

Import Content of Exports and Industrialization

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Abstract

Intra-industry trade in final and intermediate goods and International fragmentation of production, leading to the separation of phases of production which previously took place in the home country through outsourcing and or off-shoring play increasing role in the process of Industrialization. This process of Vertical specialization has been accelerated by progress in information and communication technologies, which makes it possible to reduce costs and increasing productivity. We have used Input- output tables of more than 35 countries of the world from different income groupings for the years 1995-2003 and six main sectors of economic activities including: "Agriculture, hunting, forestry and fishing", "Mining and quarrying", "Industry", "electricity, gas & water", "Construction" and "Services" to see how through vertical integration, industrial production and trade can reinforce each other and help to combine import substitution and export promotion activities. The result show that vertical integration was a common phenomenon in almost all countries, however, its proportion varies tremendously across countries. The share of import content of export was relatively high in small countries, but its proportion was relatively lower in large countries. Iran's rank in this regards is the bottom mainly because of international economic sanctions and its difficulties in having trade relation with developed countries. This is of course a reason for its low industrial development. We have also tried to find relationship between various trade performance indices and vertical integration. For this reason we have used Spearman's rank correlation coefficient between the ranks of import content of export with ranks of proportion of industrial import to total imports, proportion of industrial export to total exports, proportion of intermediate imports to total imports and proportion of industrial output to total outputs. The result show that import content of exports has had a high correlation specially with Proportion of industrial exports, and the share of intermediate imports to total imports, and also with the share of industry in GDP and with the exception of intermediate imports to total imports, all the coefficients were statistically significant, meaning there by that vertical specialization is a very import sources of growth and industrialization.

Key Words: Import Content of Export, Industrialization, Input-Output Technique.

JEL: C67, F43, L52, N65, O14, O24, O25, O53

1-Introduction

Over the last few decades world trade has grown faster than both world GDP and manufacturing value added, Intra-industry trade in final and intermediate goods accounts or a large part of this growth. International fragmentation of production, leading to the separation of phases production which previously took place in the home country through outsourcing or off-shoring has become a usual business all over the world⁵. While trade

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⁵. Meng et al. (2011), Feenstra and Hanson (1996), Goha and oliver (2004), Feenstra (1998), Leamer (1998), Hummels, et al. (1998, 2001) and Chen et al. (2005) and Egger and Egger (2003)

in raw materials and Intermediate inputs is not new, there has been a tremendous increase in the volume and range of functions that are being transferred across borders (Hummels, Ishii, & Yi, 2001; Yeats, 2001). Firms increasingly fragment the production process: locating design in one place, parts manufacturing in another place, and final assembly in a third place (NRC, 2006). This phenomenon has important implications for accurate measurement of the factor content of imports and exports (Reimer, 2006; Treer & Zhu, 2005). One must account for all the foreign factors used to produce intermediate inputs that are, in turn, used in a country's production. The value added associated with imported intermediate inputs may easily reduce the domestic value added associated with Final stage of assembly. Thus, in contrast to what generally is believed, the location of final assembly is a poor indicator of what counts in a globalized economy. Global production sharing, not only make it possible that domestic content of input account for large proportion of imports to and export from any country (NRC, 2006). In a world where GVC is the norm, exports promotion and import substitution efforts are entangled. Some exports might contain high import content, and some imports might contain high export content. Hence, the policies that affect exports and imports are no long going to be as effective. Instead, policies should be designed to manage GVCs Global value chains (GVCs), sometimes called global commodity chains or global production networks, are defined by Sturgeon (2001) as “the sequence of productive (i.e. value added) activities leading to and supporting end use.” Global value chain and or International production network whether functions within the same chain or jumping into more technologically sophisticated but related value chains – is now recognized as an important channel of industrialization (Humphrey and Schmitz, 2002).The expansion of GVCs since the early 1990s has played an important role in shifting the pattern of international trade and altering the process of industrialization⁶. With the extensive participation of developing countries in these GVCs, industrialization strategy has changed, and “upgrading” within GVCs has to a great extent replaced industrialization pure and simple as the goal of development policy (Baldwin, 2011; Milberg and Winkler, 2011). Export competitiveness remains a crucial feature of this phase, but exports are now the result of participation in global production networks and thus often depend on imports from other parts of the network. Thus vertical specialization can be high in a given sector and country in the initial stages of industrialization.

Egger and Egger (2003) considers studied the import content of domestic production - by considering the share of imported intermediate inputs on gross production- as an

⁶Various study show the importance of this phenomena ,however, terms may be different but they addressing the same things: Feenstra and Hanson (1996) in their study of United States economy called it” outsourcing “ ,Jones and Kierzkowski (2001) named it “international fragmentation of production”, Hummels et.al(2001) and Goha and oliver (2004) termedit vertical specialization and Hanson et al(2005) refer to it as vertical production networks;Leamer (1998), termed it delocalization and others like Feenstra (1998) called it production sharing Hummelset al. (1998, 2001) and Chen et al. (2005) studied OECD countries ,Egger and Egger (2003) studied eleven European countries, emphasizing on Southern EU member states. Breda et al. (2006) for Italy .international fragmentation of production on labour market developments (Feenstra and Hanson, 1996 and 1999; Amiti and Wei, 2004; Hijzenet al., 2004) and on output and value added volatility (Bergin et al., 2006).

indicator of international outsourcing. This measure attempts at representing the firm's decision to substitute domestic value-added with foreign production. That means either firms giving up stages of their intermediate production chains and, consequently, buying parts from foreign suppliers through outsourcing; or trying to establish plants abroad to produce intermediate goods and services through what is called off-shoring. Sinn (2004, 2006) For example argues that Germany's high wages and rigid labor market stimulated a wave of international relocation of production (especially in the automotive sector) and towards the neighboring Eastern European countries leaving in Germany almost only the final stages of production, which are usually more capital and skill intensive. This is done to simplify, German firms export basic components and raw materials to their foreign affiliates located in lower-wage countries, assemble (almost) entirely their products abroad and re-import them to implement the final stages of production, "put the brand" and sell the final goods in domestic and foreign markets. Vertical specialization occurs when goods and services are produced in multiple stages across different countries, with each country being involved in some stages of the good's production sequence and then exporting the good-in-process to the next country. The index of international outsourcing includes not only the value of imports directly contained in the exports, but also the value of inputs which are indirectly used in the production of an exported good. This phenomena has been accelerated by progress in information and communication technologies, which makes it possible to reduce costs and increasing productivity[(Jones and Kierzkowski (2001), Zhang (2007), Antràs and Helpman, (2003); Helpman (2006) and Michaels (2006)]. This paper aims at comparing the value of imported goods and services embodied in exports by sector, using input-output tables of various countries. These measures can be interpreted as an indicator of the degree of internationalization of production, including imports of intermediate inputs from both foreign affiliates and foreign suppliers. The import content of exports is estimated from the information on production processes provided by input-output tables at current prices. The symmetrical tables distinguish between intermediate purchases from domestic suppliers (the so called 'domestic matrix') and imported intermediate purchases (the 'import matrix'). The latest available for a representative set of countries are at current prices and referred to years 1995 and 2003.

2- Methodology and Data

2.1-Methodology

We have used the following relationship based on input- output technique to estimate import content of exports⁷:

$$x_i = \sum Z_{ij} + f_i \quad (1)$$

Presenting the above relationship in Metrical form we shall have:

$$\begin{bmatrix} X_1 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} Z_{11} & \cdots & Z_{1n} \\ \vdots & \ddots & \vdots \\ Z_{n1} & \cdots & Z_{nn} \end{bmatrix} \cdot \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix} + \begin{bmatrix} f_1 \\ \vdots \\ f_n \end{bmatrix}; \quad x = Ze + f \quad (2)$$

⁷Miller and Blair,(2009).

The above relationship shows that total output of each economy is equal to sum of intermediate and final demand .In addition total sectoral output is divided between Intermediate and final demand .In standard input output technique, it is assumed that proportion of intermediate transaction to total output is always constant. This is direct or technical coefficients:

$$a_{ij}=Z_{ij}/X_j \quad (3)$$

Thus technical coefficient matrix of $n \times n$ can be shown as follows:

$$A = Z \cdot \hat{X}^{-1} \quad (4)$$

A is Technical coefficient matrix, which shows for its production to what extent each sector Uses other sectors output (Temurshoev, 2004). Thus with the help of Technical coefficient matrix we can rewrite traditional input- output relation as follow:

$$X=AX+f \quad (5)$$

Thus we shall have:

$$x = (I - A)^{-1} \cdot f \quad (6)$$

In which $(I-A)^{-1}$ is Leontief Inverse Matrix, which shows direct and indirect intermediate inputs of each sector from other sectors (Miller and Blair, 2009).

In order to estimate import content of exports, we have to use domestic coefficients matrix and import matrix. This relationship is estimated on the bases of following equation⁸:

$$\text{Import content of exports} = \frac{u \text{ Am } (I - \text{ Ad})^{-1} \text{ Ex}}{u \text{ Ex}} \quad (7)$$

In which Am and Ad show coefficients of imports and domestic production respectively. Ex is export vector, u is vector of $1 \times n$ All its elements equal one.

In addition to estimating import content of export, we have tried to find its relation to other indices. For this reason we have used Spearman's rank correlation coefficient between the ranks of import content of export with ranks of proportion of industrial output to total output ($X_{\text{industrial}}/X$), proportion of Export to total output (EX/X), proportion of imports to output (IM/X), proportion of industrial Exports to total Exports (EX_{industry}/EX), proportion of industrial imports to total imports (IM_{industry}/IM) and intermediate imports to total imports ($IM_{\text{intermediate}}/IM$) of countries under study.

Spearman's rank correlation coefficient (r) is estimated on the bases of the following relationship:

$$r = 1 - \frac{6 \sum d_i^2}{n(n^2-1)} \quad (8)$$

In which d_i is rank differences, n is the number of variables .its values varies from -1 to +1.Closer the value to 1 shows greater correlation and zero value indicate that there is no correlation. We have also used the following formula to estimate t distribution with two degree of freedom as follows:

$$t = r \sqrt{\frac{n-2}{1-r^2}} \quad (9)$$

There have been few, if any, studies that quantify this phenomenon in the literature. In this article we examine this issue in the context of 35 countries that span the world's

⁸OECD (2011).

income distribution, and which have varying amounts of participation in international trade and global production sharing.

2.2-Data sources

We have used Input- output tables of more than 35 countries of the world .We have used Input output tables of 34 countries for the latest available date from European Statistical Organizations between the years 1995-2003. Table -1, presents name of countries, years and data sources. Input –output table of Iran is taken from Iranian Statistical Centre for the year 2001. These tables are comparable in all respects except the date. To avoid any possible complications we have aggregated these tables into six sectors. These sectors includes: “Agriculture, hunting, forestry and fishing”,” Mining and quarrying”, “Industry”, “electricity, gas & water”, “Construction” and “Services”.

Table-1: Countries , latest years and Data Sources

No.	Country	year	Source
1	Indonesia	2005	BadanPusatStatistk
2	India	2003	Ministry of Statistics and Programme Implementation
3	Brazil	2005	Brazilian Institute of Geography and Statistics
4	China	2005	National Bureau of Statistics
5	Turkey	2002	Turkish Statistical Institute
6	South Africa	2000	Eurostat
7	Romania	2005	Eurostat
8	Argentina	1997	National Institute of Statistics and Censuses
9	Czech	2005	Czech Statistical Office
10	Hungary	2005	Eurostat
11	Poland	2005	Eurostat
12	Chile	2003	Eurostat
13	Mexico	2003	National Institute of Statistics, Geography and Informatics
14	Estonia	2005	Eurostat
15	Slovak Republic	2005	Eurostat
16	Australia	2004	Australian Bureau of Statistics
17	Canada	2005	Statistics Canada
18	Switzerland	2001	Federal Institute of Technology
19	Germany	2005	Eurostat
20	Spain	2005	Eurostat
21	Finland	2005	Eurostat
22	France	2005	National Institute of Statistics and Economic Studies
23	United Kingdom	2005	The Office for National Statistics
24	Greece	2005	Eurostat
25	Italy	2005	Eurostat
26	Japan	2005	Ministry of Economy, Trade and Industry
27	Korea	2005	Bank of Korea
28	Norway	2005	Eurostat
29	New Zealand	2002	Statistics New Zealand
30	Portugal	2005	Eurostat
31	Sweden	2005	Eurostat
32	USA	2005	Bureau of Labor Statistics
33	Chinese Taipei	2001	Directorate General of Budget, Accounting and Statistics
34	Slovenia	2005	Eurostat
35	Iran	2001	Iranian Statistical center

Source: Yamano, N. and Ahmad, N. (2006)

3- Findings

The result show that vertical integration was a common phenomenon in almost all countries, however, its proportion varies tremendously across countries. The share of import content of export was relatively high in small countries. It was more than 46

percent in Hungary, more than 45 percent in Czech Republic, almost 45 percent in Estonia, 44 percent in Slovak republic, and nearly 33 percent in Finland. Lower end values ranged between 10 percent for Argentina, nearly 11 percent Brazil, more than 12 percent USA and around 13 to 14 percent in countries such as Norway, Australia, and India. Iran however, had the lowest proportion. Of course it is understandable because of International economic sanctions and Iran's difficulties in having trade relation with developed countries. This is of course a reason for its low industrial development. Iran's rank in this regards is the bottom in fact it is the last (its rank is 35). While Iran's Industry share in total output is 26 percent and its rank is 27, the share of imports to total output is less than 11 percent while export share of output is only 13.3 percent and share of industrial imports to total imports is more than 81 percent. This means that Iran's trade structure is not in favor of Industrialization. But imports contain mainly of consumer goods to meet domestic demand (Yousefi and Mohmmadi, 2013).

Table-2: Vertical Integration and Industrialization

Country	Share of industrial output To total output	rank	Share of Export To total output	rank	Share of imports to output	rank	Share of industrial Exports To total Exports	rank	Share of industrial imports o To total imports	rank	Share of intermediate imports To total imports	rank	import content of Export	rank
Indonesia	0.380	7	0.17	16	7.5%	32	0.581	26	0.688	27	0.601	24	0.144	28
India	0.341	13	0.08	32	14.8%	22	0.541	27	0.641	34	0.695	7	0.130	31
Brazil	0.347	12	0.09	31	8.8%	31	0.687	19	0.657	31	0.619	19	0.113	33
China	0.508	1	0.13	25	6.5%	35	0.820	7	0.791	12	0.788	1	0.227	19
Turkey	0.357	9	0.10	29	12.2%	28	0.662	23	0.745	21	0.611	23	0.188	23
South Africa	0.315	19	0.15	19	13.1%	26	0.405	30	0.696	26	0.578	28	0.164	25
Romania	0.314	20	0.18	14	14.4%	23	0.725	14	0.780	14	0.556	29	0.252	16
Argentina	0.296	22	0.06	34	23.3%	6	0.671	22	0.867	2	0.529	33	0.100	34
Czech	0.406	4	0.29	5	27.7%	5	0.829	5	0.810	8	0.735	3	0.452	2
Hungary	0.383	6	0.31	3	32.3%	3	0.830	4	0.851	3	0.692	8	0.462	1
Poland	0.320	16	0.18	15	18.4%	15	0.681	21	0.815	6	0.638	15	0.265	14
Chile	0.235	29	0.19	13	17.6%	16	0.335	33	0.671	30	0.597	27	0.203	20
Mexico	0.328	15	0.15	20	15.8%	20	0.735	13	0.930	1	0.536	31	0.189	22
Estonia	0.301	21	0.33	2	37.6%	1	0.684	20	0.833	5	0.631	17	0.449	3
Slovak Republic	0.385	5	0.34	1	36.1%	2	0.743	12	0.777	15	0.652	12	0.440	4
Australia	0.182	35	0.09	30	10.7%	30	0.368	31	0.780	13	0.613	20	0.138	29
Canada	0.267	26	0.21	12	19.1%	13	0.633	24	0.760	19	0.639	14	0.260	15
Switzerland	0.286	23	0.24	8	21.9%	7	0.712	17	0.807	9	0.597	26	0.285	11
Germany	0.350	10	0.22	10	18.5%	14	0.833	3	0.762	18	0.612	22	0.282	12
Spain	0.274	25	0.11	27	15.5%	21	0.699	18	0.731	22	0.670	9	0.275	13
Finland	0.350	11	0.21	11	19.2%	12	0.880	1	0.687	28	0.709	5	0.329	8
France	0.275	24	0.13	23	14.2%	24	0.715	16	0.773	16	0.623	18	0.236	17
United Kingdom	0.189	32	0.15	21	16.5%	18	0.503	29	0.712	24	0.535	32	0.193	21
Greece	0.186	33	0.11	28	19.6%	11	0.341	32	0.716	23	0.491	34	0.158	26
Italy	0.315	18	0.12	26	12.9%	27	0.775	10	0.673	29	0.663	10	0.229	18
Japan	0.338	14	0.08	33	7.3%	34	0.799	8	0.639	35	0.714	4	0.158	27
Korea	0.471	2	0.17	17	16.1%	19	0.846	2	0.644	33	0.771	2	0.319	9
Norway	0.183	34	0.27	6	17.3%	17	0.253	34	0.646	32	0.556	30	0.133	30
New Zealand	0.231	30	0.15	18	14.0%	25	0.510	28	0.795	11	0.612	21	0.186	24
Portugal	0.259	28	0.13	22	19.6%	10	0.766	11	0.771	17	0.637	16	0.342	6
Sweden	0.317	17	0.25	7	20.4%	9	0.723	15	0.704	25	0.648	13	0.289	10
USA	0.214	31	0.05	35	7.5%	33	0.591	25	0.799	10	0.601	25	0.123	32
Chinese Taipei	0.438	3	0.24	9	20.8%	8	0.789	9	0.760	20	0.699	6	0.329	7
Slovenia	0.359	8	0.30	4	31.7%	4	0.823	6	0.847	4	0.654	11	0.426	5
Iran	0.264	27	13.3%	24	10.9%	29	0.155	35	0.811	7	0.449	35	0.035	35

Source: Research Findings Based on data sources of Table-1.

Table-3: Spearman Rank Correlation between Various Integration Indices

	$EX^{im}, IM_{industry}/IM$	$EX^{im}, EX_{industry}/EX$	$EX^{im}, IM_{intermediate}/IM$	$EX^{im}, X_{industrial}/X$	$EX^{im}, EX/X$	$EX^{im}, IM/X$
(ρ) RankCorrelation	0.24	0.69	0.55	0.44	0.75	0.71
t-student	1.61	6.16	4.24	3.16	7.27	6.38

Source: Research findings based on data from Table 2.

It is expected that Small countries be generally more integrated, their domestic demand being limited; they have to export, to enjoy economies of scale. They also need to import more goods and services than larger countries in order to satisfy domestic demand. Of course, trade may include a significant proportion of re-exports and intra-firm trade linked to the presence of multinational firms. Other countries were in the middle ranges. We have also ranked countries on the bases of some related indices and tried to relate import content of exports with proportion of industrial imports to total imports, industrial exports to total exports, intermediate imports to total imports and share of industry to GDP in these countries using spearman's rank correlation and presented the result in table-3. The overall result show that import content of exports has had a high correlation specially with, proportion of Export to total output (rank Correlation Coefficient is 0.75) and the proportion of imports to output (the rank correlation coefficient is 0.71) and also with the proportion of industrial Exports to total Exports (the rank correlation coefficient is 0.69) and with the exception of intermediate imports to total imports, all the coefficients were statistically significant, meaning there by that vertical specialization is a very import sources of growth and industrialization.

4- Conclusion

Integration into global value chains and production networks are important ways through which countries can integrate into the world economy. Participating into international division of labor and specialization, help countries to promote exports, using imported intermediate goods. Production processes increasingly involve a sequential, vertical trading chain stretching across many countries, with each country specializing in particular stages of a good's production sequence. We emphasize on a key aspect of these vertical linkages — the use of imported inputs in producing goods that are exported. In this paper, using input- output technique and tables of 35 countries, the result show that vertical integration was a common phenomenon in almost all countries, however, its proportion varies tremendously across countries. The share of import content of export was relatively high in small countries. It ranged between 33 and 46 percent, with lower end values characterizing larger countries. Small countries are generally more integrated, their domestic demand being limited; they have to export, to enjoy economies of scale. They also need to import more goods and services than larger countries in order to satisfy domestic demand. Trade may include a significant proportion of re-exports and intra-firm trade linked to the presence of multinational firms. Iran, however, had the lowest proportion. Of course it is understandable because of International economic sanctions and Iran's difficulties in having trade relation with developed countries. That means Iran's trade structure is not in favor of Industrialization. This is of course a reason for its low industrial development. We have also tried to find relationship between various trade

performance indices and vertical integration. For this reason we have used Spearman's rank correlation coefficient between the ranks of import content of export with ranks of proportion of industrial import to total imports, proportion of industrial export to total exports, proportion of intermediate imports to total imports and proportion of industrial output to total outputs. The result show that import content of exports has had a high correlation specially with proportion of Export to total output and the proportion of imports to output and also with the proportion of industrial Exports to total Exports and with the exception of intermediate imports to total imports, all the coefficients were statistically significant, meaning there by that vertical specialization is a very import sources of growth and industrialization.

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