

Specialization Level and Sectoral Development Trends in Turkish Manufacturing Industry Foreign Trade^a

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Abstract

In this study, it is aimed to determine the specialization level in Türkiye's foreign trade in the 2010s in terms of the general and sub-industries of the manufacturing industry and to examine the development trends. The level of specialization in the manufacturing industry in general is determined by using both the Michaely index and the foreign trade specialization index in the 2010-2019 period. Specialization analyses in sub-sectors are made according to the foreign trade specialization index, taking into account the feature that includes additional information in terms of intra-industry trade. In these analyses, the positions of the industries are listed and their development trends are examined in terms of export and import-based specialization. It is determined that there is no significant change in the specialization level of manufacturing industry trade in general. However, significant differences have been identified in the development trends and technological qualification structures of sub-industries, both in the level of specialization, in the form of export or import-based or transition from one to another.

Keywords

Türkiye
Manufacturing Industry
Foreign Trade
Specialization

About Article

Received: 14.01.2023
Published: 28.09.2023
Doi: 10.18026/cbayarsos.1234062

Türkiye İmalat Sanayii Dış Ticaretinde Uzmanlaşma Düzeyi ve Sektörel Gelişim Trendleri

Özet

Bu çalışmada 2010'lu yıllarda Türkiye'nin dış ticaretinde uzmanlaşma düzeyinin imalat sanayinin geneli ve alt sektörleri itibariyle tespiti ve gelişim trendlerinin incelenmesi amaçlanmaktadır. İmalat sanayiinin genelinde uzmanlaşma düzeyi 2010-2019 döneminde Michaely endeksi ve dış ticarete uzmanlaşma endeksinin her ikisinden de faydalanılarak tespit edilmektedir. Ayrıca Türkiye imalat sanayii tek haneli temel sektörleri, iki ve üç haneli alt endüstrileri ayrıntısında uzmanlaşma düzeyi belirlenmektedir. Alt sektörlerde uzmanlaşma analizleri, endüstri-içi ticaret açısından ilave bilgi içeren özelliği de dikkate alınarak, dış ticarete uzmanlaşma endeksinde göre yapılmaktadır. Bu analizlerde ihracat ve ithalata dayalı uzmanlaşma ayrımında endüstrilerin konumları sıralanmakta ve gelişim trendleri irdelenmektedir. Çalışmada imalat sanayii genelinde dış ticarete uzmanlaşma düzeyinde önemli bir değişimin olmadığı saptanmıştır. Ancak alt endüstrilerin hem uzmanlaşma düzeyinde hem de ihracat veya ithalata dayalı ya da birinden diğerine geçiş biçiminde gelişim trendlerinde ve teknolojik nitelik yapılarında belirgin farklılıklar tespit edilmiştir.

Anahtar Kelimeler

Türkiye
İmalat Sanayi
Dış Ticaret
Uzmanlaşma

Makale Hakkında

Geliş Tarihi: 14.01.2023
Yayın Tarihi: 28.09.2023
Doi: 10.18026/cbayarsos.1234062

^a This article is an improved and expanded version of the paper titled "Türkiye imalat sanayii dış ticaretinde uzmanlaşma düzeyinin incelenmesi" presented at the 8th International Congress on Economy Administration and Market Surveys held on October 13, 2022 and published Turkish in the proceedings book.

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Introduction

Specialization in foreign trade takes place according to comparative advantages, which is the traditional explanation of international trade, and foresees the structure of inter-industry trade. In this structure, the degree of advantages gains importance and countries are expected to specialize in the goods they produce at the lowest cost or in the sectors in which they produce under the most favorable conditions. In more defined terms, countries are expected to gain a comparative advantage and perform export in sectors where they are rich (abundant) in terms of factor endowment and where these factors are used intensively in production, and to import in others. At this point, sectoral specialization based on comparative advantage and factor endowment as well as alternative foreign trade theories, maintains its importance in the explanation of international foreign trade. In this context, specialization structure in foreign trade, which has dynamic sectors and is compatible with world demand, has priority in terms of the performance of the national economies. In addition, in today's competitive conditions, it can be said that alternative foreign trade theories, such as technology gap and product cycles, are technology-based and in the form of intra-industry trade, to some extent complementary to the traditional trade theory. Thus, it can be possible to explain the current foreign trade flows, which are not covered in one theory alone, with others.

In the determination of the comparative advantages and the analysis of competitiveness, the revealed comparative advantage indexes, which are more than ten in number with their formulations in different forms, are frequently used in the national and international literature. These indexes, especially the Balassa index, are also used in analyzes for the level of specialization in sectoral or total foreign trade. On the other hand, unlike these indexes, it is seen that studies based on the Michaely index and the foreign trade specialization index are carried out, especially in international studies, in order to determine the specialization level in foreign trade. These two indexes, can also provide meaningful information in terms of intra-industry trade, being more obvious in the foreign trade specialization index due to their formulation forms. On the other hand, it is observed that the studies in which Türkiye's data is applied to both indexes are limited and they focus on the past periods rather than the recent period. In this study, it is tried to examine the specialization level of the Turkish manufacturing industry in the 2010s by making use of both indexes. In addition, as another difference from other studies, in this study, sectoral developments trends and technological characteristics are examined by distinguishing between export and import-based specialization.

In this context, this study aims to determine the level of specialization in foreign trade in terms of the general and sub-industries of the Turkish manufacturing industry in the 2010s, to examine the relative specialization position and development trends of these industries. It is also aimed to analyze the specialization structure of the manufacturing industry by determining the industries that show specialization based on export or import or transition from one to the other. As a method in the study, both the Michaely index and the foreign trade specialization index are used to determine the level of specialization in the manufacturing industry in general. In addition, specialization analyzes in sub-sectors are made according to the foreign trade specialization index, which also contains additional information in terms of intra-industry trade. The period of the study is determined as 2010-2019 due to the disruptions in the economies and foreign trade flows of the countries, especially in 2020, because of the Covid-19 pandemic. The scope of the manufacturing industry consists of the Standard International Trade Classification (SITC) 1, 4 to 8 single-digit major sectors and related sub-

sectors, and the foreign trade data of 174 three-digit industries in UN Comtrade SITC Rev.3 are used.

In this perspective, first of all, the conceptual framework, scope, data and method of the study are explained. Then, starting from the SITC three-digit industry data, the specialization level and development of the Turkish manufacturing industry in the 2010s is examined in terms of general and its sub-sectors. Following this, by distinguishing between export and import based specialization, three-digit industries that stand out in these fields are identified and the characteristics of these industries are examined. In addition, it is tried to analyze the change in the relative positions of the industries that specialize in exports and imports or transition from oTürkiyene to the other. Finally, industries with export-based specialization in manufacturing industry foreign trade are examined in more detail. In this context, industries that strengthen the current exporter position and transition from an import-based position to export-based specialization are discussed and the technological characteristics of these industries are determined.

Conceptual Framework

Traditional foreign trade theory is based on Adam Smith's absolute advantages, Ricardo's comparative advantages and Heckscher-Ohlin (H-O) or factor endowment theorem. According to absolute advantages, a country should specialize in the production of goods produced at a lower cost compared to other countries. However, the degree of advantages is important according to comparative advantages. According to this, if a country has higher advantages in the production of which goods relative to the others, in other words, if it produces at the lowest cost, it should specialize in manufacturing of these goods and import the others. Seyidođlu (2003, pp. 18-24) draws attention to the shortcomings of the theory of comparative advantage in many aspects, but points out that it has a very strong structure and is accepted as the basis for the explanation of foreign trade even today. In this framework, according to comparative advantages, countries' ability to make "profitable foreign trade" stems from cost differences based on labor productivity differences. However, the issues that are not emphasized in the comparative advantage theorem and which are determinative in the labor productivity difference of countries have been clarified with the factor endowment theory, which is complementary to comparative advantages (Krugman & Obstfeld, 2003, pp. 12, 67; Seyidođlu, 2003, pp. 63-64). According to the factor endowment theory, a country can gain a comparative advantage in producing the goods that must be used intensively the factor that it is rich in (which it has in abundance) and can specialize by producing these goods with a lower cost. Thus, comparative advantage consists of the interaction of countries' resources (relative abundance of production factors) and production technology (factor density difference required by different manufacturing goods) (Krugman & Obstfeld, 2003, p. 67; Lindert & Pugel, 1996, pp. 51-53, 57-58; Seyidođlu, 2003, pp. 18-24, 63-64). Krugman & Obstfeld (2003, p. 67) describe this theory, which bases international trade largely on the resource differences of countries and is also called the theory of factor ratios, as one of the most impressive theories of international economics.

On the other hand, new hypotheses have been developed in order to explain the foreign trade "performed on goods of different qualifications", especially after the 1960s, as well as the traditional foreign trade theories, which basically envisage specialization in foreign trade.

Among these approaches, which take into account today's foreign trade structure and are also called "alternative" foreign trade theories or "new theorems", the technology gap and product cycles theorems draw attention in terms of their relevance to the subject of the study (Lindert & Pugel, 1996, pp. 95, 65-68; Seyidođlu, 2003, pp. 23-24, 75-91). With the technology gap hypothesis and the product cycle hypothesis, which is an expanded version of technology gap hypothesis, foreign trade between countries is based on the advantages achieved in technological developments. According to the technology gap theorem, new products developed by innovative companies of industrialized countries and protected by intellectual property rights are exported by these countries during the development period. However, over time, the production and export of products whose technology is acquired through standardization, imitation, etc., shifts to underdeveloped or developing countries with the effect of relatively cheap labor factor. In the product cycle hypothesis, the transition stages of these products from the new goods to the old goods form and the geographical location of production and the direction of foreign trade at each stage are explained. Therefore, in these models, which are also described as the adaptation of technological developments to the factor endowment theory, comparative advantage is possible with technological innovations provided by factors such as qualified workforce and R&D expenditures. Sustaining these advantages of countries with advanced technology and innovative sectors requires continuous investment in R&D and highly qualified workforce (Bender & Li, 2002, p. 1; Lindert & Pugel, 1996, pp. 87-88; Seyidođlu, 2003, pp. 81-86).

In addition, to summarize in terms of providing complementary information to the study, while international foreign trade is expected to occur in the form of inter-industry trade in traditional trade theory, a significant intra-industry trade is observed in today's competitive conditions. Intra-industry trade is basically due to product differentiation and economies of scale in sophisticated industrial products with high information and technology content and wide supply structure. Intra-industry trade, which stands out among alternative foreign trade theories, corresponds to exports and imports made simultaneously in the same industry. In horizontal intra-industry trade, foreign trade arises from product variety or quality differentiation and economies of scale in similar products. In vertical intra-industry trade, with the effect of international production and intra-firm trade, bilateral input supply and final product trade can be effective. Contrary to the prediction of traditional foreign trade theories, horizontal industrial trade is expected to be between developed countries with similar level of development or similar factor endowments. However, in this context, it is important to work on the basis of sub-industry categories or product groups as much as possible, rather than the aggregated industry level in studies on foreign trade structure. For example, relatively different products in subcategories of industry groups with high aggregation levels, such as SITC level 1 or level 2, may lead to exports in some items and imports in others. This situation may cause the level of specialization in calculations made at high aggregation level to be lower than it actually is, but the intra-industry trade to be determined at a higher level.

In this context, changes in factor endowment ratios, technology gap and product cycle approaches are considered as three main determinants in explaining the change in the sectoral structure of countries' foreign trade (Carolan, Singh, & Talati, 1998, p. 363). Similarly, according to Seyidođlu (2003, p. 91), it can be stated that in terms of explaining foreign trade, the theory of comparative advantages and factor endowment and new theories have complementary characteristics rather than replacing each other, and foreign trade flows that are not covered in a particular theory alone can be clarified with others.

Finally, although it is not directly related to the subject of the study, the relationship between export specialization and economic growth has an important place in studies on foreign trade. The effect of export specialization on growth depends on the nature of the comparative advantages, in other words, the sectoral specialization structure of the countries. In this context, the change in the composition of the country's foreign trade and its adaptability with the developments in world trade are elaborated. It is confirmed that the specialization structure compatible with the dynamic structure of international trade demand is important for growth. It has been stated that gaining competitiveness in technology-intensive goods is the most preferred sectoral structure in terms of the performance of the economy and increases economic growth (Amable, 2000; Balassa & Noland, 1989; Carolan et al., 1998; Fagerberg & Srholec, 2004; Murshed & Serino, 2011; Plümper & Graff, 2001).

Scope and Data

It is observed that the studies in which Michaely index and foreign trade specialization index are applied together to determine the specialization level of Turkish manufacturing industry foreign trade in general and in sectoral detail are limited and cover the past years rather than the recent period. In this study, both indexes are used to examine the recent developments in the specialization level of Turkish manufacturing industry foreign trade in a ten-year perspective. In this framework, this study focuses on Turkish manufacturing industry foreign trade in the 2010s. Accordingly, 2010 is taken as the starting year of the study. Because of the disruptions occurred in the economic activities and foreign trade flows of countries, especially in 2020 due to the Covid-19 pandemic, 2019 is preferred as the last year of the study. Thus, the period of the study is determined as 2010-2019. The scope of the manufacturing industry consists of Standard International Trade Classification (SITC) 1, 4 to 8 main sectors and related sub-sectors. In the study, UN Comtrade SITC Rev.3 foreign trade data of 174 three-digit industries from World Integrated Trade Solution Trade Data (WITS) is used. TURKSTAT Foreign Trade Classifications (TURKSTAT, 2022) and UNCTAD Classification (UNCTADSTAT, 2022a) are used in the classification (naming) of SITC industries.

Methodology

In the literature, revealed comparative advantage (RCA) indexes are frequently used in studies to analyze the comparative advantage and competitiveness of countries in terms of sectoral basis, manufacturing industry in general or total foreign trade. In the competitiveness analysis, many indexes exceeding ten in numbers, primarily the Balassa index and the derivatives of this index to a certain extent, such as the relative export import index, the revealed trade advantage index, and the revealed competitiveness index are used (Vollrath, 1991). Within the scope of sectoral competitiveness studies in different periods and for different target countries in Türkiye, Demir (2001) for the white goods industry, Erkan (2013) for the textile and apparel sector, and Çeştepe & Tunçel (2018) for the iron-steel sector can be illustrated. In addition, for the competitiveness of general or certain sectors of the Turkish manufacturing industry and total foreign trade, Aydın, H. Saygılı & M. Saygılı (2007), Bağcı (2016), REF-SEDEFED (2010), Topçu & Sarıgül (2015), Utkulu & Seymen (2004), Yalçın & Bakan (2021), and Yılmaz & Ergun (2003) studies can be seen. Bender & Li (2002), Konstantakopoulou & Skintzi (2015), Kuzmenko, Rumankova, Benesova & Smutka (2022), and Zaman & Vasile (2012) studies can

be mentioned about the studies conducted for different countries at the international level. Especially in terms of competitiveness analysis, these indexes provide limited information due to their formulation structure. While some indexes rely only on export data compared to the world, they do not provide import data or information about intra-industry trade; another includes import data but not world data. In addition, these indexes may be high in relatively underdeveloped economies where exports are concentrated in certain industries or where export diversification is low. More importantly, the revealed trade data may be the result of protectionist policies and sector-specific incentives in foreign trade. For these reasons, it is clear that it is necessary to be cautious in discussing the competitiveness issue, which has multifaceted features with its macro and micro dimensions, based on these indexes (Bedir, 2009, pp. 80-81; Demir, 2001, p. 51; Kibritçioğlu, 1996, p. 12-14; Utkulu & Seymen, 2004, pp. 8-11; Vollrath, 1991). In order to determine the specialization in foreign trade, it is seen that revealed comparative advantage indexes with different characteristics, especially the Balassa index, are also used, similar to the competitiveness analysis. In this context, indexes such as Balassa index, Lafay index, revealed symmetric comparative advantage index, relative export import index are used (Erkan, Saeed & Bozduman, 2019; Filiztekin, 2006; Kaya, 2006; Konstantakopoulou & Skintzi, 2015; Kuzmenko et al., 2022; Zaghini, 2003). The Balassa index, in other words, the revealed comparative advantage (RCA-2) index, is based on the comparison of export performance with the target country group, but it does not include import data (Vollrath, 1991, p. 268).

On the other hand, in addition to the above-mentioned comparative advantage indexes, Michaely index and foreign trade specialization index are benefited specifically to determine the level of specialization in foreign trade. In measuring the specialization level in foreign trade, Michaely index is used in Amable (2000) and Murshed & Serino (2011), foreign trade specialization index is used in REF-SEDEFED (2010). In Balassa & Noland (1989), the net export index is used with an approach similar to the foreign trade specialization index. Zaman & Vasile (2012) and Zaghini (2003) refer to Michaely index and foreign trade specialization index. Moreover, Bender & Li (2002) uses the Michealy index and foreign trade specialization index together in determining the foreign trade specialization level of Asian and Latin American countries. Similarly, Anastassakou (2015) uses both of the specialization index together to determine Greece, Türkiye, Germany, neighboring countries, EU's main economies and EU-27's manufacturing industry foreign trade specialization level. The Michelay index is described as the "most traditional" or widely used index. The foreign trade specialization index, which weights the specialization degree of each sub-industries according to its relative importance in total trade, is seen as a further improvement of the Michealy index. The formulation structure of these indexes also provides information in terms of intra-industry trade. Both indexes, especially the foreign trade specialization index, contain the opposite information with the Grubel-Lloyd intra-industry trade index (Anastassakou, 2015, p. 79; Bender & Li, 2002, pp. 7-8; Murshed & Serino, 2011, p. 154).

In this context, the level of specialization in the manufacturing industry is determined by using both the Michaely index and the foreign trade specialization index in this study. Specialization analyzes in sub-sectors are made according to the foreign trade specialization index, taking into account the feature that includes additional information in terms of intra-industry trade.

$$\text{Michaely index: } I = \frac{1}{2} \sum_i^n \left| \frac{X_i}{\sum_i X_i} - \frac{M_i}{\sum_i M_i} \right|$$

In the equation, X_i and M_i are the export and import value of industry “ i ” in a given year. The index varies between 0 and 1. Index value approaching “1” indicates that the specialization level is high.

$$\text{Foreign trade specialization index for a particular industry} = \frac{|X_i - M_i|}{X_i + M_i}$$

The level of foreign trade specialization for an industry group or sector at the aggregated level, for example the manufacturing industry or a sector consisting of many sub-industries, is obtained by summing the foreign trade specialization level of each sub-industry weighted by the foreign trade ratio of these industries. In this context, foreign trade specialization index:

$$TSI = \sum_{i=1}^n \left\{ \left[\frac{X_i + M_i}{\sum_i (X_i + M_i)} \right] \frac{|X_i - M_i|}{X_i + M_i} \right\} = \sum_{i=1}^n \left\{ \frac{|X_i - M_i|}{\sum_i (X_i + M_i)} \right\}$$

In this equation, $\frac{X_i + M_i}{\sum_i (X_i + M_i)}$ is the foreign trade ratio of industry “ i ” and is also the weighting criterion.

Like the Michaely index, the foreign trade specialization index varies between 0 and 1. “1” corresponds to full specialization, in other words, purely export or import. The closeness of the index to “1” indicates that the specialization level is high.

Findings

The specialization level of manufacturing industry trade in general has been determined in three sections as of 2010, 2015 and 2019 by making use of both the Michaely Index and the foreign trade specialization index. No significant change is observed in the manufacturing industry specialization level, which is calculated from the SITC three-digit sub-industries, according to both the Michaely index and the foreign trade specialization index. As can be seen in Table 1, although there is a partial decrease in the interim year 2015, the level of specialization in manufacturing industry foreign trade in 2010 and 2019 was 0.49 and 0.483 in the Michaely index, and 0.50 and 0.481 in the foreign trade specialization index.

Table 1. Specialization level in foreign trade of manufacturing industry

	Michaely index			Foreign trade specialization index		
	2010	2015	2019	2010	2015	2019
Manufacturing industry	0.49	0.458	0.483	0.50	0.477	0.481

Although there is no significant difference in the specialization level of the manufacturing industry in the studied period, there are remarkable differences in sub-sectors both in terms of level and development trend. Calculations made for single-digit industry groups and two-digit basic sectors, based on three-digit industry data according to the foreign trade specialization index are presented in Table 2. Among the single-digit industry groups, 8: Miscellaneous manufactured products has the highest specialization level with an index value of 0.624. The level of specialization in this group also increased by 0.052 points compared to 2010. Within this group, the level of specialization in 84: Apparel and clothing and 82: Furniture sectors stands out both in terms of level and increase. Another group with a

relatively high level of specialization is 5: Chemicals and related products. In this group, it is seen that organic and inorganic chemicals numbered 51 and 52, 54: Medicine and pharmaceutical products and 57: Plastics have a high level of specialization. The relative low index values of other main groups and some of the sectors in these groups indicate the importance of intra-industry trade in these areas.

Table 2. Specialization level of single and double-digit industries

Code	Sector/industry name	2010	2019
1	<i>Beverages and tobacco</i>	0.332	0.308
11	Beverages	0.422	0.358
12	Tobacco and related products	0.309	0.289
4	<i>Animal and vegetable oils, fats</i>	0.505	0.414
41	Animal oils and fats	0.822	0.747
42	Vegetable oils and fats	0.573	0.368
43	Processed animal and vegetable oils and fats	0.005	0.753
5	<i>Chemicals and related products</i>	0.667	0.560
51	Organic chemicals	0.768	0.868
52	Inorganic chemicals	0.711	0.624
53	Dyeing-tanning and colouring materials	0.508	0.411
54	Medicine and pharmaceutical products	0.773	0.568
55	Essential oils, perfumes and cleaning materials	0.277	0.150
56	Fertilizers other than group 272	0.664	0.610
57	Plastics - primary forms	0.832	0.701
58	Plastics - non-primary forms	0.284	0.259
59	Chemical products, n.e.s.	0.668	0.455
6	<i>Manufactured goods</i>	0.485	0.448
61	Leather manufactures and dressed furskins	0.355	0.330
62	Rubber products	0.204	0.287
63	Cork - wood products (excluding furniture)	0.199	0.577
64	Paper products	0.715	0.546
65	Textile products	0.391	0.481
66	Non-metallic mineral products	0.541	0.521
67	Iron and steel	0.574	0.470
68	Non-ferrous metals	0.509	0.393
69	Metal products, n.e.s.	0.419	0.375
7	<i>Machinery and transport equipment</i>	0.427	0.421
71	Power generating machines and equipment	0.522	0.294
72	Specialized machines	0.454	0.343
73	Metal working machines	0.434	0.273
74	Other industrial machines and parts	0.406	0.211
75	Office and automatic data processing machines	0.919	0.854
76	Telecommunication and sound recording appliances	0.688	0.737
77	Electrical machinery and appliances	0.501	0.465
78	Road vehicles	0.197	0.468
79	Other transport vehicles	0.561	0.357
8	<i>Miscellaneous manufactured products</i>	0.572	0.624
81	Prefabricated buildings; sanitary, heating and lighting products	0.474	0.662
82	Furniture and parts	0.324	0.725

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83	Travel goods and handbags	0.306	0.078
84	Apparel and clothing accessories	0.636	0.806
85	Footwear	0.250	0.280
87	Professional and scientific instruments	0.770	0.543
88	Photo apparatus, optical goods and watches	0.886	0.753
89	Miscellaneous manufactured products, n.e.s.	0.476	0.414

Since foreign trade specialization indexes are ratios in absolute value, it is difficult to say at first glance whether the calculated specialization levels are based on exports or imports. Sub-industries of a given industry can have both net exporting and net importing industries. The absolute value expression in the indexes also positively includes the specialization rate of the net importing industries. In this framework, in order to distinguish between export and import specialization, the foreign trade specialization index for which the absolute value expression removed for the sub-industries, in other words the net foreign trade ratio, is used. As can be seen in Table 3, the industries with the highest level of export-based specialization include textiles and clothing, construction materials and some types of road vehicles; among the import-based industries, mainly chemical industry products, some communication and information processing devices, non-ferrous metals and machinery industry products come to the fore. Considering the OECD (2011) and UNCTADSTAT (2022b) classifications, the top 10 industries with export-based specialization are largely labor and resource-intensive sectors and low and medium technology products; import-based industries mainly include highly qualified labor and medium and high technology products.

Table 3. Industries with the highest level of specialization

Industries	Net foreign trade ratio		
	2010	2019	
<i>10 industries with the highest level of export-based specialization</i>			
659	Floor coverings, etc.	0.748	0.955
811	Prefabricated buildings	0.625	0.921
661	Lime, cement, natural stones, asphalt and their products	0.814	0.905
844	Women's clothing - textile, knitted or crocheted	0.856	0.895
783	Road motor vehicles, n.e.s.	0.146	0.892
846	Clothing accessories - textile fabrics	0.672	0.882
658	Articles of textile materials, n.e.s.	0.859	0.875
845	Apparels - textile fabrics, n.e.s.	0.677	0.849
691	Structures and parts - iron, steel and aluminum	0.768	0.849
812	Sanitary, plumbing, heating fixtures, fittings of iron, steel and ceramics	0.591	0.808
<i>10 industries with the highest level of import-based specialization</i>			
762	Wireless telephone, telegraph and radio-broadcast receivers	-0.971	-0.988
686	Zinc	-0.982	-0.983
712	Steam turbines, their components and parts	-0.916	-0.977
512	Alcohols, phenols, phenol-alcohols etc. derivative	-0.841	-0.958
515	Organo-inorganic, heterocyclics, nucleic acids	-0.944	-0.957
571	Ethylene polymers - primary forms	-0.892	-0.904
573	Vinyl chloride or halogenated olefins polymers	-0.937	-0.903
752	Automatic data processing machines	-0.927	-0.902

685	Lead	-0.965	-0.895
514	Nitrogen-function compounds	-0.748	-0.878

Finally, the developments in the specialization structure of the three-digit industries based on export or import, in other words, the change in their relative positions within the manufacturing industry are analyzed. As in Table 4, the share of the industries that increased their level of export-based specialization in 2010-2019, in the manufacturing industry foreign trade of 2019 is found to be 25.2 percent. Despite having the export-based specialization in both years, the share of the industries, which showed a relative decrease in the export-based specialization level in this period, in the manufacturing industry foreign trade is 11.0 percent in 2019. On the other hand, the share of industries, which transitioned from import-based specialization to export-based specialization in the same period, in the manufacturing industry foreign trade in 2019 is 13.3 percent, while the share of industries that switched from export-based specialization to import-based specialization is 2.0 percent.

Table 4. Developments in export or import based specialization structure of industries

<i>Export-based specialization in 2010-2019</i>	
A) Share of 2019 foreign trade of industries that have increased their level of export-based specialization, in manufacturing industry foreign trade (%)	25.2
B) Share of 2019 foreign trade of industries that have experienced a relative decrease in the export-based specialization level, in the manufacturing industry foreign trade (%)	11.0
C) The share of 2019 foreign trade of industries that have transitioned from import-based specialization to export-based specialization, in the manufacturing industry foreign trade (%)	13.3
<i>Import-based specialization in 2010-2019</i>	
D) Share of 2019 foreign trade of industries that have increased their level of import-based specialization, in manufacturing industry foreign trade (%)	5.5
E) Share of 2019 foreign trade of industries that have experienced a relative decrease in the import-based specialization level, in the manufacturing industry foreign trade (%)	43.0
F) The share of 2019 foreign trade of industries that have switched from import-based specialization to export-based specialization, in the manufacturing industry foreign trade (%)	2.0
Total	100.0

A more detailed analysis of the developments in the export-based specialization trends of the manufacturing industries would be beneficial. According to Table 4, industries that increase their current exporter position between 2010-2019 are classified in category A) and industries that maintain their export-based specialization position but decrease in specialization level over time are classified in category B). In addition, industries that transition from an import-based structure to an export-based specialization are classified in the C) category. In this context, a detailed list of the relative positions of the industries in the A) and C) categories, which experienced a development or transformation in favor of export-based specialization in the 2010s, is presented below.

Table 5. Development trends of industries that increased the specialization level in favor of exports in the manufacturing industry in 2010-2019

Specialization Level and Sectoral Development Trends in Turkish Manufacturing Industry Foreign Trade

Code	Sector/industry name	2010	2019	Increase
<i>Industries that further increase their position of export-based specialization</i>				
783	Road motor vehicles, n.e.s.	0.1461	0.8918	0.7457
821	Furniture & parts	0.3240	0.7254	0.4014
678	Wire - iron or steel	0.0967	0.4304	0.3336
811	Prefabricated buildings	0.6246	0.9213	0.2967
727	Food processing machines	0.0954	0.3909	0.2954
642	Paper and paperboard related products	0.5160	0.7596	0.2436
775	Household equipment - electrical or not, n.e.s.	0.5229	0.7657	0.2427
697	Household equipment - base metal, n.e.s.	0.5510	0.7876	0.2366
841	Men's clothing - not knitted textile fabrics	0.5091	0.7439	0.2348
782	Motor vehicles - transport of goods	0.5804	0.7976	0.2172
812	Sanitary, plumbing, heating fixt. of iron, steel and ceramics	0.5909	0.8079	0.2171
842	Women's clothing - textile fabrics	0.5929	0.8037	0.2108
846	Clothing accessories - textile fabrics	0.6719	0.8817	0.2098
659	Floor coverings, etc.	0.7483	0.9549	0.2066
635	Wood products, n.e.s.	0.2464	0.4371	0.1908
845	Apparels - textile fabrics, n.e.s.	0.6771	0.8494	0.1722
621	Rubber materials	0.1996	0.3378	0.1382
653	Fabrics, woven - man-made fabrics	0.1943	0.3266	0.1323
665	Glassware	0.3723	0.5031	0.1308
761	Television receivers	0.3517	0.4724	0.1207
893	Plastics products, n.e.s.	0.2055	0.3121	0.1066
625	Rubber tyres and inner tubes	0.2078	0.3104	0.1026
662	Clay construction, refractory materials	0.5572	0.6532	0.0960
661	Lime, cement, natural stones, asphalt and their products	0.8136	0.9055	0.0918
843	Men's or boy's clothing - textile, knitted, crocheted	0.7061	0.7897	0.0836
691	Structures and parts - iron, steel and aluminum	0.7684	0.8492	0.0808
733	Machine tools for working metal (removing material excl.)	0.0803	0.1498	0.0695
793	Ships, boats and floating vehicles	0.0317	0.0937	0.0620
583	Plastics monofilaments - cross-section > 1mm	0.6828	0.7317	0.0489
655	Fabrics - knitted or crocheted, n.e.s.	0.5456	0.5857	0.0401
844	Women's clothing - textile, knitted or crocheted	0.8561	0.8946	0.0385
693	Wire products (excl. electrical) and fencing grills	0.6820	0.7166	0.0346
658	Articles of textile materials, n.e.s.	0.8592	0.8748	0.0155
629	Rubber products, n.e.s.	0.1992	0.2047	0.0055
848	Apparel products, clothing accessories, excl. textile	0.1531	0.1577	0.0046
<i>Industries that transitioned from an import-based structure to an export-based specialization</i>				
523	Metallic salts and peroxy salts - inorganic acids	-0.6739	0.4977	1.1716
896	Art and collectors' pieces, antiques	-0.7682	0.1701	0.9383
718	Other power generating machinery and parts	-0.7072	0.2296	0.9368
634	Veneers, plywood and other wood, n.e.s.	-0.1808	0.6296	0.8104
721	Agricultural machinery (excl. tractors) and parts	-0.2059	0.5830	0.7888
723	Civil engineering, contractors' plant and equipment	-0.4704	0.3010	0.7714
674	Flat rolled products - iron or non-alloy steel coated	-0.4503	0.2992	0.7496
722	Tractors (excl. those of 71414 & 74415)	-0.0141	0.7180	0.7321
677	Rails and railway track construction materials - iron or steel	-0.5423	0.1402	0.6825
613	Furskins - tanned or dressed, excl. 8483	-0.2703	0.3867	0.6570

781	Motor vehicles - transport of persons	-0.0469	0.5475	0.5945
611	Leather	-0.3837	0.1854	0.5691
851	Footwear	-0.2502	0.2798	0.5301
666	Pottery	-0.3077	0.1616	0.4693
421	Vegetable fats and oils	-0.2545	0.1979	0.4524
694	Metal nails, screws, nuts, bolts etc.	-0.3757	0.0328	0.4085
652	Cotton fabrics - woven	-0.0531	0.3179	0.3710
657	Special yarn, special textile fabrics and related	-0.1398	0.1996	0.3393
813	Lighting fixtures and fittings, n.e.s.	-0.1928	0.1014	0.2943
582	Plastics plates, sheets, foil, strip etc.	-0.0890	0.1710	0.2600
892	Printed matter	-0.1835	0.0520	0.2355
741	Heating-cooling equipment and parts	-0.1139	0.0991	0.2130

As can be seen in Table 5, the industries that further increased their export-based specialization in the 2010-2019 period are automotive, furniture, basic metals, machinery manufacturing, paper, textile and ready-made clothing, television receivers and lighting, rubber and plastic, wood, cement, glass, ceramics and sea transportation products. Moreover, in the same period, some types of chemicals, collectibles, some power engines and leveling vehicles in the machinery industry, tractors and agricultural machinery, automotive (passenger cars), basic metal, textile, leather, shoes, wood and soil industry, food, publishing and air conditioning products are the industries that transitioned from an import-based structure to an export-based specialization structure. For providing more defined information, these industries are classified according to their technological intensity as follows.

Table 6. Distribution of the industries that increased the level of specialization in favor of exports in 2010-2019 according to the technological intensities of 2019 exports

	Primary and resource (raw material) intensive products	Low-technology products	Medium- technology products	High- technology products
Industries that further increase their position of export-based specialization				
Share (%)	10.3	56.9	30.5	2.9
Industries that transitioned from an import-based structure to an export-based specialization				
Share (%)	9.8	20.4	68.5	1.4

Table 6 is arranged according to the Lall (2000) study and the United Nations technology classification (UN Statistics Wiki, 2022) based on this study. In addition, United Nations SITC Rev.2 and Rev.3 comparison tables (United Nations, 2022b) are used for a limited number of three-digit industries that need harmonization. Industries numbered 892 and 896, which are in the Other Transactions group in the United Nations technology classification, are evaluated in the technology category, which includes industries in the same series. In this framework, it is seen that the industries, which strengthened the current export-based specialization position in the Turkish manufacturing industry in the 2010s, are mainly consisted of low and medium technology industrial products. However, in the same period, the exports of industries that transitioned from an import-based structure to an export-based specialization structure mostly consist of medium technology products. As seen in Table 6, the share of medium technology products in 2019 exports of industries that transitioned from an import-based structure to an export-based specialization in 2010-2019 reaches 68.5 percent.

Conclusion

In the study, no significant change is observed in both the Michaely index and the foreign trade specialization index at the specialization level of the manufacturing industry in general, calculated from the SITC three-digit sub-industries. In 2010 and 2019, the specialization level in manufacturing industry foreign trade was 0.49 and 0.483 in the Michaely Index, and 0.50 and 0.481 in the foreign trade specialization index. However, there are remarkable differences in terms of both level and development trend in the sub-sectors of the manufacturing industry. 8: Miscellaneous manufactured products, one of the single-digit industry groups, has the highest level of specialization in 2019 with an index value of 0.624, an increase of 0.052 points compared to 2010. Within this group, the level of specialization in 84: Apparel and clothing accessories and 82: Furniture sectors stands out both in terms of level and increase. Another group with a relatively high level of specialization is 5: Chemicals industry and related products. In this group, organic and inorganic chemical products numbered 51 and 52, 54: Medicine and pharmaceutical products and 57: Plastics have a high level of specialization. The relative low index values of other main groups and some sectors under these groups reflect the importance of intra-industry trade in these areas.

Since the foreign trade specialization indexes are absolute value equations, they do not show whether the calculated specialization levels directly based on exports or imports. In this context, the distinction between export and import-based specialization is made in the study, and the developments in the export or import-based specialization structure of the three-digit industries in the Turkish manufacturing industry over time are analyzed. Among the industries with the highest level of export-based specialization, textile and clothing, construction materials and some motor vehicles, among import-based industries, mainly chemical industry products, some communication and information processing devices, non-ferrous metals and machinery industry products stand out. In other words, the highest 10 industries with export-based specialization are largely labor and resource-intensive sectors and low and medium technology products; the highest 10 industries with import-based structure mainly include qualified labor and medium and high technology products.

In the study, the share of the foreign trade of the industries that increased the level of export-based specialization in 2010-2019 in the manufacturing industry foreign trade is found to be 25.2 percent in 2019. In the same context, the share of industries that increased the level of specialization based on imports is 5.5 percent. However, while the share of industries that transitioned from import-based specialization to export-based specialization is 13.3 percent, the share of industries that transitioned from export-based specialization to import-based specialization is 2.0 percent. In this context, industries that increase the level of specialization in exports compared to imports are proportionally higher. At the same time, it is noteworthy that the relative highness of the industries that switched from import-based structure to export-based specialization compared to the opposite situation. These issues point to the potential of the manufacturing industry to increase the export-based specialization level with appropriate macro policies and incentives.

Finally, the developments in the export-based specialization structure of the Turkish manufacturing industries are examined in detail, focusing on industries that have developed or transformed in favor of export-based specialization in the 2010s. In this context, the industries increased the current exporter position are composed of automotive, furniture,

basic metal, machinery manufacturing, paper, textile and ready-made clothing, television receivers and lighting, rubber and plastic, wood, cement, glass, ceramics and sea transportation products. Moreover, in the same period, industries transitioned from an import-based structure to an export-based specialization are some kinds of chemicals, collectibles, power engines and leveling vehicles, tractors and agricultural machinery, automotive, basic metal, textile, leather, shoes, wood and soil industry, food, publishing and air conditioning products. When these industries are classified according to technology intensity, It is determined that the industries increased the current exporter position are mainly consisted of low and medium technology industrial products. However, the industries transitioned from an import-based structure to an export-based specialization are mostly composed of medium technology products. The medium technology products have a high share of up to 68.5 percent in the export value of these industries.

In this framework, to summarize, it is seen in the literature that determination of comparative advantages and competitiveness analysis of countries are made based on a large number of revealed comparative advantage indexes, and different forms of these indexes are used in determining the level of specialization in foreign trade. In this study, the Michaely index and the foreign trade specialization index are used together to determine the specialization levels of the manufacturing industry foreign trade in general for the period 2010-2019. However, the main contribution of this study to the literature is the distinction between export-based and import-based specialization on a sectoral level by making use of the foreign trade specialization index. In this context, sectors with a high level of specialization based on exports or imports are identified, and the developments in the specialization levels based on exports and imports over time in the sectoral structure of the manufacturing industry are examined. In addition, industries that have increased the level of export-based specialization and transition from import-based to export-based specialization are identified, and these industries are also been classified in terms of their technological structure. Taking these findings into account, it will be possible to conduct more detailed sector-specific studies in the future and to analyze the impact of public policies on these developments. In this context, it would be appropriate to study in more detail the major industries with high levels of export or import-based specialization identified in this study, especially those industries that have increased their level of export-based specialization over time or transformed from import-based specialization to export-based specialization. Although they have different effects on exports and imports, it would be useful to analyze whether and to what extent macroeconomic policies, supply-side constraints, investment, export and R&D incentives have an impact on these developments.

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