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HOW SOPHISTICATED ARE POLAND'S AND TURKEY'S EXPORTS?

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ABSTRACT

This paper is an attempt to use the sophistication index developed by Lall et al. (2006) to analyze the export structures of Turkey and Poland. Export sophistication index is calculated to determine the sophistication levels of each industry at the 3 digit ISIC system. These index values are then used to compare export sophistications of Poland and Turkey. The findings indicate that export structures of the two countries were similar with regard to their sophistication levels in 1985, Poland's position improved and Turkey's position declined in the last two decades. Today Poland is exporting relatively more sophisticated manufactured products than Turkey.

Keywords: *Export Sophistication, Revealed Comparative Advantage, Export Similarity*

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INTRODUCTION

As globalization accelerates, international trade has gained importance in world economies. Accordingly, export expansion has increased in importance as an indicator of economic growth. The export-led growth hypothesis that was developed after the world oil crises asserts that export growth will contribute to economic growth through several channels including facilitating exploitation of economies of scale, efficiency enhancement through increased competition and relief of foreign exchange constraints. However, new studies in the related literature have shown that not all export expansion will contribute to economic growth. Lall, Weiss and Zhang (2006) and Rodrik (2006) pointed out that it is the sophisticated exports that promote economic growth and, Lui and Shu (2003) indicated that technology-intensive exports are required for sustaining economic growth. Therefore, not the quantity of exports but the quality of exports has become important.

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According to this new evaluation, competitiveness in export markets and high export earnings can be achieved through export sophistication.

Export sophistication is a relatively new concept. There is no exact definition of sophistication but it is believed to assess exports' quality as well as their level of technology. Coombs, Gibbons, Saviotti and Stubbs (1981) were the first to use this concept and they based sophistication on technology. According to Coombs et al. (1981) research and development expenditures and innovations in an industry will determine its level of sophistication. Similarly, Gertler (2006) defined sophistication as technology intensity. On the other hand, Rodrik (2006) and Hallak (2006) related sophistication to product quality: The higher the quality of the product, the more sophisticated it became. Kwan (2002) indicated that sophistication depends on the value added to the products. High value added products are accepted as sophisticated and they are likely to be exported from countries with a high per capita income level. In another study Hausmann, Hwang and Rodrik (2005) did not use the concept of sophistication but they discussed that productivity levels of some goods are higher than others and the countries that export these goods will achieve a better result. Thus their higher productivity goods resemble the sophisticated goods that were defined by other researchers.

The aim of this study is to compare Poland and Turkey with regards to the sophistication levels of their manufactured exports. In this paper, sophistication levels of industries are calculated by using the export sophistication index (Lall et al., 2006); furthermore, these sophistication levels are used to assess the export sophistication of Poland and Turkey. The sophistication index used in this study is relatively new. Lall et al. (2006) calculated the index for only 1990 and 2000. In this study the index is calculated for a term of four years (1985, 1990, 1995 and 2004) and the performances of two countries with regards to export sophistication are analyzed in detail. The focus both place on export makes the assessment more meaningful.

The liberalization process in Poland and Turkey differs in time periods, but liberalization and especially export expansion was seen as an avenue for economic growth in both countries. Poland underwent a transition process from a planned economy to a market economy which began in January 1990 with a reform program entitled the Balcerowicz plan. However, Turkey's liberalization period started earlier in January 1980, with a stabilization and structural adjustment program. Figure 1 plots the shares of exports in GDP's of both countries. It can be seen that share of exports in GDP increased from 1990 to 2005 in both countries; however, the rate of increase was about 30 percent in Poland, and 106 percent in Turkey.

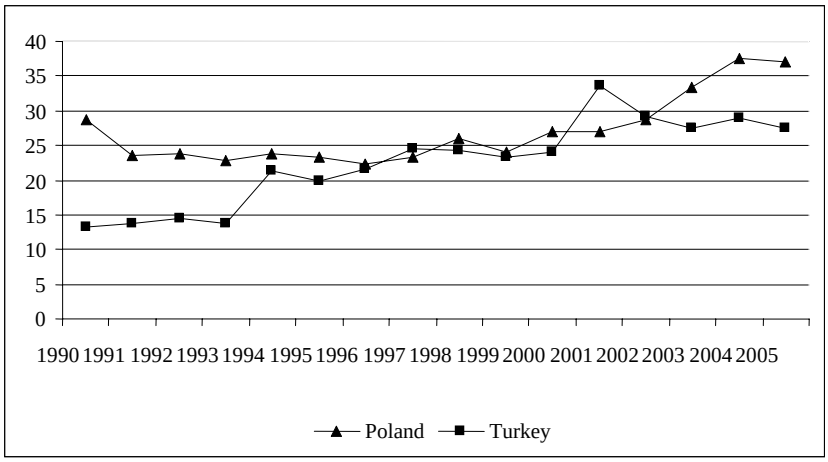

Figure 1: The Share of Exports in GDP, 1990-2005

Source: Data from World Bank, World Development Indicators Database

Table 1 shows the sectoral composition of Poland's and Turkey's exports in 2004. From this table it can be seen that the shares of industries are not exactly the same in both countries but structurally they are similar. The share of agriculture in both is about 10 percent and the share of total manufacturing industries (Machinery and transport equipment plus other manufactured exports) is about 77 percent in Poland and 71 percent in Turkey in which they can be compared.

Table 1: Sectoral composition of exports (%) (2004)

Sector definition (SITC Rev. 3)	Poland	Turkey
Agricultural products (0+1)	8.2	10.3
Crude Materials (2+4)	2.7	4.6
Energy (3)	5.5	10
Chemicals (5)	6.4	4.1
Machinery and transp. equip. (7)	38.8	28.9
Other manufactured products (6+8)	38.4	42.1

Source: Data from Eurostat.

The remainder of the paper is organized as follows. Section 2 explores the export sophistication index. An overview of the data is provided and calculated index values are presented in Section 3. Exports of Poland and Turkey are analyzed for their sophistication levels and the revealed comparative advantage indices are also exhibited in this section. Concluding remarks are presented in Section 4.

EXPORT SOPHISTICATION INDEX

Export sophistication is calculated by using different indicators and methodologies in related literature. Mani and Hwang (2004) simply used shares of primary exports against total exports as an indicator of sophistication. Feenstra and Rose (2000) ranked 160 countries for their levels of export sophistication. The ranking was based on each country's exports to the United States between 1972 and 1994: Goods that were exported earlier to the US were less advanced or less sophisticated than goods that were exported subsequently. In another study, Schott (2004) also used the US as a benchmark and simply classified the industries according to the exporters' income levels: Low, middle and high income countries exporting low, middle and high quality products respectively to the US. Hallak (2006) used export unit value indices as an indicator of product quality and these export unit values are found to be strongly correlated with exporter per capita incomes. Hausmann et al. (2005) developed an index to measure the sophistication of exports and Rodrik (2006) applied this index to China. This index is based on the premise that countries with higher human capital levels will produce goods of higher sophistication. The index can be calculated in two steps: At the first step, the income level of the commodity is calculated by the weighted average of the countries exporting the commodity, weights are the revealed comparative advantage of each country, and this is called PRODY. At the second step, the weighted average of the PRODY for each country, where weights are the share of each commodity in that country's total exports, is calculated and it is named EXPY. So, EXPY measures the productivity level of a country's exports.

A similar but more detailed sophistication index, which will be used in this study, was developed by Lall et al. (2006). The index is based on the idea that countries with high per capita income levels will export more sophisticated products. Countries with high per capita incomes are the ones with high wage rates and consequently with relatively high production costs. If the exports of the high income countries are focused on some products or product groups, this means that these products can be sold at relatively high prices on international markets which might be possible because these products embody high technology and/or they are of high quality. It is implicitly assumed that the higher the technology is embodied in a product, the higher the level of its quality and the more sophisticated it becomes. The sophistication of industries are assessed by the average per capita income of the exporter countries. The higher the per capita Gross National Income (GNI) of the nation, the more likely it is to export sophisticated products.

Calculation of this index firstly requires the calculation of unique sophistication scores for each industry. In order to do this, countries are ranked with their per capita GNI's in a descending order. Then these countries are divided in 10 income groups for each year. Since the

rankings of the countries change between years, the income groups structure also changes annually. Accordingly the unique sophistication scores can be calculated as shown:

$$US_i = \sum_i \left(\frac{X_{i,g}}{X_i} * APCGNI_g \right)$$

where US_i represents unique sophistication score of industry i, X represents exports, and APCGNI represents average per capita GNI. Subscript i refers to an industry at the 3 digit level and g stands for each income group. These particular sophistication scores are then used to calculate the sophistication index. The Sophistication Index is defined as follows:

$$SI_i = \frac{(US_i - US_{\min})}{(US_{\max} - US_{\min})} * 100$$

where SI is the sophistication index and US is the unique sophistication score as a dollar value. US_{min} is the minimum unique sophistication score dollar value for all industries and US_{max} is the maximum unique sophistication score dollar value for all industries.

DATA AND EMPIRICAL FINDINGS

Data

Trade data used in the calculations are International Standard Industrial Classification (ISIC) Revision 2, 3 digit manufacturing industries. Export data are drawn from Nicita and Olarreaga (2006) and they are mirrored data which are obtained from the partner country. Per capita GNI values are obtained from World Bank, World Development Indicators Database. The Sophistication Index is calculated for four years: 1985, 1990, 1995 and 2004. The study covers 95 countries and Appendix A lists the countries included in the calculations.

The Sophistication of Industries

In this study, the sophistication index developed by Lall et al. (2006) is used to analyze the sophistication of manufactured exports. The sophistication index is calculated for 28 manufacturing industries at the 3 digit ISIC system and then these 28 industries are divided into 4 sophistication levels depending on their index values, level 1 represents the most sophisticated industries. The industries at each sophistication level are presented in Table 2[1].

[1] Definitions of these industries are presented in Appendix B.

Table 2: Industries at Each Sophistication Level

	1985	1995
Level 1	354 Misc. petroleum and coal prod. 384 Transport equipment 351 Industrial chemicals 382 Machinery, except electrical 383 Machinery, electric 341 Paper and products 311 Food products	384 Transport Equipment 382 Machinery, except electrical 352 Other chemicals 351 Industrial chemicals 383 Machinery, electric 341 Paper and products 381 Fabricated metal products
Level 2	353 Petroleum refineries 332 Furniture, except metal 390 Other manufactured products 372 Non-ferrous metals 314 Tobacco 352 Other chemicals 385 Professional and scientific equip.	385 Professional and scientific equip. 311 Food products 371 Iron and steel 353 Petroleum refineries 355 Rubber products 372 Non-ferrous metals 321 Textiles
Level 3	321 Textiles 381 Fabricated metal products 371 Iron and steel 322 Wearing apparel, except footwear 342 Printing and publishing 362 Glass and products 369 Other non-metallic mineral prod.	390 Other manufactured products 314 Tobacco 362 Glass and products 369 Other non-metallic mineral prod. 356 Plastic products 331 Wood products, except furniture 342 Printing and publishing
Level 4	355 Rubber products 331 Wood products, except furniture 356 Plastic products 313 Beverages 361 Pottery, china, earthenware 324 Footwear, except rubber and plas. 323 Leather products	313 Beverages 322 Wearing apparel, except footwear 332 Furniture, except metal 323 Leather products 354 Misc. petroleum and coal prod. 324 Footwear, except rubber and plas. 361 Pottery, china, earthenware
	2000	**2004**
Level 1	384 Transport Equipment 352 Other chemicals 385 Professional and scientific equip. 382 Machinery, except electrical 351 Industrial chemicals 383 Machinery, electric 341 Paper and products	352 Other chemicals 384 Transport Equipment 351 Industrial chemicals 385 Professional and scientific equip. 382 Machinery, except electrical 341 Paper and products 311 Food products
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Level 3	321 Textiles 313 Beverages 314 Tobacco 356 Plastic products 369 Other non-metallic mineral prod. 362 Glass and products 332 Furniture, except metal	355 Rubber products 356 Plastic products 369 Other non-metallic mineral prod. 321 Textiles 390 Other manufactured products 331 Wood products, except furniture 342 Printing and publishing
Level 4	331 Wood products, except furniture 342 Printing and publishing 324 Footwear, except rubber and plas. 322 Wearing apparel, except footwear 354 Misc. petroleum and coal prod. 361 Pottery, china, earthenware 323 Leather products	332 Furniture, except metal 362 Glass and products 354 Misc. petroleum and coal prod. 361 Pottery, china, earthenware 323 Leather products 322 Wearing apparel, except footwear 324 Footwear, except rubber and plas.

An examination of Table 2 reveals that industries at each sophistication level have changed over time. Some of the industries improved and some of them declined in terms of their sophistication level. In 1985, 354 (Miscellaneous petroleum and coal products) was the most sophisticated industry with the highest index value, however; in 1995 it moved from level 1 to level 4 and remained there. No other industry displayed such massive alteration. In all other years 384 (Transport equipment) was the first or second in the rankings. The other industries which were in the first level showed only slight changes in their positioning. From 1985 to 2004, five industries out of seven remained in the first level. However, when the content of the level 4 industries are analyzed, it can be observed that only three industries continued to be at the same level from 1985 to 2004, which are 361 (Pottery, china, earthenware), 323 (Leather products) and 324 (Footwear, except rubber or plastic). The industry which showed the highest change is 313 (Beverages) which gradually increased its ranking. When the level 2 and level 3 industries are examined, it can be seen that there is no major change in the positioning of these industries.

The shares of each sophistication level in total world exports are shown in Table 3. The composition of total world exports in terms of their sophistication levels has changed in the last two decades. The share of first and second level industries increased whereas the share of industries at the third and fourth levels decreased. For all years the share of level 1 industries is the highest in terms of total exports. The largest change in export shares from 1985 to 2004 was realized in level 4 industries, which showed sharp falls.

Table 3: Share of Each Sophistication Level in Total World Exports

Soph. levels	Share in 1985	Share in 1995	Share in 2000	Share in 2004	Change in share (1985-2004)
1	0,431	0,547	0,593	0,505	0,172
2	0,189	0,218	0,199	0,292	0,543
3	0,192	0,131	0,107	0,122	-0,365
4	0,188	0,104	0,101	0,081	-0,569

Similar sophistication scores can be also calculated for each country by multiplying the share of each country in total world manufacturing exports with the country's per capita GNI. These sophistication scores can be calculated as follows:

$$CSS_j = \sum_i \frac{X_{i,j}}{X_{i,w}} \cdot APCGNI_j$$

where CSS represents country sophistication score, X represents exports, and APCGNI represents average per capita GNI. Subscript i refers to industry, j represents country and w represents the world. The calculated country sophistication scores which show the overall sophistication of the selected countries' are presented in Table 4 for the years 1995 and 2004.

Table 4: Aggregate country sophistication of selected countries (1995 and 2004)

	2004		1995	
	Sophistication Score	Rank	Sophistication Score	Rank
United States	76948,170	1	59216,807	1
Germany	63484,221	2	52668,078	3
Japan	40167,160	3	55759,952	2
France	33982,951	4	28592,890	4
Italy	31974,711	5	21373,693	5
United Kingdom	27259,421	6	17263,358	7
Netherlands	25226,838	7	17880,144	6
Canada	22049,317	8	14576,176	10
Belgium-Luxemburg	21566,930	9	16756,138	8
Switzerland	17437,436	10	15736,352	9
Slovenia	6573,940	19	2402,555	24
China	3966,778	24	681,067	43
Czech Republic	1567,670	34	436,867	50
Poland	**1339,270**	**37**	**604,378**	**45**
Turkey	**1038,454**	**43**	**413,543**	**51**
Hungary	899,529	44	248,426	55
Gabon	6,579	85	2,553	88
Cote D'Ivorie	6,506	86	7,867	81
Cameroon	4,761	87	2,657	87
Bolivia	3,832	88	3,085	86
Armenia	2,739	89	0,196	92
Azerbaijan	2,184	90	0,284	91
Ghana	1,429	91	2,014	89
Kyrgyzstan	0,543	92	0,311	90
Benin	0,141	93	0,088	94
Ethiopia	0,090	94	0,124	93

In Table 4, sophistication scores of ten countries with the highest and lowest index values and some selected countries, mainly transition economies, are shown. It can be seen that the top ten countries did not change in one decade and the lowest ten countries are also stable. All the other selected countries moved upwards in the rankings. Poland and Turkey both moved eight steps upwards and their sophistication scores

more than doubled, an indication that both Turkey and Poland in 2004 exported more sophisticated manufactured products when compared to 1995.

Sophistication of Poland's and Turkey's Exports

In this section sophistication of Poland's and Turkey's exports are analyzed. The share of industries at each sophistication level are calculated and presented in Tables 5 and 6 for Poland and Turkey respectively.

Table 5: Share of Poland's Exports in Total World Exports by Sophistication Levels

Sophistication levels	Share in 1985	Share in 1995	Share in 2000	Share in 2004	Change in share (1985-2004)
1	0,010	0,020	0,024	0,051	4,100
2	0,106	0,030	0,041	0,047	-0,557
3	0,054	0,072	0,039	0,055	0,019
4	0,334	0,081	0,147	0,065	-0,805

In 1985, relatively less sophisticated exports accounted for a significant part of Polish manufactured exports whereas the more sophisticated industries had substantially smaller shares. However the share of sophisticated (Level 1) exports has been growing continuously during the last two decades, while the shares of less sophisticated exports have been declining.

Comparatively, Turkey's manufactured exports are dominated by low sophisticated industries (Level 4), their share in total world exports has decreased from 38, 4 percent in 1985 to approximately 14,3 percent in 2004. Level 1 industries have the smallest share in Turkey's manufactured exports in all the years which have been analyzed.

Export structures of Poland and Turkey were very similar in 1985. Over the years Turkey's share decreased in sophisticated industries but Poland's share increased. In 2004 the share of level 1 and level 2 industries in total world exports were higher for Poland than Turkey. Also, shares of all sophistication levels, except level 3, decreased in total world exports for Turkey; however, shares of level 1 and level 3 industries increased for Poland.

Table 6: Share of Turkey's Exports in Total World Exports by Sophistication Levels

Sophistication level	Share in 1985	Share in 1995	Share in 2000	Share in 2004	Change in share (1985-2004)
1	0,045	0,008	0,010	0,024	-0,467
2	0,130	0,036	0,030	0,036	-0,723
3	0,068	0,041	0,038	0,075	0,103
4	0,384	0,065	0,118	0,143	-0,628

Export Sophistication and Comparative Advantage

In the previous section it was shown that Poland's manufacturing exports are relatively more sophisticated than Turkey's manufacturing exports. At this point an important question which arises is: In which industries do Poland and Turkey have comparative advantage? Are these industries sophisticated or not? In order to shed light on this question, the comparative advantage of Poland and Turkey in each industry base must be calculated and its relation to sophistication levels be analyzed.

In order to measure the comparative advantage of Poland and Turkey, Revealed Comparative Advantage Index (RCA) will be used which was developed by Balassa (1965). The original RCA index was formulated as follows:

$$RCA = \frac{\frac{X_{i,j}}{\sum_i X_{i,j}}}{\frac{X_{i,w}}{\sum X_{i,w}}}$$

where, X represents exports and i and j stand for industry and country respectively, and w represents the world. If the value of RCA is greater than 1, that shows that the country has comparative advantage in the industry, if the RCA is lower than 1, the nation has comparative disadvantage in the industries analyzed. When RCA values are high, this implies that the industries are highly competitive.

The deficiency of the RCA index is that it varies from positive 1 to infinity for industries in which a country has a comparative advantage, but only from zero to minus 1 for industries with comparative disadvantage. Dalum, Laursen and Villumsen (1998) proposed a Revealed Symmetric Comparative Advantage Index (RSCA) to solve this problem. This index is defined as follows:

$$RSCA = (RCA_{i,j}-1)/(RCA_{i,j}+1)$$

RSCA takes a maximum value of 1 and a minimum value of -1. Positive values of RSCA indicate that the country has comparative advantage in the industries analyzed; on the other hand, the index will take a negative value if the industry has comparative disadvantage.

Table 7 displays the calculated RSCA Index values of manufacturing industries for Poland and Turkey at each sophistication level. The industries with a comparative advantage are presented in bold. In 1985, Turkey had comparative advantage in only one industry at the first level (341- Paper and products); on the other hand, Poland did not have comparative advantage in any of the industries at this level. Both Turkey's and Poland's advantages were in less sophisticated industries.

Table 7: Revealed Symmetric Comparative Advantage Index for Manufacturing Industries of Poland and Turkey

	1985			1995	
	Poland	**Turkey**		**Poland**	**Turkey**
Level 1:					
354	-0,952	-0,997	*384*	-0,235	-0,523
384	-0,901	-0,943	*382*	-0,441	-0,609
351	-0,827	-0,883	*352*	-0,607	-0,587
382	-0,917	-0,984	*351*	-0,062	-0,375
383	-0,922	-0,978	*383*	-0,355	-0,466
341	-0,917	**0,429**	*341*	-0,226	-0,703
311	-0,553	-0,717	*381*	**0,222**	-0,220
Level 2:					
353	-0,864	-0,392	*385*	-0,786	-0,780
332	-0,729	**0,536**	*311*	**0,026**	**0,147**
390	-0,970	-0,921	*371*	**0,308**	**0,462**
372	-0,970	-0,921	*353*	-0,415	-0,203
314	-0,976	-0,600	*355*	-0,110	**0,173**
352	**0,706**	-0,955	*372*	**0,367**	-0,382
385	-0,979	**0,602**	*321*	-0,181	**0,589**
Level 3:					
321	-0,899	-0,408	*390*	-0,649	-0,575
381	-0,859	-0,928	*314*	**0,847**	**0,794**
371	-0,802	-0,892	*362*	**0,004**	**0,060**
322	-0,678	-0,078	*369*	**0,043**	**0,245**
342	**0,448**	**0,454**	*356*	-0,516	-0,681
362	-0,850	-0,747	*331*	**0,347**	-0,788
369	-0,943	-0,856	*342*	-0,810	-0,899
Level 4:					
355	-0,973	-0,954	*313*	-0,883	-0,815
331	-0,788	**0,851**	*322*	**0,426**	**0,828**
356	-0,994	**0,568**	*332*	**0,573**	-0,541
313	**0,681**	**0,636**	*323*	-0,230	-0,621
361	**0,757**	**0,535**	*354*	**0,838**	**0,763**
324	-0,894	-0,996	*324*	-0,241	-0,725
323	**0,749**	-0,990	*361*	-0,529	-0,578

In 1995 and 2000, both Poland's and Turkey's competitiveness increased to the second and third level industries, and also the number of industries in which Poland and Turkey had comparative advantage increased. However, the rise for Poland was sharper.

Table 7: Revealed Symmetric Comparative Advantage Index for Manufacturing Industries of Poland and Turkey (continued)

	2000			2004	
	Poland	Turkey		Poland	Turkey
384	**0,086**	-0,284	*352*	-0,284	-0,636
352	-0,351	-0,487	*384*	**0,213**	**0,071**
385	-0,715	-0,812	*351*	-0,272	-0,504
382	-0,382	-0,455	*385*	-0,486	-0,850
351	-0,181	-0,395	*382*	-0,286	-0,335
383	-0,232	-0,319	*341*	**0,224**	-0,548
341	**0,028**	-0,616	*311*	**0,294**	-0,015
311	**0,209**	**0,102**	*314*	-0,395	-0,892
371	**0,246**	**0,445**	*313*	-0,443	-0,786
381	**0,246**	-0,127	*372*	**0,115**	-0,343
390	-0,597	-0,278	*383*	-0,080	-0,267
353	-0,469	-0,346	*381*	**0,280**	**0,014**
372	**0,151**	-0,321	*353*	-0,381	-0,316
355	**0,117**	**0,170**	*371*	**0,080**	**0,428**
321	-0,110	**0,656**	*355*	**0,320**	**0,177**
313	-0,617	-0,815	*356*	**0,025**	-0,231
314	-0,867	-0,883	*369*	**0,150**	**0,594**
356	-0,190	-0,429	*321*	-0,107	**0,631**
369	-0,158	**0,448**	*390*	-0,626	-0,389
362	**0,064**	**0,091**	*331*	**0,268**	-0,735
332	**0,597**	-0,356	*342*	-0,392	-0,837
331	**0,255**	-0,770	*332*	**0,692**	-0,116
342	-0,575	-0,831	*362*	**0,059**	-0,099
324	-0,451	-0,754	*354*	-0,831	**0,829**
322	**0,160**	**0,775**	*361*	-0,321	-0,060
354	**0,920**	**0,908**	*323*	-0,379	-0,547
361	-0,292	-0,360	*322*	-0,127	**0,765**
323	-0,316	-0,557	*324*	-0,447	-0,556

In 2004, the highest performing sectors with the highest RSCA index values were 354 (Miscellaneous petroleum and coal products) and 322 (Wearing apparel, except footwear) for Turkey and 332 (Furniture, except metal) for Poland which were among the least sophisticated level 4 industries. Poland had comparative advantage in three industries out of a total of seven industries at the first level, but Turkey had comparative advantage in a single industry that year. Also Poland's comparative advantage increased in terms of the size of the index values. So, it is apparent from these results that the relative competitiveness of Poland is higher in sophisticated industries than Turkey.

Can Poland's relative improvement be a threat for Turkey's exports? It depends on whether Poland and Turkey are competitors in world markets or not. To answer this question the Export Similarity Index (Finger and Kreinin, 1979) for Turkey and Poland is calculated. The export similarity index is used to measure the similarities between the exports of both nations in a market. If the exports of the nations are

similar, it shows that these nations are competitors in the market. Export similarity index is defined as follows:

$$B(ab,c) = \sum_i Minimum\left[X_i(ac), X_i(bc)\right]$$

where X_i (ac) shows the share of industry i in total exports of country a in market c and X_i (bc) shows the share of industry i in total exports of country b in market c. If share of an industry in both countries' exports are same, the index will take the value of 1. However, if one of the nations does not export i, the index will take the value of 0. The export similarity index values for Poland and Turkey are presented in Table 8.

Table 8: Export Similarity Index for Poland and Turkey

Year	Export similarity index
1985	0,189
1995	0,110
2000	0,148
2004	0,109

The calculated index values are low, that means that the exports of Poland and Turkey in world markets are not similar. In other words, according to the calculated index values Poland and Turkey are not competitors[2], therefore, Poland's improvement is not expected to affect Turkey.

CONCLUSION

In this study, the sophistication index developed by Lall et al. (2006) is used to measure the sophistication levels of 3 digit ISIC industries in the manufacturing sector. Using data covering 95 countries, the export sophistication indices are calculated for the years 1985, 1995, 2000 and 2004 separately. Export performances of Poland and Turkey were evaluated and compared through this index.

The results indicate that the export structures of Poland and Turkey with regard to their sophistications were very similar in 1985 but in the last two decades, Poland strengthened her position whereas Turkey's position decreased. Poland is exporting relatively more sophisticated industrial products than Turkey. The evidence from this study also suggests that export competitiveness of Turkey and Poland are strongly influenced by the sophistication levels of the industries. For the years 2000 and 2004, comparative advantage of Turkey is in relatively less sophisticated industries than Poland. However, Poland's

[2] When the export similarity index is calculated for each sophistication level in the year 2004, index values were very low revealing that there is no competition between both countries. These results are presented in Appendix D.

superiority in exports is not expected to affect Turkey, as according to the export similarity index Poland and Turkey are not competitors in world markets.

The reasons behind the differences between Poland's and Turkey's export performances are beyond the scope of this study. The rise of the export performance of Poland may be partly explained by restructuring and privatization of manufacturing industries together with increased foreign direct investment flows. On the other hand, the repeated economic crises in the last decade may explain Turkey's lagging behind. However it needs to be explored in further research.

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Appendix A: Countries Included in the Calculation of the Sophistication Index

Algeria, Argentina, Armenia*, Australia, Austria, Azerbaijan*, Benin, Bangladesh, Bulgaria, Belgium-Luxemburg, Bolivia, Brazil, Botswana*, Canada, Chile, China, Cote D'Ivorie, Colombia, Costa Rica, Cyprus, Czech Republic*, Denmark, Ecuador, Egypt, Ethiopia*, Finland, France, Gabon, Ghana, Germany, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Jordan, Kenya, Korea, Kuwait, Kyrgyzstan*, Latvia*, Lithuania*, Macau, Malawi, Malaysia, Malta, Mauritius, Mexico, Moldova*, Mongolia, Morocco, Mozambique, Nepal, Netherlands, New Zeland, Nigeria, Norway, Oman, Pakistan, Panama, Peru, Philippines, Poland*, Portugal, Romania, Russian Federation*, Senegal, Singapore, Slovakia*, Slovenia*, Spain, Sri Lanka, South Africa, Sweden, Switzerland, Tanzania*, Thailand, Trinidad and Tobago, Tunusia, Turkey, Uganda, Ukraine*, United Kingdom, United States, Uruguay, Venezuela, Yemen*.

*Countries not included in 1985 because of lack of data.

Appendix B: The ISIC 2 Digit Industry Definitions (Manufacturing)

Code	Industry
311	Food products
313	Beverages
314	Tobacco
321	Textiles
322	Wearing apparel, except footwear
323	Leather products
324	Footwear, except rubber or plastic
331	Wood products, except furniture
332	Furniture, except metal
341	Paper and products
342	Printing and publishing
351	Industrial chemicals
352	Other chemicals
353	Petroleum refineries
354	Miscellaneous petroleum and coal products
355	Rubber products
356	Plastic products
361	Pottery, china, earthenware
362	Glass and products
369	Other non-metallic mineral products
371	Iron and steel
372	Non-ferrous metals
381	Fabricated metal products
382	Machinery, except electrical
383	Machinery, electric
384	Transport equipment
385	Professional and scientific equipment
390	Other manufactured products

Source: http://www.unido.org/doc/3531

Appendix C: Country Sophistication Scores (1995 and 2004)

	2004 Sophistication Score	Rank	1995 Sophistication Score	Rank
United States	76948,170	1	59216,807	1
Germany	63484,221	2	52668,078	3
Japan	40167,160	3	55759,952	2
France	33982,951	4	28592,890	4
Italy	31974,711	5	21373,693	5
United Kingdom	27259,421	6	17263,358	7
Netherlands	25226,838	7	17880,144	6
Canada	22049,317	8	14576,176	10
Belgium-Luxemburg	21566,930	9	16756,138	8
Switzerland	17437,436	10	15736,352	9
Norway	13300,904	11	7096,787	13
Sweden	11835,860	12	8387,808	11
Spain	11036,390	13	5651,697	18
Ireland	10290,569	14	2584,586	23
Austria	9884,138	15	6466,344	15
Kuwait	9700,383	16	7531,793	12
Denmark	7813,224	17	6011,767	16
Korea	7030,820	18	4816,864	19
Slovenia	6573,940	19	2402,555	24
Finland	6254,554	20	3772,998	20
Singapore	5684,091	21	6640,662	14
Australia	4675,421	22	2985,504	22
Hong Kong	4667,032	23	5918,268	17
China	3966,778	24	681,067	43
Mexico	3669,116	25	887,099	37
Slovakia	3325,125	26	274,689	52
Trinidad and Tobago	3156,589	27	2289,075	25
Oman	2883,889	28	1974,788	26
Malta	2430,332	29	1826,749	28
Portugal	2286,034	30	1808,126	29
New Zeland	2169,590	31	3100,469	21
Lithuania	1890,473	32	583,683	46
Israel	1763,927	33	1060,723	35
Czech Republic	1567,670	34	436,867	50
Panama	1540,942	35	1838,977	27
Mauritius	1441,492	36	785,369	41
Poland	1339,270	37	604,378	45
Malaysia	1206,584	38	1317,838	34

Appendix C: Country Sophistication Scores (1995 and 2004) (continued)

Venezuela	1192,491	39	1618,309	30
Uruguay	1101,239	40	1490,701	32
Latvia	1099,875	41	987,006	36
Russian Federation	1077,522	42	1366,306	33
Turkey	1038,454	43	413,543	51
Hungary	899,529	44	248,426	55
Brazil	884,506	45	762,065	42
Greece	833,027	46	460,619	49
Thailand	715,796	47	650,663	44
Peru	564,363	48	847,113	39
South Africa	513,422	49	1509,247	31
Chile	487,554	50	270,923	53
Romania	437,840	51	177,818	57
El Salvador	399,160	52	844,051	40
Tunusia	395,573	53	848,756	38
Argentina	324,486	54	551,673	47
Indonesia	265,547	55	214,608	56
Moldova	260,060	56	177,362	58
Iceland	202,430	57	95,015	62
India	169,706	58	62,396	66
Senegal	164,236	59	140,351	61
Pakistan	155,953	60	167,082	59
Nigeria	135,568	61	74,239	63
Morocco	113,854	62	536,545	48
Philippines	112,010	63	72,561	64
Ukraine	110,599	64	260,841	54
Sri Lanka	110,535	65	146,186	60
Mongolia	108,024	66	24,185	74
Bulgaria	102,083	67	30,927	73
Tanzania	99,916	68	48,148	68
Colombia	79,147	69	52,944	67
Costa Rica	79,000	70	34,461	72
Cyprus	68,543	71	35,438	71
Nepal	66,325	72	22,816	75
Egypt	47,400	73	21,390	76
Mozambique	45,793	74	37,267	70
Algeria	38,823	75	62,603	65
Yemen	37,200	76	40,431	69
Iran	36,068	77	19,231	77
Guatemala	33,739	78	14,948	79
Uganda	24,767	79	15,627	78
Honduras	18,411	80	5,789	84

Appendix C: Country Sophistication Scores (1995 and 2004) (continued)

Ecuador	18,183	81	9,394	80
Jordan	17,418	82	5,012	85
Bangladesh	15,733	83	7,738	82
Malawi	7,417	84	6,588	83
Gabon	6,579	85	2,553	88
Cote D'Ivorie	6,506	86	7,867	81
Cameroon	4,761	87	2,657	87
Bolivia	3,832	88	3,085	86
Armenia	2,739	89	0,196	92
Azerbaijan	2,184	90	0,284	91
Ghana	1,429	91	2,014	89
Kyrgyzstan	0,543	92	0,311	90
Benin	0,141	93	0,088	94
Ethiopia	0,090	94	0,124	93

Appendix D: Export Similarity Index at Each Sophistication Level (2004)

Sophistication level	Export similarity index
Level 1	0,024
Level 2	0,030
Level 3	0,033
Level 4	0,025