068	5.9	607,136	8.9
Gyeongnam	949,872	27.7	998,717	29.6	1,948,589	28.7
Gyeongbuk	582,954	17.0	573,588	17.0	1,156,542	17.0
Jeonnam	92,588	2.7	222,687	6.6	315,275	4.7
Jeonbuk	82,299	2.4	64,106	1.9	146,405	2.1
Chungnam	109,732	3.2	128,214	3.8	237,946	3.6
Chungbuk	147,453	4.3	111,343	3.3	258,796	3.8
Gangwon	6,858	0.2	3,374	0.1	10,232	0.1
Total	3,429,141	100.0	3,374,042	100.0	6,803,183	100.0

Source: Busan Port Authority 2006

Table 1 shows the origin and destination(O-D) of loaded container cargo of Busan port,excluding trans-shipment containers. Of container cargo Busan makes use of only 8.9% of all loaded container cargo within Busan and rest of them goes to other areas throughout Korea. Instead the regional economy is influenced by the port and port related industries, and the port plays an active role in the regional economy in this case. A next point to check is that whether the regional economy has been actually influenced by the port and port related activities. This relationship can be checked by the change of industrial structure in Busan. According to the statistical classification the port related function belongs to the category of transportation industry.

Source: KOSIS

<Table 2> Share of Busan GRDP by Industry

(unit: %)

	1985	1990	1995	2000	2005
Agriculture and Fishery	2.5	2.0	2.5	2.5	2.0
Mining	1.8	1.1	0.4	0.3	0.2
Manufacturing	10.4	8.7	5.3	4.0	3.3
Utilities	2.7	3.0	2.9	6.0	7.0
Construction	6.4	6.3	6.2	5.7	6.2
Wholesale and retail	9.8	10.2	9.6	9.8	8.7
Hotels and Restaurants	8.2	8.9	9.2	8.6	9.1
Transportation	14.0	14.1	12.2	13.5	14.1
Communication	7.4	6.0	5.9	6.5	5.7
Banking and Insurance	6.5	6.7	7.0	6.4	6.2
Real Estate and Business Service	7.9	7.2	6.8	6.1	5.8
Public Administration and national defence	5.3	5.5	5.5	4.9	4.6
Educational Service	7.3	6.9	6.8	6.8	6.8
Health and Social Welfare	6.5	6.2	8.9	7.8	7.3
Other Services	8.1	7.5	6.2	6.4	6.1

Table 2 shows the share of Busan industries to the national industrial total. Throughout the period the share of transportation which includes port related activities is exceptionally high along with hotels and restaurants industry. One characteristic to be pointed is that Busan had industrial structure of manufacturing oriented industries from 60's to 80's but that kind of structure has been completely changed and the city shows the characteristics of industrial structure of typical large cities in the world.

<Table 3> LQ of Busan Employment

(unit: %)

	1985	1990	1995	2000	2005
Agriculture and Fishery	0.3	0.3	0.4	0.4	0.7
Mining	0.2	0.1	0.1	0.0	0.4
Manufacturing	1.3	1.2	0.8	0.7	0.9
Utilities	0.3	0.4	0.5	1.0	0.9
Construction	0.8	0.8	1.0	1.0	1.0
Wholesale and retail	1.3	1.4	1.5	1.7	1.4
Hotels and Restaurants	1.0	1.2	1.4	1.5	1.2
Transportation	1.8	1.9	1.9	2.3	1.8

Communication	0.9	0.8	0.9	1.1	1.1
Banking and Insurance	0.8	0.9	1.1	1.1	1.1
Real Estate and Business Service	1.0	1.0	1.1	1.0	1.1
Public Administration and national defence	0.7	0.7	0.9	0.8	1.0
Educational Service	0.9	0.9	1.1	1.2	1.2
Health and Social Welfare	0.8	0.8	1.4	1.3	1.2
Other Services	1.0	1.0	1.0	1.1	1.3

Source: KOSIS

In terms of employment the characteristics of port city seems more obvious. The location quotient(LQ) of Busan employment is shown in Table 3. The table shows that Busan is very specialized in the transportation industry which includes port related activities and also the magnitude of LQ remains almost the same by time. The LQ of transportation is 1.8 in 1985 and it increases steadily for ten years and reached to 1.9 in 1995 showing a changing industrial structure of Busan affected by the port related industries. It shows a little lower coefficient of 1.8 after 2.3 of 2000 but this industry is the only outstanding one having a very high LQ coefficient in Busan industries.

One categorical problem to be indicated is that the transportation industry includes industries related to surface, air, sea transportation activities and other related industrial activities too. That is the specialization of transportation industry may not be caused by sea transportation industry only. Table 4 indicates port related industrial activities among transportation industries. The definition of port and port related industries is tricky in this kind of study. Because of difficulty in statistical data acquisition a standardized definition of port and port related industries is hard to make. Table 4 shows classification of port and port related industries by three categories of port activity, directly port dependent and indirectly port dependent following a research report(BPA 2005). The port activities are so called sea transportation themselves such as ocean going transportation and sea terminal operations. Some industrial activities like warehouse and fisheries are classified as directly port dependent. Rest of the industrial activities such as marine products wholesale and universities are classified as indirectly port related.

<Table 4> Employment Structure of Port and Port Related Industries . *

(unit: man)

	Busan				Nation			
	1996	1998	2001	2003	1996	1998	2001	2003
Port activities	8,585	6,410	8,350	12,587	28,888	20,124	25,291	26,700
Port dependent	111,409	101,846	99,980	108,891	1,174,427	1,073,472	1,181,598	1,283,856
direct	45,735	42,112	40,595	44,049	447,172	370,229	430,367	469,632
indirect	65,674	59,734	59,385	64,842	727,255	703,243	751,226	814,224
Total Port related	119,994	108,256	108,280	121,478	1,203,315	1,093,596	1,206,884	1,310,556
All industries	1,137,990	1,010,408	1,106,917	1,130,189	14,006,754	12,416,558	14,109,641	14,729,166

*: Industries included in the port related(dependent) industries are water transportation service, water transportation ancillary service, port transportation, storage and warehouse, sea and port related organizations and services, container maintenance and others. These industries are subdivided as port directly dependent industries such as ship building and maintenance and special cargo transportation, and port indirectly dependent industries such as business services and fish sales.

Source: KOSIS

As shown in Table 4 the employment of port activities in Busan accounts nearly one third of the national total up to 2001. If we add port activities and directly port dependent industries from Table 4 and compare the industrial share between Busan and Korea, respectably, the share of Busan is 4.5% in 1996 and 5.0% in 2003. Whereas that of the nation is 3.4% in 1996 and 3.4% in 2003 showing no change over the same period. Therefore more detailed classification reconfirms Busan's specialization in port related industrial activities in the regional economy as well as the national economy.

We can conclude that the relationship between port and port related industries and regional economy is almost unilateral flowing from port to regional economy in the case of Busan. Therefore the port and port related industries have been constantly influencing the industrial structure change of Busan.

III. Measurement of Impact of Port and Port Related Industries on Regional Economy.

Once the relationship is examined, it is necessary to measure the impact of port and port related industries on the regional economy. There has been basically two ways of measurement of impact. A more traditional way is to measure and

estimate all industrial activities by second hand statistics or to estimate the impact by direct survey and interview or indirect method like 1)extrapolation. Most studies so far have followed this way The other way is to estimate the impact by industrial inter-relation like L_O table.

1. Measurement by survey

Yochum and Agrawal(1984) measured the impact of Virginia’s port. Kitakyushu Maritime Administration(1991) reported the same thing. Lim(1989) estimated the impact of Busan port by following the framework of the previous two studies. Rotterdam and Singapore Port Authorities also reported their regional impact of port industries. Table 5 summarizes the findings and report of impact measurement.

<Table 5> Impact of Ports on Regional Economy

(unit: %)

Port	GRP*	Value Added	Employment	Source	Year
Busan	34.2	20.7	27.2	Lim	1989
Kobe	30.8		17.3	Kobe Maritime Administration	1981
Kitakyushu	34.8	20.4	17.7	Seaport and Airport Bureau of Kitakyushu	1981
Virginia			5.0	Yochum and Agrawal	1984
Rotterdam	22.8		16.0	Rotterdam Port Authority	2003
Singapore	11.0		5.4	Port of Singapore Authority	2003

* Singapore’s case is GDP

Since the classification of industries and the coverage of port related industries are different by study and by country it is hard to derive a general observation from Table 5. Nevertheless we can claim that the port and port related industries account for at least one third of GRDP in most of regions where the estimates are tried. In the case of employment about 27% of regional employment is related to port related industries in Busan(Lim 1989). However in this study the indirectly dependent industries included manufacturing industries partially reflecting the locational characteristics such as the portion of logistics. If the more

1) An anonymous referee indicated that the estimation of 1989 for Busan is outdated. However this estimation is a recent one excluding Moon(1995) which uses the same model as Lim(1989) basically and shows a similar outcome.

comprehensive inclusion like manufacturing industries is excluded, about 17% of regional employment was reported as the impact.

In the case of Rotterdam about 22% of GRDP is related to the port related activities. The Singapore's case should be different from others because it is a nation instead of a city.

2. Measurement by Input-Output Table

One of more scientific way of measuring economic impact is using input-output(I-O) table. The I-O table is a good method figuring out not only the direct impact of policy or economic variables but the linkage effect as well. The problem so far was the availability of regional I-O table and, even in the case of existence, the accuracy of the table really mattered

Recently the regional I-O table was made by the city of Busan²⁾. The table is not superior to the national I-O table in any sense but the availability itself made many empirical researches possible. An estimation of measuring impact of port and port related industries on regional economy has been tried in this study.

The first problem for this study is the coverage of sectors. The Busan regional I-O table is by 170*170 sectors. But the port and port related industrial activities are not specified as individual sectors. Therefore we added 12 more sectors³⁾ as an expanded I-O table for the model. For a more accurate estimation more disaggregated sectors are necessary. However it is generally impossible because of data problem.

The second problem is inconsistency with the national I-O table. Since the regional I-O table was established not by the adjustment method like RAS(Bacharach 1970, for example) but by the regional statistical data and survey the inconsistency problem occurred inevitably. According to our judgment the problem was not severe nor structural but occasional, thus we only report the problem encountered in the measurement process. The third problem is a rather

2) Publishing a regional I-O table has been tried since early '90s in Korea. However it divided whole Korean region into a larger area and the number of industrial sector was small. A surveyed I-O table for a province or a metropolitan city became possible recently.

3) The added sectors are: ①Port facilities ②Railroad transportation ③Surface road transportation ④ Near sea and inland water transportation ⑤Ocean transportation ⑥Air transportation ⑦Surface road ancillary service ⑧Water transportation ancillary service ⑨ Air transportation ancillary service ⑩Loading and Unloading ⑪Storage and warehouse ⑫ Other transportation related services

general problem associated with I-O model. That is the I-O model does not reflect the changing economic conditions. But in this case the estimate by I-O table should be useful to figure the linkage structure among regional economic variables.

3. Estimation result

The estimation result is reported in Table 6. All the tables such as reverse matrices coefficient, various kinds of linkage coefficient or inducement coefficients are not reported here individually⁴⁾. The final result is shown in Table 6.

<Table 6> Impact of Port industries by I O

Method	Impact	Remark	
Regional I O (2005)	Output	20.64	① Estimate by the regional I O
	direct	9.88	
	indirect	10.76	② Distinction of direct and indirect follows the classification of Table 4
	Value Added	21.49	
	direct	7.25	③ Port related industries are as in footnote 1
	indirect	14.24	
Employment	14.21		
direct	4.37		
indirect	9.84		
National I O (2004)	Output	2.03	① In the National I O Table only two sectors of marine and port industries are included
	marine	1.87	
	port	1.23	
	Value Added	1.51	② National impact only of all ports in Korea
	direct	0.87	
	indirect	0.64	
Employment	1.61		
direct	0.63		
indirect	0.98		
Multi regional I O (2002)	GRDP	22.42	① Multi regional I O of 34*34
	direct	7.02	② Port industry is only included
	indirect	15.40	

Table 6 reports the estimation result by the regional I-O table and compares with two other preceding studies by the national and multi-regional I-O models. First of all the result is quite different from the outcome of survey methods. If we compare the I-O result with the survey result(Table 5) the latter generally

4) They are available upon request

underestimate the impact than the I-O method. It is natural because the survey method cannot figure out the linkage effect of various steps and also the survey method could be less comprehensive technically.

<Table 7> Comparison of Two Estimations

	Survey (1989)	Survey(reduced) (1989)	I-O (2005)
GRDP	34.2	15.90	20.64
V A	20.7	10.20	21.49
Employment	27.2	10.00	14.21

Table 7 compares the final outcome of two different estimations. In order to make the coverage of industries of two studies comparable the reduced form of estimate(1989) is also reported in the table. There may be two reasons on the differences between two estimates. The estimate by survey could not cover the related sectors fully and thus the underestimate was inevitable. In addition, the time gap between two studies is 16 years and thus the structural change of regional economy and the industrial change of Busan should be considered in comparison.

What we can find from this study is that the port and port related activities influence the regional economy to a large extent in Busan. At least one fifth of the regional output or added value is related to the port, More than ten percent of regional employment is generated from port and port related activities. Since the port and port related industrial activities are classified as a part of transportation the importance of transportation industry in Busan is also proved by this result.

IV. Application of Regional I-O Model⁵⁾

1. Impact of new port related investment

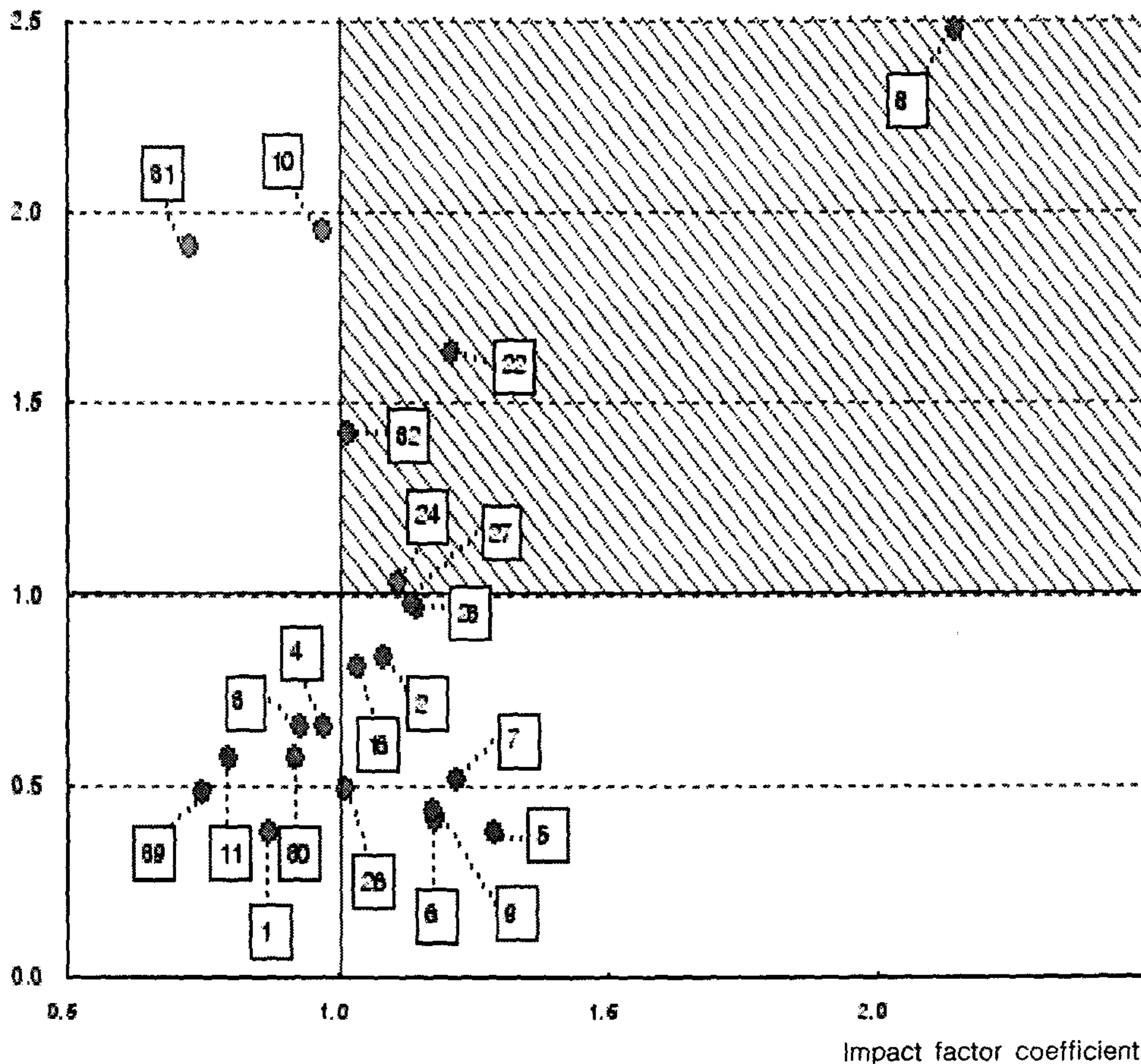
The compilement of regional I-O table makes estimate the impact of new

⁵⁾ This section is based on Busan Port Authority(2005)

investment on regional economy possible. The construction of Busan new port is under way from 2001 to 2011. The plan is constructing 30 berths along the Gaduk Island located at the West of Busan(BPI 2005). The total projected investment amounts to 6,625 billion Won. The estimation by the same I-O table reports that between 2005 and 2013 the output inducement effect turned out to be 15,400 billion Won and employment inducement effect of 167,977 where indirect linkage effect of 101,346 is included.

2. Impact factor coefficient and sensitivity coefficient of major industries in Busan

Sensitivity coefficient



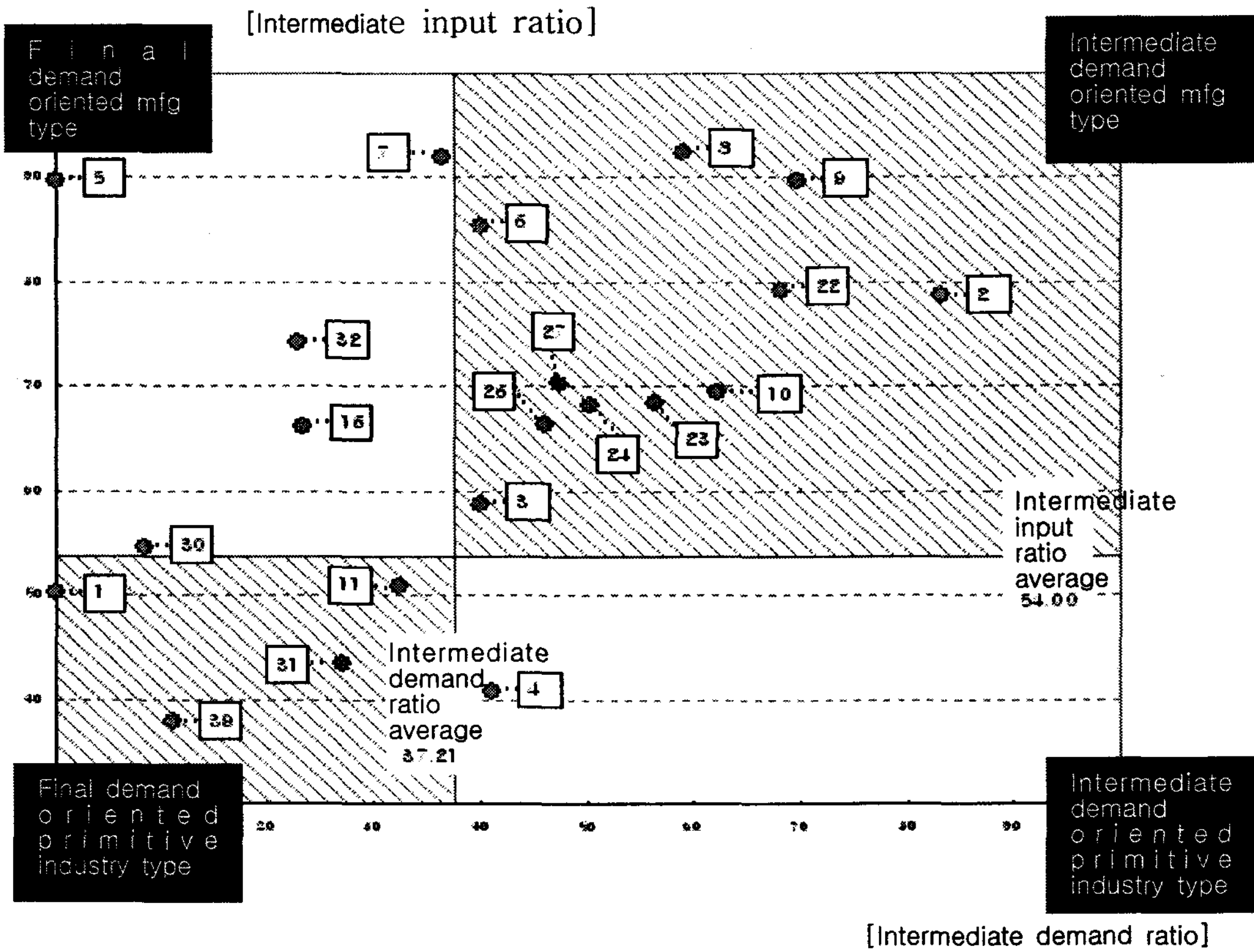
<Figure 1>

1. Port facilities	11. Storage and warehouse
2. Railroad transportation	16 Textile and leather pdts
3. Surface road transportation	22. Fabricated metal
4. Near sea and inland water transportation	23. Metal products
5. Ocean transportation	24. General machineries
6. Air transportation	26. Precision machineries
7. Surface road ancillary service	27. Transportation equipment
8. Water transportation ancillary service	30 Construction
9. Air transportation ancillary service	31. Wholesale and retail
10. Loading and unloading	32. Restaurants and hotels
	39. Social and other services

If we analyze the impact factor and sensitivity coefficient of major indust

ries of Busan by I_O table as an application using the regional I_O the result is as Figure 1. Among the port and port related industries the industry having higher coefficient in both sensitivity coefficient and impact factor coefficient turned out to be water transportation ancillary service as shown in Figure 1. Besides that all industries having coefficient of 1 or larger belong to non-port related industries. In port related industries the loading and unloading industry has higher sensitivity coefficient reflecting high forward linkage effect and ocean transportation and surface road ancillary service showed relatively higher impact factor coefficient.

3. Relative impact power of port and port related industries associated with industrial agglomeration and linkage effect.



<Figure 2>

1. Port facilities	11. Storage and warehouse
2. Railroad transportation	16. Textile and leather pdts
3. Surface road transportation	22. Fabricated metal
4. Near sea and inland water transportation	23. Metal products
5. Ocean transportation	24. General machineries
6. Air transportation	26. Precision machineries
7. Surface road ancillary service	27. Transportation equipment
8. Water transportation ancillary service	30. Construction
9. Air transportation ancillary service	31. Wholesale and retail
10. Loading and unloading	32. Restaurants and hotels
	39. Social and other services

In order to classify Busan industries including port related industries by characteristics of intermediate demand oriented or final demand oriented Figure 2 is constructed. As shown in the Figure most port and port related industries

belong to the quadrant of above average of intermediate input and demand ratio meaning that they possess the industrial characteristic of higher intermediate demand rather than final demand and more manufacturing related than non-manufacturing(primitive) industries. Among those water transportation ancillary service, railroad transportation and air transportation industries show the characteristics of higher intermediate input and demand. Likewise the fabricated metal industry and loading and unloading industry also have higher ratios. Instead port facility has average intermediate input ratio but almost non-intermediate demand ratio. The storage and warehouse industry shows almost average level in two factors. The near sea and inland water transportation industry shows primitive industry type having high forward linkage effect and low backward linkage effect.

We showed only three cases of application of regional I_O analysis here and more interesting outcome could be shown.

V. Conclusion and Further Consideration

Generally and also specifically in Busan the port and port related industries influence regional economy directly and indirectly. In the past the impact of port and port related industries on a regional economy was estimated by survey or by indirect statistical methods. The availability of regional I_O table made a more scientific estimation possible like this study. In the case of Busan the regional I-O model shows the port and port related industries account for more than one fifth of regional production and value added, and more than one seventh of employment, at least. The port and port related industries are the most important sector in Busan economy as well as other major ports such as Rotterdam and Singapore. The impact estimation of port and port related industries is compared by the previously held survey study. The compilation of regional I-O table makes more diverse analysis on regional economic variables available and a few sample cases are reported in this paper.

By the compilation of regional I-O table the impact measurement of port and port related industries become more scientific and more diverse. However one important point to be indicated is that more accurate and reliable I-O table is necessary to be prepared and more disaggregated data on specific industries as shown in this study be filed consistently for more applicable estimation.

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< 요약 >

항만과 항만관련산업이 부산지역경제에 미치는 영향

임정덕

항만과 항만관련 산업은 지역경제에 직접, 간접으로 영향을 미친다. 부산의 경우 지역 투입산출표(I-O)를 이용하여 추계하면 항만과 항만관련산업은 지역생산과 부가가치의 최소 1/5이상, 지역고용의 1/7이상의 영향력을 가지는 것으로 나타난다. 항만과 항만관련산업은 부산경제에서 가장 중요한 부문이며 세계의 다른 주요항만인 로테르담이나 싱가포르도 마찬가지이다. 항만이 지역경제에 미치는 영향은 과거 조사에는 실제 조사방법을 사용하였다. 지역투입산출표가 지역경제변수에 대한 보다 다양한 분석을 가능하게 하며 이 논문에서의 몇 개의 응용예가 보고되고 있다.

□ 주제어 : 부산, 항만, 지역경제, 항만관련산업