

**A Decomposition Analysis of Inward Foreign Direct Investment in Korea
Shift-Share Analysis, 2003-2006***

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Abstract

Applying the shift-share analysis, this paper decomposes inflow of FDI into Korea for the period of 2003-2006. The paper finds that Korea has been lagging behind the world average in absorbing inward foreign direct investment. While the aggregate competitive effects have recorded negative effects, several industries have recorded positive competitive effect: electrical and electronic equipment, motor vehicles and other transport equipment, hotels and restaurants, transport, storage and communications, finance, and business services.

JEL Classifications: F14, F21

Keywords: Foreign Direct Investment, Shift-Share Analysis, World Growth Effect, Industry-Mix Effect, Competitive Effect, Allocation Effect

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1. Introduction

Foreign direct investment (FDI) is an important mode of international capital movement and transactions in services. It also affects human capital spillover between countries. Quite naturally, much attention has been paid on the role of FDI in economic growth of developing countries and developed countries as well. It is important to identify causes for FDI flows, i.e., changes in FDI stocks. With relevant identification of causes for such changes in FDI stocks, governments can have clear understanding of forces underlying changes in FDI and thus can establish relevant facilitating policies toward FDI flows.

The purpose of this paper is to decompose FDI inflow into Korea by the shift-share analysis. The shift-share analysis is a technique widely used in regional economics for decomposition of changes, usually in employment, in a set of urban areas or regions. Arcelus (1984) notes that its popularity is mainly due to its “considerable analytical potential and the relatively undemanding statistical requirements for its use.” The use of shift-share analysis is also widely criticized, as Fothergill and Gudgin (1979, p. 309) state succinctly that “shift-share fits the expectation that, when a technique is simple and apparently useful, it will be both widely used and heavily criticized.”

There are several versions of shift-share analysis. This paper applies the shift-share analysis, in its original form and in the extended form of Esteban-Marquillas (1972) and Arcelus (1984) as well, to decompose the FDI inflow in Korea for the period of 2003-2006. The original shift-share analysis decomposes the change into three effects: the overall growth effect (share effect), industry-mix effect and the competitive effect. The extended version of shift-share analysis of Esteban-Marquillas (1972) and Arcelus (1984) decomposes the changes into four components: share effect, industry-mix effect, competitive effect and allocation effect.

While the shift-share analysis is extensively used in regional economics, it is seldom used in the analysis of FDI. It is well known that the study of FDI has been hindered by the lack and low quality of detailed data. Since the burden of data acquisition and analysis for the shift-share analysis is low, the shift-share analysis can be readily applied to the analysis of FDI. However, little effort is made to apply the shift-share analysis to examine changes in Korean FDI stocks. As a rare exception, to the authors' best knowledge, Ahn and Lee (2007) have applied the original shift-share analysis to decompose FDI inflow in service industries in Korea for the period of 2001-2002. Complementing Ahn and Lee (2007), the present paper decomposes FDI inflow into Korea for the period of 2003-2006 years. The two decomposition results will be

compared to each other.

The decomposition analysis can be viewed as a first step in identifying the sources of FDI inflows. That is, the model can be applied prior to thorough examination of determinants of FDI inflows. This is so because the decomposition analysis can offer timely and prompt identification of probable causes underlying changes in FDI stocks. With the help of the decomposition analysis, governments may be able to identify the industries where more attention for industrial policy is called for. Thorough examination of conditions underlying the industries would then reveal proper information about the industries and FDI inflow, and thus, the need for relevant policies.

The remainder of the paper is organized as follows. Section 2 introduces the model of the shift-share analysis. Section 3 presents the results of decomposition of FDI inflow into Korea. The results are also compared to those of Ahn and Lee (2007). The final section offers concluding remarks.

2. Models of Shift-Share Analysis

This section introduces the model of shift-share analysis that decomposes FDI inflow into three or four components. With a slight change in terms, the original shift-share analysis can be applied to decompose an increase (or a decrease) in inward FDI stock in a country into three components: (1) a world growth effect, which is the part of the change in inward FDI stock of a country attributed to the growth of the world inward FDI stock, (2) an industry-mix effect, the amount of change in FDI stock the country would have experienced had FDI stock of each industry of the country grown at the corresponding world industrial growth rate, less the world growth effect, and (3) a competitive effect, the difference between the actual change in FDI stock and the change in FDI stock to be expected if FDI stock of each industry grew at the world industrial growth rate.¹ Of course, the sum of these three effects equals the actual change in FDI stock of the industry of the country over a prescribed time period. For each effect, the industry values are summed to obtain the total effect for the country.

We now present the mathematical formula of the shift-share analysis. Consider (net) FDI inflow into Korea, i.e., an increase in FDI stock of Korea for a given period (from

¹ In defining the three component effects, the present paper uses the National Growth Rate method, which is widely used in American studies. Several alternative definitions of the three components have been proposed. For a detailed discussion, see Barff and Knight (1988).

the end of year 0 to the end of year 1)². We define variables necessary for the formula as follows:

X_{iw} : world FDI stock of industry i at year 0.

X_w : world aggregate FDI stock of all industries, that is, $X_w = \sum_i X_{iw}$

X_{ik} : FDI stock of industry i of Korea at year 0.

X_k : aggregate FDI stock of Korea at year 0, that is $X_k = \sum_i X_{ik}$

r_{ik} : growth rate of FDI stock of industry i in Korea

r_w : growth rate of aggregate world FDI stock

r_{iw} : growth rate of world FDI stock of industry i

An increase (or a decrease) in FDI stock of industry i of Korea is given by $X_{ik} r_{ik}$. The shift-share analysis decomposes the FDI inflow, $X_{ik} r_{ik}$, by the following identity.

$$X_{ik} r_{ik} = X_{ik} r_w + (r_{iw} - r_w) X_{ik} + (r_{ik} - r_{iw}) X_{ik} \quad (1)$$

The first term in the right hand side of eq. (1), $X_{ik} r_w$, can be regarded as the increase in FDI stock of industry i of Korea resulting from the worldwide increase in FDI stock: world growth effect. In other words, this is the part of the change in FDI stock of industry i in Korea ascribed to the rate of growth of world FDI stock as a whole. That is, if FDI stocks of all the industries in all the countries have increased at the same rate, FDI stock of industry i of Korea would also have increased exactly by the same rate.

The second term in the right hand side of eq. (1), $(r_{iw} - r_w) X_{ik}$, is the industry mix effect. $(r_{iw} - r_w)$ denotes the difference between industry i 's growth rate and the overall growth rate in world FDI stock. Thus, $(r_{iw} - r_w) X_{ik}$ can be regarded as worldwide industry mix effect. Industries with FDI stocks growing faster than the world aggregate FDI stock would record positive industry mix effect.

The remaining term in the right hand side of eq. (1), $(r_{ik} - r_{iw}) X_{ik}$, measures competitive effect for industry i in Korea. If the environment of Korea were more conducive to inward FDI of industry i than the world, then Korea would have recorded higher growth rate in industry i than the world aggregate FDI stock of industry i , and as a result, a positive competitive effect. It can measure, *ex post*, the country-specific effect, resulting from country's potential in FDI absorption and policies towards FDI in industry i : This part is thus denoted competitive effect. Industries with higher growth

² Note that the analysis in this section can be applied to any country and is independent of a specific country.

rates than the world average would record positive competitive effect. The competitive effect can be viewed as reflecting the overall effect of policy packages and potential for FDI absorption.

The shift-share analysis uses the comparative-static approach, which considers conditions only at the beginning and end years of the time period.³ To reduce the arbitrariness associated with initial conditions in the comparative static approach in the shift-share analysis of employment growth, Esteban-Marquillas (1972) has introduced the concept of “homothetic employment in sector *i* of region *j*,” which he defined as “the employment that sector *i* of region *j* would have if the structure of the employment in such region were equal to the national structure.”

This paper now presents the model of the extended shift-share analysis of Esteban-Marquillas (1972) and Arcelus (1984). Note that the share of Korean FDI in the world at year 0 is given by (X_k / X_w) . Define the homothetic, not real, FDI stock of industry *i* of Korea at the base year, $X(I)_{ik}$, as follows:

$$X(I)_{ik} = X_{iw} (X_k / X_w) \quad (2)$$

Borrowing the terminology of Esteban-Marquillas (1972), $X(I)_{ik}$ is the “homothetic FDI stock” of industry *i* of Korea at a base period Korea would have had if the FDI composition of Korea were identical to that of the world.

Actual increase in FDI stock of industry *i* in Korea is now decomposed as

$$\begin{aligned} & X_{ik} r_{ik} \\ = & X(I)_{ik} r_{iw} + r_{iw} (X_{ik} - X(I)_{ik}) + X(I)_{ik} (r_{ik} - r_{iw}) + (X_{ik} - X(I)_{ik})(r_{ik} - r_{iw}) \end{aligned} \quad (3)$$

The first term in the right hand side of eq. (3) measures the expected contribution of world growth of world FDI stock of industry *i* to change in FDI stock of industry *i* of Korea, had $X(I)_{ik}$ been equal to X_{ik} . The second term in the right hand side of eq. (3) shows the differential effect reflecting Korean FDI’s specialization in industry *i*: industry-mix effect. The third term in eq. (3), $X(I)_{ik} (r_{ik} - r_{iw})$, measures the competitive advantage, or lack thereof, of Korea as compared to world with regard to industry *i*:

³ To minimize the problems associated with comparative static nature of the shift-share analysis, Barff and Knight (1988) suggest the dynamic shift-share analysis that takes into account continuous changes in both industry mix and size of total employment of the region over the time period. The dynamic shift-share analysis cannot be readily applied to FDI inflow due to lack of data, however.

competitive effect. The last term in eq. (4), $(X_{ik} - X(I)_{ik})(r_{ik} - r_{iw})$, takes into account Korea's degree of specialization in FDI of industry i : allocation effect. As noted by Esteban-Marquillas (1972), the allocation effect will be positive if Korean FDI is specialized in those industries with faster growth in FDI stock, and/or if it is not specialized in industries in which it lacks competitive advantage. On the contrary, the allocation effect is negative if Korea is specialized in industries in which it lacks competitive advantage in hosting inward FDIs, and/or if it is not specialized in industries in which it has competitive advantage.

3. Decomposition of FDI Inflow into Korea, 2003 - 2006

This section now applies the shift-share analysis to decompose changes in Korean FDI stocks. Korea has experienced rapid FDI inflow following the financial crisis in 1997. The rapid inflow in FDI has been stabilized since 2000, however. We focus on the FDI increase from the end of 2002 to the end of 2006, i.e., for the period of 2003 - 2006. United Nations Conference on Trade and Development (UNCTAD) publishes annually *World Investment Report* that contains surveys and preliminary analysis of world FDI flows. We chose the year 2002 as the base year due to data availability.⁴

Ahn and Lee (2007) have applied the shift-share analysis to decompose FDI inflow into Korea for the 2001-2002 period. We will later compare the decomposition results of the present paper with those of Ahn and Lee (2007). We use both the original shift-share analysis and the extended shift-share analysis of Esteban-Marquillas (1972) and Arcelus (1984), while Ahn and Lee (2007) only apply the original shift-share analysis.

Data Description

Korean data on inward FDI stock based on notification are obtained from the Ministry of Knowledge Economy (formerly Ministry of Commerce, Industry and Energy) homepage. Data on world FDI stock at the end of year 2002 and 2006 are obtained from *World Investment Report 2004 and 2008*, respectively. To minimize arbitrariness associated with sector/industry classification of data, the present paper uses only FDI stock data, where one-to-one sector/industry correspondence between Korean data and

⁴ In the volume of *World Investment Report 2004*, UNCTAD has published data on world industrial FDI stock of year 1990 and 2002. Since then UNCTAD has reported world industrial FDI stock annually for years after 2002.

world data can be safely established. The total world FDI stock in year 2002 reported in Table 1 amounts to 81.9 percent of world FDI stock of the year. The 2006 world FDI stock reported in Table 1 is 85.1 percent of total world FDI stock in that year. The total Korean FDI stock in year 2002 reported in Table 2 amounts to 87.9 percent of Korean FDI stock in the corresponding year. The 2006 Korean FDI stock reported in Table 2 is 89.0 percent of total Korean FDI stock in that year. Thus, even though only those FDI stock data of the industries with exact one-to-one correspondence between world classification and Korean classification are considered, the FDI stock data in the present analysis covers virtually most of world and Korean FDI stocks, respectively.

Table 1 reports estimated world inward FDI stock in year 2002 and 2006, respectively. Some comments on characteristics of world FDI stock and Korean FDI stock are in order. First, it is worthwhile to note that a lion's share of world FDI is in service industries, accounting for two thirds of total FDI. It is also notable that the world FDI stock has increased substantially for the period of 2003-2006, increasing by more than 75% for the period. Thirdly, while the share is relatively small compared to manufacturing or service industries, world FDI stock in primary industries commands a large share of total world FDI stock. Moreover, it has increased rapidly for the period. We surmise that this is to some extent attributable to a world-wide rush to pre-empt natural resources in the midst of rapid economic growth of China and other developing countries.

Table 2 reports industrial FDI stocks of Korea at the end of years 2002 and 2006, respectively. Several comments are in order as well. First, overall growth in FDI stock of Korea lags behind the growth trend of the world. While the world FDI stock of the world has grown by 75% for the same period, Korean FDI stock has grown only by 51 percent. This result is in sharp contrast to the result in Ahn and Lee (2007, p. 9) that reports that Korea has absorbed more than twice the world average growth in FDI stock.⁵ Second, quite naturally, a share of inward FDI stock of primary industries in Korea is negligible, reflecting Korea's poor endowment of natural resources. Thirdly, compared to the world, inward FDI of Korea is still focused on manufacturing industries, commanding about a half of FDI stock.

Decomposed Results

⁵ Part of this difference is explained by the difference in data used for the analysis. Korean data both in Ahn and Lee (2007) and in the present paper are actual data reported by Korean government. However, world FDI stock data in year 2002 in Ahn and Lee (2007) are estimated data by the authors using a linear formula, while the present paper uses actual data.

Table 3 reports results of decomposition of an increase in FDI stock of Korea by the original shift-share analysis. Since Korea lags behind the world in absorbing FDI, as a result, the aggregate world growth effects have accounted for more than actual increase in FDI stock. The aggregate industry-mix effects have recorded negative 31 percent of total FDI growth. This is so because Korean FDI stock consists mainly of manufacturing industries, whose FDI stock grows slowly, while the world FDI stock mainly consists of service industries that grow faster than manufacturing industries. The aggregate competitive effects have recorded negative 14 percent. However, several industries have recorded **positive competitive effect**: electrical and electronic equipment, motor vehicles and other transport equipment, hotels and restaurants, transport, storage and communications, finance, and business services. Korea is revealed to have competitive advantage in recruiting inward FDI in these industries. Obviously Korea has competitive advantage in electrical and electronic equipment and motor vehicles and other transport equipment, as is witnessed by large exports in these industries. Moreover, it is worthwhile to note that Korea has revealed competitive advantage in absorbing inward FDI in most service industries. This result is in accordance with Ahn and Lee (2007) that report that a substantial increase in inward FDI of service industries reflects deregulation efforts by the Korean government for those industries.

Table 4 reports results of decomposition by the extended shift-share analysis of Esteban-Marquillas (1972) and Arcelus (1984). Again, the aggregate world growth effects have accounted for more than actual increase in FDI stock. Also, the aggregate industry-mix effects have recorded negative 31 percent of total FDI growth. While the scales are somewhat influenced, the aggregate competitive effects have recorded negative 11 percent. The same industries have again recorded **positive competitive effect**: electrical and electronic equipment, motor vehicles and other transport equipment, hotels and restaurants, transport, storage and communications, finance, and business services. Korea is definitely revealed to have competitive advantage in recruiting inward FDI in these industries. While most industries have recorded negative allocation effect, industries such as electrical and electronic equipment, motor vehicles and other transport equipment, hotels and restaurants have recorded positive allocation effect.

Table 5 presents the result of decomposition of FDI inflow into Korea during 2001-2002 by Ahn and Lee (2007). Ahn and Lee (2007) find that Korea has absorbed more than twice the world average in FDI inflow during the period. Ahn and Lee (2007) also

find that Korea has experienced shift towards service industries in FDI inflows. This result is in line with findings in the present paper. They argue that this is partly because world FDI has shifted toward services and partly because Korea has lifted many regulations on inward service FDIs. Ahn and Lee (2007) find that world growth effect can account for 44 % of FDI inflow during 2001-2002. Competitive effects can account for 57% of FDI inflow into Korea during the period. Primary and manufacturing industries recorded negative industry-mix effect while service industries recorded net positive effect. This reflects shift toward services in FDI inflow into Korea. However, the aggregate industry-mix effect is fairly small.

4. Concluding remarks

This paper has decomposed FDI inflow into Korea by the original version of shift-share analysis and by the extended version of shift-share analysis as well. Of course, FDI inflows are influenced by many factors. The decomposition of FDI inflow by shift-share analysis can be viewed as a first step in identifying the determinants for FDI inflows. That is, the shift-share analysis can be applied prior to thorough examination of determinants for FDI inflows. What the shift-share analysis can offer is the timely and prompt analysis for causes underlying changes in FDI inflows. With the help of the shift-share analysis, governments may be able to identify the policy area where more attention is called for. Thorough investigation of the area would then reveal more information about the situation regarding FDI inflow.

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Table 1. Estimated world inward FDI stock, by sector and industry, 2002 and 2006
(millions of US dollars)

Sector/Industry	2002(A)	2006(B)	B-A
Primary	448,101	988,732	539,831 (120.26)
Manufacturing	1,622,134	2,539,238	917,104 (56.54)
Food, beverages and tobacco	192,038	348,511	156,473 (81.48)
Textiles, clothing and leather	52,338	77,450	25,112 (47.98)
Wood and wood products	78,054	102,515	24,461 (31.34)
Chemicals and chemical products	418,189	735,220	317,031 (75.81)
Non-metallic mineral products	64,144	105,434	41,290 (64.37)
Metals and metal products	150,382	280,398	130,016 (86.46)
Machinery and equipment	127,311	208,221	80,910 (63.55)
Electrical and electronic equipment	287,937	349,558	61,621 (21.40)
Motor vehicles and other transport Equipment	251,741	331,931	80,190 (31.85)
Services	3,964,078	7,034,197	3,070,119 (77.45)
Trade	793,724	1,339,527	545,803 (68.76)
Hotels and restaurants	75,334	91,307	15,973 (21.20)
Transport, storage and communications	476,082	772,408	296,326 (62.24)
Finance	1,248,975	2,434,579	1,185,604 (94.93)
Business services	1,150,676	2,055,499	904,823 (78.63)
Electricity, gas, water and construction	219,287	340,877	121,590 (55.45)
Total	6,035,113	10,562,167	4,527,054 (75.01)

Sources: Annex Table A.I.18, World Investment Report 2004

Annex Table A.I.5, World Investment Report 2008

* Numbers in parentheses denote the growth rate of the corresponding FDI stock.

Table 2. Inward FDI stock of Korea, by sector and industry, 2002 and 2006

(millions of US dollars)

Sector/Industry	2002(A)	2006(B)	B-A
Primary	410	422	12 (2.93)
Manufacturing	37,117	51,838	14,721 (39.66)
Food, beverages and tobacco	3,623	4,171	548 (15.13)
Textiles, clothing and leather	853	1,126	273 (32.00)
Wood and wood products	2,508	2,660	152 (6.06)
Chemicals and chemical products	6,743	9,851	3,108 (46.09)
Non-metallic mineral products	1,874	2,569	695 (37.09)
Metals and metal products	2,070	2,617	547 (26.43)
Machinery and equipment	3,746	4,789	1,043 (27.84)
Electrical and electronic equipment	11,794	17,915	6,121 (51.90)
Motor vehicles and other transport equipment	3,906	6,140	2,234 (57.19)
Services	36,926	60,520	23,594 (63.90)
Trade	13,128	16,509	3,381 (25.75)
Hotels and restaurants	5,092	6,777	1,685 (33.09)
Transport, storage and communications	2,109	4,768	2,659 (126.08)
Finance	9,769	21,580	11,811 (120.90)
Business services	2,541	4,983	2,442 (96.10)
Electricity, gas, water and construction	4,287	5,903	1,616 (37.70)
Total	74,453	112,780	38,327 (51.48)

Source: Ministry of Knowledge Economy homepage

Table 3. Decomposition of an increase in FDI stock of Korea, 2003 -2006

(millions of US dollars)

Sector/Industry	share effect	industry-mix effect	competitive effect	actual
Primary	308	186	Δ481	12
Manufacturing	27,844	Δ9,438	Δ3,683	14,721
Food, beverages and tobacco	2,719	234	Δ 2,404	548
Textiles, clothing and leather	640	Δ 231	Δ 136	273
Wood and wood products	1,881	Δ 1,095	Δ 634	152
Chemicals and chemical products	5,058	54	Δ 2,004	3,108
Non-metallic mineral products	1,406	Δ 199	Δ 511	695
Metals and metal products	1,553	237	Δ 1,243	547
Machinery and equipment	2,810	Δ 429	Δ 1,338	1,043
Electrical and electronic equipment	8,847	Δ 6,323	3,597	6,121
Motor vehicles and other transport equipment	2,930	Δ 1,686	990	2,234
Services	27,699	Δ 2,628	Δ 1,474	23,594
Trade	9,847	Δ 820	Δ 5,646	3,381
Hotels and restaurants	3,820	Δ 2,740	605	1,685
Transport, storage and communications	1,582	Δ 269	1,346	2,659
Finance	7,328	1,946	2,538	11,811
Business services	1,906	92	444	2,442
Electricity, gas, water and construction	3,216	Δ 837	Δ 761	1,616
Total	55,847	Δ 11,882	Δ 5,638	38,327

 Source: Own calculation

Table 4. Decomposition of an increase in FDI stock of Korea, 2003 -2006
(millions of US dollars)

Sector/Industry	share effect	industry-mix effect	competitive effect	allocation effect	actual increase
Primary	6,660	Δ6,167	Δ 6,498	6,017	12
Manufacturing	11,313	7,091	Δ3,472	Δ211	14,721
Food, beverages and tobacco	1930	1,022	Δ 1,572	Δ 832	548
Textiles, clothing and leather	310	99	Δ103	Δ33	273
Wood and wood products	302	484	Δ243	Δ391	152
Chemicals and chemical products	3,911	1,201	Δ1,533	Δ471	3,108
Non-metallic mineral products	509	697	Δ216	Δ295	695
Metals and metal products	1,604	186	Δ1,114	Δ129	547
Machinery and equipment	998	1,383	Δ561	Δ777	1,043
Electrical and electronic equipment	760	1,764	1,083	2,514	6,121
Motor vehicles and other transport equipment	989	255	787	203	2,234
Services	37,844	Δ12,807	5,650	Δ7,125	23,594
Trade	6,733	2,294	Δ4,212	Δ1,435	3,381
Hotels and restaurants	197	883	110	495	1,685
Transport, storage and communications	3,655	Δ2,343	3,749	Δ2,403	2,659
Finance	14,627	Δ5,353	4,003	Δ1,465	11,811
Business services	11,162	Δ9,165	2,480	Δ2,036	2,442
Electricity, gas, water and construction	1,500	877	Δ480	Δ 281	1,616
Total	55,847	Δ 11,883	Δ 4,320	Δ1,319	38,327

Source: Own calculation

Table 5. Decomposition of an increase in FDI stock of Korea, 2001 -2002
(millions of US dollars)

Sector/Industry	share effect	industry-mix effect	competitive effect	actual
Primary	54	Δ11	Δ20	23
Manufacturing	4,558	Δ426	1,113	5,247
Services	4,106	295	7,965	12,366
Trade	1,602	115	365	2,082
Hotels and restaurants	536	Δ58	766	1,244
Transport and storage	115	39	363	439
Communications	86	29	109	224
Finance	959	Δ55	1,778	2,792
Real estate	199	14	919	1,132
Business services	275	69	217	561
Culture and entertainment	265	19	2,573	2,857
Public services	70	5	960	1,035
Electricity, gas, water and construction	214	40	2,503	2,757
Total	8,933 (43.8%)	Δ 102 (-0.5%)	11,561 (56.7%)	20,393

Source: Ahn and Lee (2007)