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Do domestic firms benefit from FDI?: evidence from Korean manufacturing industries

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Abstract

FDI is considered to be a meaningful component for the economic growth of a country. But, it has not been proven clear that the effect of FDI is really beneficial in a host country regardless of the state of the countries. This paper tries to provide an evidence of the effect of FDI in developing country. To do this, we relate industry level value-added to inward and outward FDI stocks in Korea in a production function framework. Especially we divide inward FDI into FDI on the Greenfield projects and FDI for M&A. The results show that the effect of inward FDI as a whole on productivity is not statistically significant, though we can presume that the direction is positive, whereas the effect of outward FDI is strongly negative, and is statistically significant. But the effects of inward FDI by the characteristics of FDI are not differentiated.

Keywords: *FDI, economic development, production function, capital flow, Korean industry.*

1. Introduction

The unprecedented increase of foreign direct investment (FDI) in the world economy especially from 1990's has drawn attention of both academics and the governments. The most important issue is on the effect of FDI on either the host economy or the source economy. But the results of the numerous works done by many scholars in the world haven't shown a clear

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path of it.

In the literature, much of work focuses on so-called horizontal productivity spillovers in the hosting economy, i.e., effects of FDI on domestic firm within the same broadly defined industry. The results show that the direction of the effect of the FDI depends on the degree of economic or technological progress of the countries and the characteristics of the FDI. Based on the inductive reasoning, it seems that FDI in the developed nations is beneficiary, whereas those in the developing countries are harmful to the productivity of the domestic firms. But the effect is proven different across the country especially in the cases of developing countries (Gorg & Greenway, 2005).

Given this somewhat unsatisfactory state of the literature, we provide some new evidence on the link between productivity in a developing host country and FDI. To do this, we relate industry level value-added in Korea to inward and outward FDI stocks in Korea in a production function framework. Especially we divide inward FDI into FDI on the Greenfield projects and FDI for M&A. By doing so, we try to contribute to the literature in several ways.

First, we add one more meaningful study on the effect of FDI by dealing with the case of Korea. From mid-90's, significant part of FDI in the world has been concentrated to the countries in East Asia, mostly to China. Though drawing less attention from MNCs as the destination of FDI than China, Korea has been very active in attracting FDI from mid 90's. During that time, the Korean economy has experienced the financial crisis of 1997 and, henceforth, has seen tremendous changes in its foreign economic relations, which results in faster inducement of FDI. Hence, the case study on Korea can be interpreted as the prototype of the effect of FDI on the economic recovery from the financial crisis.

Second, the effect of FDI can be different by the characteristics of FDI. Existing literature consider it by classifying FDI either inward or outward. But inward FDI can be further classified into FDI on the Greenfield project and FDI for M&A. These two types of inward FDI may result in different effects as they are closely related with the industry characteristics of host country. We assume that the FDI on the Greenfield project contains the transfer of the technology as well as the capital, whereas the FDI for M&A is just the movement of capital to make use of the competitive condition of production in a host country. Hence, more detailed classification of inward FDI is helpful for identifying the exact effects of FDI.

The rest of the paper is structured as follows. Section 2 reviews and discusses the existing literature and the importance of the classification of inward FDI. The theoretical and empirical research on FDI spillover is surveyed. In section 3, the econometric framework and background facts are provided. In addition to this, the significance of the case study of Korea is explained combined with the data description. Section 4 presents the empirical findings and policy implication while section 5 concludes.

2. Literature review

2.1 Review of theoretical studies

This section starts with a review of the theoretical literature on FDI spillover and the implication of the impact of FDI on the host country (Gorg & Greenway, 2005 and Blomstrom & Kokko, 2003).

FDI spillover can occur in two ways. The first way is intra-industry level spillover, and the second, inter-industry level spillover. Intra-industry spillover means that FDI affects the productivity of firms in the same industry, which is horizontal spillover, while inter-industry spillover is the vertical spillover among industries.

The channels through which spillovers might affect the productivity of the host country can be summarized to 4 ways.

First, imitation is the classic transmission mechanism for new products and processes. It means that upgrade of local technology derived from the imitation of the technology of developed country through FDI results in the productivity growth of the firms in host country. The scope of imitation depends on the complexity of products and process and the same principles can be applies to managerial and organizational innovations as well as the technology.

Second, adoption of new technology can also occur through the acquisition of human capital. Even when the locational incentive for FDI is relatively low wage, MNCs tend to demand relatively high-skilled labor due to the technological nature of the products or the process. It entails the investment in training programs of labors in the host country. The movement of labor from MNCs to the firms in host country can generate productivity improvements.

Third, competition with MNCs might stimulate indigenous firms to improve technology level. Even if indigenous firms are unable to imitate the technology and production processes of MNCs, the entry of MNCs in the domestic market will drive them to use existing technology more efficiently or to increase the speed of adoption of new technology.

Fourth, a further indirect source of productivity gain might be through exports. Export generally involves fixed costs to establish distribution networks, create transport infrastructure, and learn about consumers' tastes, regulatory arrangements and so on in overseas markets. Through collaboration or more likely imitation, domestic firms can learn how to penetrate export markets from MNCs already armed with such information.

Through these four channels, firms in host country can improve the productivity. But the ability or the speed of adoption of new technology and managerial information depends on the characteristics of the host country.

The most important determinant factor of the ability or the speed of spillovers is overall development level of the host country. According to the cross sectional studies among countries by Balasubrmanyam et al. (1996, 1998), FDI can be a potent instrument of development, but only in the presence of a threshold of human capital, well developed infrastructure facilities, a stable economic climate, and outwardly oriented trade policy. Thus, only the most advanced developing countries are able to benefit from FDI.

Another important factor deciding the effect of FDI is the institutional arrangement for FDI. Based on the argument that foreign firms can promote economic development and growth, many countries have introduced various investment incentives to encourage MNCs to invest in their market. But, as is well argued by Blomstrom & Kokko(2003), such incentives can mainly be justified if the foreign firms differ from local companies in that they possess some firm-specific intangible asset that can spill over to local firms.

At the same time, there are good reasons to remain cautious in granting incentives exclusively on foreign investors. Difficulty to calculate the value of intangible assets, the risk for rent-seeking based on the lack of transparency, and the possibility of overbidding due to the competition among governments may end up with the offset of the benefit of spillovers and the shift of the profit from the host country to MNCs.

The characteristics of FDI are another important issue deciding the effects of spillovers. In general, it is assumed that outward FDI will affect the productivity of the source country negatively, while inward FDI are supposed to have a positive effect on the host country. It may be true if the spillover is interpreted based on the 4 channels explained above. The firms in the source country will lose the opportunity of imitation, skill acquisition, collaborated export and competition for efficiency through outward FDI. But, in another aspect, outward FDI might facilitate the chance to acquire cheaper intermediate inputs and increase the export of domestic goods, hence contribute the productivity gain in the source country (Ahn et al., 2005).

Two different types of inward FDI may bring out different effects on the host country. FDI on the Greenfield projects seems to have more possibility to induce new technologies compared with FDI for M&A. Hence, if the positive spillover effect of inward FDI is mainly explained by the gap of technology level rather than managerial information and so on, the impact of FDI in two types of inward FDI can be assumed to be different.

2.2 Review of empirical studies

Based on the theoretical framework explained above numerous empirical researches have been carried out by many scholars. Table 1 lists some selected example of those researches.

Due to data limitation, until recently, most of the studies have the forms of case studies of specific countries using the firm level or industry level panel data. Two exceptional cases are Sadik (2001) analyzing 6 Arab countries and Bitzer & Gorg (2005) analyzing 17 OECD countries. But neither uses the firm level or industry level data.

Summary of the characteristics of the estimation method of existing literature is as follows.

First, most of the study uses a Cobb-Douglass type production function framework.

Table 1
Selected list of empirical studies on the effects of FDI

Author	Country	Period	Data	Aggregation	Type	Results
Ahn et al.(2005)	Korea	'90-'03	Panel	Micro	Inter-Ind.	+
Kohpaiboon(2006)	Thailand	'96	C/S	Micro	Inter-Ind.	-
Kugler(2006)	Columbia	'74~'98	Panel	Industry	Inter-Ind.	+
Sadik(2001)	Arab	'87~'98	Panel	Country	Intra-Coun.	+
Aitken&Harrison(1999)	Venezuela	'76~'89	Panel	Micro	Intra-Ind.	-
Barrios et al.(2004)	Ireland	'72~'00	Panel	Micro	Intra-Ind.	+
Bitzer & Gorg(2005)	OECD	'73~'00	Panel	Industry	Intra-Ind.	+
Chuang&Lin(1999)	Taiwan	'91	C/S	Micro	Intra-Ind.	+
Liu & Wang(2003)	China	'95	C/S	Industry	Intra-Ind.	+
Liu et al.(2000)	UK	'91~'95	Panel	Industry	Intra-Ind.	+
Ramirez(2006)	Mexico	'60~'01	T/S	Industry	Intra-Ind.	-
Takii(2005)	Indonesia	'90~'95	Panel	Micro	Intra-Ind.	+

Note: Updated and selected based on Gorg & Greenway(2005).

Second, the dependent variables are usually output, value-added, and TFP for productivity growth study. Wage is used for welfare effect (Lipsey & Sjoholm, 2001), and export is used for the analysis of interaction between outward FDI and trade (Ahn et al., 2005).

Third, explanatory variables basically contain labor, capital, R&D, and trade. For FDI proxy, share of foreign capital stock, share of employees in foreign firms, share of foreign firms, and FDI flows are used.

Fourth, estimation methods are OLS, 2SLS, and FGLS.

Among the studies cited above, Bitzer & Gorg (2005) uses the most similar method with this paper. Using transformed Cobb-Douglass function, they tries to identify the relation between output and FDI stock (inward and outward). They use the industry level data of 17 OECD countries covering the period 1973 to 2000. But the data for FDI is not classified into industry level, which is serious shortcoming of the study.

Another problem raised from existing studies is that they give little attention to the characteristics of FDI. Most of the studies consider only inward FDI to analyze the effect of FDI on the host country and outward FDI to analyze the interaction between FDI and trade (Ahn et al., 2005)[1]. Classification of inward FDI according to the subject of investment can be found in no existing studies.

[1] Only Bitzer & Gorg (2005) considers outward and inward FDI in a function. But the purpose of it is ambiguous.

3. Empirical methodology and data

3.1 Methodology

The methodology used in this paper is not different from existing studies. We uses transformed Cobb-Douglass function including R&D, FDI and other necessary dummies in the ordinary function.

$$lnY_{it} = \alpha + \beta\, lnK_{it} + \gamma\, lnL_{it} + \delta\, lnM_{it} + \theta\, lnRD_{it} + \lambda\, lnIG_{it} + \tau\, lnIB_{it} + \sigma\, lnOT_{it} + \mu_i + \iota_t + \varepsilon_{it}$$

Dependent variable Y is value-added of manufacturing industries.

K, L and M are the standard production factors capital, labor and materials, respectively. K is calculated using the perpetual inventory method and investment data, assuming a ten percent depreciation rate.

RD is a proxy for the R&D capital stock and is calculated using the same approach as for capital stock K. IG, IB, and OT are intended to capture the effects of inward greenfield FDI, inward M&A FDI, and outward FDI respectively, and are calculated applying the same method of K.

μ_i and ι_t are the dummies for industry and year respectively[2]. We need another dummy to control the special economic environment in Korea, which is the impact of the financial crisis of 1997. As the impact of the crisis is supposed to be recovered completely in 2002, we put another dummy variable to sort out these 4 years.

3.2 Data

Before concrete examination of the data, we need to understand the economic characteristics of Korea.

Korea is known as the country with a threshold of human capital, well developed infrastructure facilities, a stable economic climate, and outwardly oriented trade policy. Based on the criteria of Balasubrmanyam et al. (1996, 1998), Korea is a representative advanced developing country which are able to benefit from FDI.

Figure 1 shows the trend of FDI in Korea. FDI from/to Korea has been activated from mid 90's. Inward FDI has begun to increase from 1994 after the accession to OECD and has rapidly increased since 1998, after the financial crisis in 1997 due to the government's welcoming FDI policies. The inward FDI approvals during 1962-1997 were U$22.9bil, while those during 1998-2000 reached U$36.8bil.

Outward FDI increased during 1993-96, plunged right after the financial crisis but are rising again lately surpassing the pre-crisis peak level.

[2] These dummies are only meaningful in OLS estimation. Hence they are deleted in panel analysis.

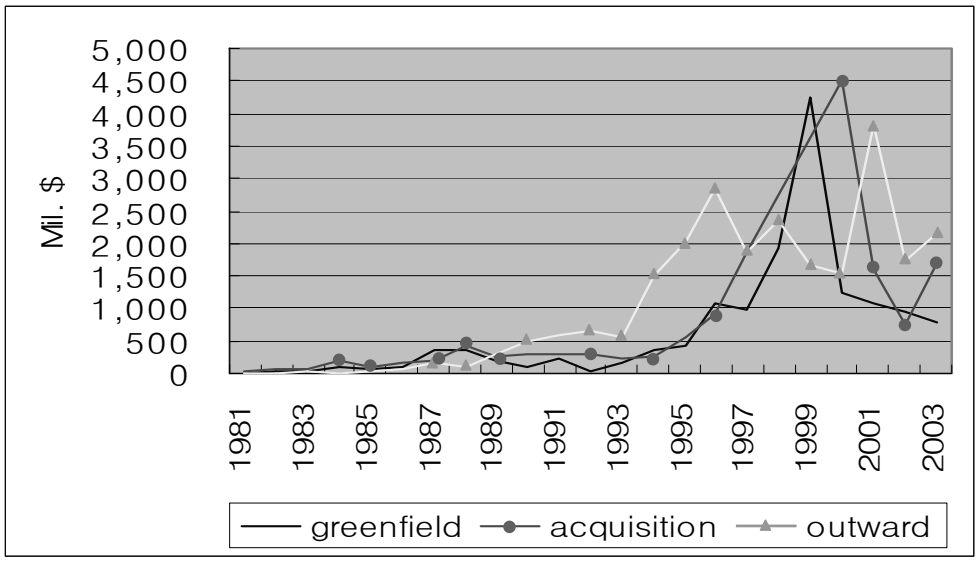

Figure 1. The Trend of FDI in Korea

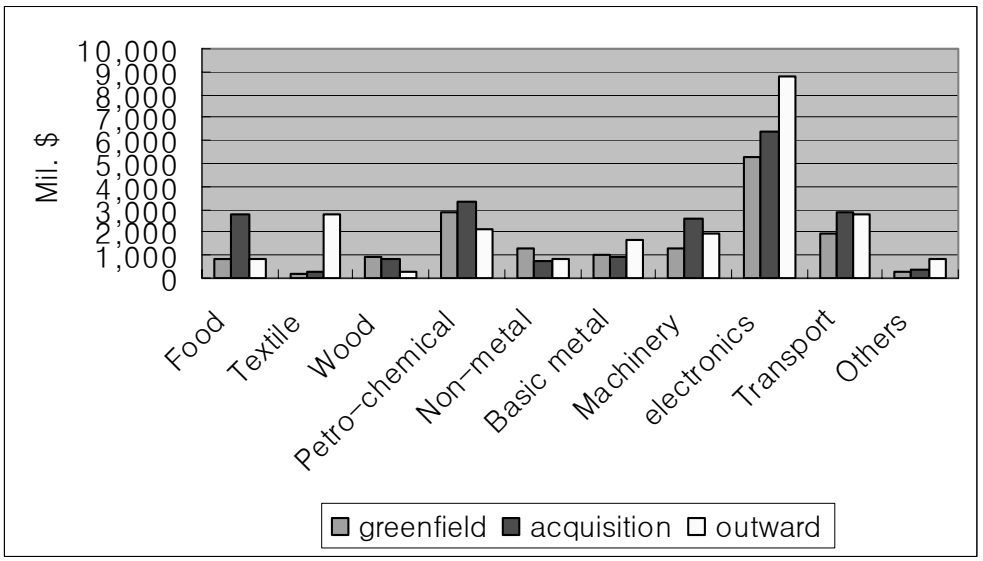

Figure 2. Volume of FDI by Industries

As Figure 2 shows well, major industries of Korea are electronics, vehicles and transport equipment, and petro-chemicals, and also those are the industries in which both inward and

outward FDI are concentrated.

The data used in the analysis consists of 13 ISIC Rev. 3 manufacturing sectors in Korea covering the period of 1991 to 2003.

The data of outward FDI is from the website of the EXIM Bank of Korea (http://www.koreaexim.go.kr/kr/oeis/m03/s01.jsp), and the data of inward FDI is from the website of the Ministry of Commerce, Industry (http://www.mocie.go.kr/index.jsp).

The data of the industry information is constructed at the industry level from the OECD STAN database. Some of the data missed in the original database (mainly the data of R&D and investment) are filled based on the database of National Statistics Office of Korea. Table 2 show the overall feature of the data used[3].

All nominal variables were converted into 2000 Korean Won and again into USD using OECD exchange rate index.

Table 2
Overall features of the data Unit: thousand $

	Average	S.D.	Max.	Min.
R&D	519,480	956,017	5,659,081	0
FDI-Greenfield	85,455	215,772	2,159,579	0
FDI-M&A	114,192	260,406	1,767,313	0
FDI-Outward	138,047	267,957	2,836,181	6,137
VALUE-ADDED	8,609,753	6,568,706	33,958,720	390,218
LABOR	4,346,645	2,939,228	14,205,497	222,072
MATERIAL	26,248,842	20,488,281	97,425,951	1,571,676
CAPITAL	14,993,378	11,974,797	52,243,077	670,218

4. Estimation results

Estimation process was carried out after the normalization process of the data except for the dummies by the mean value of each industry and taking the form of natural log. Table 3 shows the results of estimating the production function using an OLS and panel fixed effect estimator and panel random effect estimator.

In terms of factor inputs, we find that KLM return positive and statistically significant coefficients in all estimation methods. The magnitude of each factor can be accepted as being reasonable, as well.

[3] More detailed description on data is provided in appendix

Table 3
Estimation result of OLS and panel

	OLS	PANEL	
		FE	RE
LABOR	0.5963***	0.5353***	0.5275***
	(0.0527)	(0.0585)	(0.0565)
INTERMEDIATE	0.1930***	0.2814***	0.2883***
	(0.0562)	(0.0610)	(0.0592)
CAPITAL	0.1451***	0.1307**	0.1343**
	(0.0511)	(0.0579)	(0.0561)
R&D	0.0006	0.0076*	0.0054
	(0.0034)	(0.0043)	(0.0036)
FDI GREENFIELD	0.0060	0.0084*	0.0075*
	(0.0040)	(0.0048)	(0.0044)
FDI M&A	0.0039	0.0101**	0.0086*
	(0.0041)	(0.0050)	(0.0044)
OUTWARD FDI	-0.0237***	-0.0156*	-0.0130
	(0.0077)	(0.0086)	(0.0082)
(Adj.) R^2	0.9957	0.9245	0.9248
F(df)	3915.43(10, 158)	235.25(8, 148)	-
Wald χ^2(df)	-		1968.77(8)

Notes: Standard errors in parentheses.
*, **, *** indicate significant level of 90, 95, and 99 percent, respectively. All the models are estimated using 169 observations (13 years X 13 industries). R^2 in panel estimators are that of overall.

Turning to the knowledge stock, we find that the stock of domestic R&D capital is positively related to the productivity, with an elasticity of 0.005, which means that a ten percent increase in the stock of R&D leads to an increase in value-added by 0.05%. But the problem is that the result of R&D can not be accepted as being statistically significant.

Regarding inward FDI, we find a positive and statistically significant coefficient in panel estimation, with elasticity of about 0.008. This provides evidence that FDI inflows have positive effects on productivity in the host country. But the effects of inward FDI by the characteristics of FDI are not differentiated, which needs an additional reasoning based on the economic situation of Korea. A possible reasoning may stem from the financial crisis of 1997. As the economic crisis had its root on the deficit of capital balance, Korean firms had to attract FDI as much as possible

without considering the type of investment[4].

The stock of outward FDI shows a negative and statistically significant coefficient, which can be interpreted as follows. The outward FDI of Korea is the moving-out of domestic firms which have the role of horizontally competitive with existing firms. Hence the outward FDI neither have the effect of vertical spillovers with existing firms nor drive the increase in export.

Table 4 shows the result of estimation on the selective observation except for 4 industries[5] which have little relation with FDI.

Table 4
Estimation result of OLS and panel for selective industries

	OLS	PANEL	
		FE	RE
LABOR	0.6099***	0.6129***	0.6075***
	(0.0686)	(0.0708)	(0.0685)
INTERMEDIATE	0.2482***	0.2466***	0.2551***
	(0.0703)	(0.0726)	(0.0700)
CAPITAL	0.1640***	0.1603***	0.1617***
	(0.0566)	(0.0585)	(0.0566)
R&D	0.0361**	0.0365**	0.0379**
	(0.0152)	(0.0158)	(0.0151)
FDI GREENFIELD	0.0056	0.0061	0.0055
	(0.0044)	(0.0047)	(0.0044)
FDI M&A	0.0044	0.0043	0.0045
	(0.0044)	(0.0048)	(0.0044)
OUTWARD FDI	-0.0304***	-0.0302***	-0.0286***
	(0.0091)	(0.0094)	(0.0090)
(Adj.) R^2	0.9365	0.9413	0.9413
F(df)	172.02(10, 106)	180.58(8, 100)	-
Wald χ^2(df)	-	-	1716.40(8)

Notes: Standard errors in parentheses.
*, **, *** indicate significant level of 90, 95, and 99 percent, respectively. All the models are estimated using 117 observations.

[4] A series of sudden and hostile M&A occurred in Korea after the crisis is a circumstantial evidence of the unconditional inducement of FDI.
[5] Those industries are leather, paper, fabricated metals and other manufactures.

From the new results, we can easily find out that the effect of R&D and outward FDI become stronger and statistically more significant, whereas the effect of inward FDI becomes statistically less significant. These changes in the result can be explained as follows.

First, the industries with stronger relation with FDI pay more attention on the R&D and the 10 percent increase in R&D investment leads to about 0.35% increase in value added.

Second, negative effects of outward FDI on value added offset the statistically insignificant positive effect of inward FDI. As a whole, the effect of FDI in Korea is negative.

Third, the classification of inward FDI by the characteristics of FDI shows no meaningful results in the period of the financial crisis and its recovery.

5. Conclusions

This paper investigates the productivity effects of inward and outward FDI using industry level data for Korea. The paper relates to a large recent literature on productivity spillovers from inward FDI, which mainly uses micro level data for a particular country as case studies. However, we also consider the relationship between productivity and each type of inward FDI as well as the relationship between productivity and outward FDI. Major findings from this study are as follows.

First, the effect of inward FDI as a whole on productivity is not statistically significant, though we can presume that the direction is positive. The effects of inward FDI by the types are not differentiated at least during the period of the financial crisis and its recovery in Korea.

Second, the effect of outward FDI is much stronger than that of inward FDI, and is statistically significant. Hence the effect of FDI as a whole in Korea should be interpreted as being negative.

Third, as a byproduct of this paper, we can suppose that the industries with stronger relation with FDI pay more attention on R&D investment. It, in turn, can be interpreted as the interest in the global competition.

The shortcomings of this paper are that proxy variables for some important factors such as trade, human capital and so on is missed out and that time period of data is too short to grasp the exact impact of inward FDI by the types.

Appendix. Descriptive analysis of the data used

1. R&D Unit: thousand $

	Average	S.D.	Max.	Min.
Food	220,040	116,245.9	455,190	56,306
Textile	70,863	33,418.5	136,748	27,058
Leather	9,460	6,032.6	18,959	1,323
Wood	30,060	21,678.5	79,132	2,160
Paper	33,539	15,918.8	67,191	14,977
Petro-chemical	799,937	198,508.3	1,068,937	459,101
Non-metal	75,485	23,927.0	126,822	47,603
Basic-metal	146,779	77,422.6	282,697	60,306
Fabricated metals	67,065	63,391.8	275,319	36,612
Machinery	556,033	331,869.2	1,263,195	211,113
Electronics	3,115,757	1,268,785.4	5,659,081	1,265,853
Transport	1,610,617	599,992.3	2,621,584	814,796
Others	17,597	21,976.4	65,137	0

2. FDI-greenfield Unit: thousand $

	Average	S.D.	Max.	Min.
Food	56,868	99041.4	369,185	2,340
Textile	13,510	17339.2	64,456	1,065
Leather	-	-	-	-
Wood	69,828	118995.1	446,940	531
Paper	-	-	-	-
Petro-chemical	187,875	248060.3	878,716	8,342
Non-metal	86,476	140100.7	406,469	336
Basic-metal	74,514	145785.8	452,272	1,150
Fabricated metals	-	-	-	-
Machinery	89,384	100278.1	394,553	3,977
Electronics	377,967	591750.3	2,159,579	2,804
Transport	136,302	149163.4	514,108	358
Others	18,185	15825.9	50,734	574

3. FDI-M&A Unit: thousand $

	Average	S.D.	Max.	Min.
Food	199,983	248,516.0	835,367	28,489
Textile	20,472	17,287.6	48,442	151
Leather	-	-	-	-
Wood	62,213	122,631.5	438,105	29
Paper	-	-	-	-
Petro-chemical	234,298	187,160.7	668,430	39,896
Non-metal	50,915	56,215.6	192,620	4,074
Basic-metal	67,206	81,737.6	233,689	1,151
Fabricated metals	-	-	-	-
Machinery	195,188	400,930.9	1,485,641	8,321
Electronics	438,752	602,836.4	1,767,313	41,401
Transport	191,231	285,464.6	791,147	7,317
Others	24,234	12,923.3	45,282	8,085

4. FDI-outward Unit: thousand $

	Average	S.D.	Max.	Min.
Food	61,261	36017.2	135,498	10,850
Textile	197,929	61969.7	301,732	98,353
Leather	43,479	21607.9	80,424	13,718
Wood	18,329	10870.0	38,164	7,576
Paper	24,345	11171.1	44,240	6,137
Petro-chemical	152,797	79772.7	268,717	46,389
Non-metal	61,972	56468.1	181,940	18,479
Basic-metal	103,710	73622.6	267,347	12,935
Fabricated metals	44,669	47160.0	182,494	13,941
Machinery	146,195	126354.8	494,534	16,640
Electronics	674,180	723717.8	2,836,181	99,568
Transport	202,578	229933.3	875,260	13,890
Others	63,165	28252.5	115,801	20,208

5. Outpu Unit: thousand $

	Average	S.D.	Max.	Min.
Food	44,308,231	5757711.9	54,937,136	33,706,512
Textile	30,039,127	4393552.3	36,394,468	21,115,487
Leather	6,752,595	2440033.5	10,994,806	3,903,566
Wood	3,347,887	666846.0	4,383,181	1,961,895
Paper	18,162,317	3870597.2	23,331,795	12,522,340
Petro-chemical	72,552,851	18264756.5	100,939,432	44,526,621
Non-metal	32,704,059	5816430.0	40,863,998	21,473,770
Basic-metal	45,836,005	8312389.0	57,579,748	34,659,761
Fabricated metals	18,015,266	5214259.5	27,257,817	11,182,681
Machinery	31,708,474	8597875.7	42,869,440	18,442,547
Electronics	83,762,402	30670622.7	131,198,255	39,255,715
Transport	57,984,186	15701367.7	81,814,181	34,884,492
Others	7,988,331	1125240.3	9,715,399	5,089,053

6. Value-added Unit: thousand $

	Average	S.D.	Max.	Min.
Food	8,413,020	1329990.1	10,246,029	6,345,439
Textile	7,017,561	1102726.2	8,481,217	4,687,419
Leather	1,535,652	444270.8	2,366,633	919,451
Wood	775,844	162587.1	1,026,133	390,218
Paper	5,429,482	1195983.5	7,228,364	3,366,200
Petro-chemical	17,138,620	3254873.5	22,248,240	11,581,113
Non-metal	10,108,705	1597476.1	12,446,682	6,570,353
Basic-metal	9,885,315	1727240.0	12,155,747	7,006,258
Fabricated metals	5,087,174	1418180.8	7,322,305	3,224,857
Machinery	8,560,387	2515846.7	11,534,774	4,892,151
Electronics	22,008,433	8356724.6	33,958,720	9,541,529
Transport	13,589,219	3269912.3	17,320,668	8,616,393
Others	2,377,377	347038.0	2,914,385	1,598,794

7. Labor Unit: thousand $

	Average	S.D.	Max.	Min.
Food	4,012,058	849215.1	5,578,876	2,472,378
Textile	4,229,337	852418.5	5,717,382	2,510,718
Leather	1,184,581	448461.6	2,034,424	564,954
Wood	478,230	127819.2	699,898	222,072
Paper	3,311,528	793008.8	4,750,972	2,083,816
Petro-chemical	6,203,618	1199549.9	7,950,909	3,994,033
Non-metal	5,303,270	1034105.8	7,133,433	3,120,094
Basic-metal	3,487,713	762194.7	4,874,546	2,136,371
Fabricated metals	3,178,158	949715.2	4,778,314	1,863,382
Machinery	5,141,433	1605319.7	7,440,336	3,068,368
Electronics	10,239,268	3162828.0	14,205,497	5,611,652
Transport	8,146,079	2114061.0	11,163,588	5,115,155
Others	1,591,106	316994.7	2,106,905	940,088

8. Materials Unit: thousand $

	Average	S.D.	Max.	Min.
Food	35,895,211	4550285.2	44,691,107	27,320,211
Textile	23,021,567	3319425.6	27,960,693	16,428,068
Leather	5,216,943	2006795.9	8,628,173	2,984,115
Wood	2,572,044	534259.0	3,409,583	1,571,676
Paper	12,732,834	2825414.4	16,103,431	8,661,497
Petro-chemical	55,414,231	15455579.0	79,228,350	32,945,508
Non-metal	22,595,355	4246026.3	28,417,317	14,903,417
Basic-metal	35,950,690	6630422.1	45,424,002	26,850,775
Fabricated metals	12,928,092	3836160.7	19,935,512	7,957,824
Machinery	23,148,087	6112825.8	31,356,664	13,550,396
Electronics	61,753,969	22364109.3	97,425,951	29,714,187
Transport	44,394,967	12574506.9	64,507,508	26,268,100
Others	5,610,953	804272.8	6,801,013	3,490,259

9. Capital Unit: thousand $

	Average	S.D.	Max.	Min.
Food	13,632,343	2783077.8	18,790,781	9,481,663
Textile	13,878,043	2930337.9	18,561,331	9,152,507
Leather	1,324,085	484111.2	2,167,722	670,218
Wood	1,578,582	310135.8	2,165,769	1,062,080
Paper	9,789,525	2186695.4	12,165,210	5,548,268
Petro-chemical	42,378,582	7847375.7	52,243,077	26,219,663
Non-metal	11,283,473	2296793.2	15,730,930	7,864,171
Basic-metal	19,857,043	3661204.6	25,036,211	13,545,161
Fabricated metals	7,620,873	1647513.3	10,194,217	4,933,831
Machinery	20,406,339	4456474.0	26,688,916	12,613,907
Electronics	24,266,833	8742964.8	38,027,920	11,116,303
Transport	25,979,747	7144312.4	32,939,575	13,317,032
Others	2,918,449	481622.1	3,673,939	1,920,619

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