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ESCAPE FROM MIDDLE INCOME TRAP: AN EXPORT STRUCTURE APPROACH TO THE CASE OF POLAND[1]

Poland, although a few years ago was indicated among the countries that were in danger of falling into the middle income trap, nowadays in most studies is counted among the rich countries. Poland was examined in this article as a successful case of "escaping from middle income trap". This article searched for the keys to the success story of Poland among its trade patterns. In the analysis the author used the product space approach first developed by Hidalgo et al. (2007), and added to it market analysis, mainly using the growth-share matrix of the Boston Consulting Group, first formulated by Henderson (1970). The results show that Poland is achieving a healthy transformation towards medium technology automotive and engineering products and some high technology products. To improve its position in world markets, Poland should also carefully examine the market structure of its exports.

Keywords: product space, Poland, growth-share matrix, export structure
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1. INTRODUCTION

Achieving high growth rates is one of the most important aims of governments throughout the world. Although many countries reach very high growth rates from time to time, sustaining high growth is not a common occurrence. A middle income country, aiming to become a rich country, should reach high growth rates and sustain it for long periods of time, but this is usually not easy for many such countries.

The middle income trap (MIT), as a concept, was first introduced by Gill and Kharas (2007): "Middle-income countries, it is argued, are squeezed between the low-wage poor-country competitors that dominate in mature

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industries and the rich-country innovators that dominate in industries undergoing rapid technological change" (Gill and Kharas, 2007, p. 5).

The literature on the definition of the middle income trap can be divided into two: those perceiving the trap as growth slowdowns (Hausmann, Pritchett and Rodrik 2005; Eichengreen, Park and Shin 2013; Felipe, Abdon and Kumar 2012; Berg 2012; Aiyar 2013), and those emphasising the catching-up problems (Paus 2009; Ohno 2009; Woo 2012; Jankowska et al. 2012). The former offer a threshold GDP per capita level at which high growth rates of developing countries usually slow down and thus fall into the middle income trap. The latter use a high income country, usually the USA, as the benchmark and define middle income trap countries as those with GDP per capita levels at a certain percentage of that of the high income country for long periods of time. As of 2010, 88 countries out of 123 have per capita incomes below 30% of the USA; moreover, during 1985-2010, the gap increased for about half of the countries (Aiyar et al. 2013).

Felipe et al. (2012) defined four income categories in terms of PPP adjusted per capital income basis as: i) low income: below $2000, ii) lower-middle income: $2000-$7250, iii) upper-middle income: $7250-11750, and iv) high income: above $11750. Descriptive statistics on data show that on average it takes 28 years for a lower middle income country to join the group of higher middle income countries, and it takes 14 years for a higher middle income country to become a high income country. Felipe et al. (2012) considered the countries remaining in their groups for more than these averages as being in the middle income trap. According to the analysis by Felipe et al. (2012), on this basis, as of 2010, 35 out of the 52 middle income countries were in the middle income trap (MIT). Being trapped in lower middle income is more likely, as out of the 35 MIT countries, 30 were in the lower middle income trap and 5 in the upper-middle income trap. Among the remaining 17 middle income countries which were not in the trap, 8 were at risk of falling into it, 3 into the lower income trap, and 5 into the upper middle income trap (Felipe et al., 2012, p. 25).

Ito (2017) explained the results of his panel data growth convergence analysis for East Asian countries: "…in Asia there are three convergence paths: low income, middle income, and high income. Economies can and do jump from one convergence path to another by pursuing reforms and stimulating innovation…. the middle-income trap is understood as a result of failing to make the jump from the middle-income convergence path to the high-income convergence path. Hence, growth convergence results in a steady

state that is lower than the steady state of the advanced economies (or the US)" (Ito 2017; p. 4, p. 19).

The aim of this article was to examine a country which is deemed to be a rich country by some, and still a developing country (although a successful one at the edge of high income) by others, such as Poland. The author examined Poland's case focusing on its export structure, and aimed to see whether the export basket of the country is changing in line with the way that the middle income trap literature expects. After obtaining a current picture of the export basket, the author offered some policy advice to improve it, in order to reach higher levels of development and competitiveness.

2. LITERATURE REVIEW

One of the most frequently cited causes of the difference between growth rates of countries are productivity differences (Jankowska et al. 2012; Aiyar et al. 2013; Rodrik 2011; Yılmaz 2016). According to Aiyar et al. (2013), in the success of Asian countries, the contribution of a robust total factor productivity (TFP) growth is important and accounted for more than half of the GDP growth in Taiwan and China. Kohli and Mukherjee (2011) stated that countries that achieve high-income levels do so by quickly converging their total factor productivity to global best practices.

The Commission on Growth and Development (2008) emphasised the importance of dedication by policy makers, public investment in health, education and infrastructure, economic policies allowing 'creative destruction', and commitment to equality of opportunities in reaching a high income level. Eichengreen et al. (2013) concluded that "slowdowns are less likely in countries where the population has a relatively high level of secondary and tertiary education and where high-technology products account for a relatively large share of exports…" (Eichengreen et al. 2013, p. 2).

There is an extensive literature on the effects of the export structure on the level of the economic development of a country. The level of sophistication of production and the export basket of a country are the most frequently named determinants of whether a middle income country graduates to a high income level or falls into the middle income trap. To be able to escape it, most studies emphasise the importance of the structural transformation of production and the export basket of a country from low value added, low technology activities to high technology activities, and the country's production of its own technology and innovative products rather than copying them from elsewhere. According to Lucas (1988), "a growth miracle sustained for a period of decades thus must involve the continual introduction of new goods, not merely

continual learning on a fixed set of goods." Similarly, Michalski (2018) pointed out: "the essence of the middle-income trap is that an economic system smoothly adopts foreign technologies, which induces better productivity of labour and relatively higher wages, but is incapable of creating its own innovations" (Michalski 2018; p. 407).

Zhu, He and Zhou (2017) differentiated regional diversification patterns into two: path-dependent and path-breaking. Developing countries, to be able to reach developed countries' level should make path-breaking diversifications into higher value added industries. Path dependencies exist due to fact that countries can more easily diversify into products that are technologically proximal, in which case, for many developing countries there may not be higher value added and higher technology products that the country can easily jump to, hence the country can get locked into the existing products and technologies. On the other hand, path-breaking requires radical innovations against technological discontinuities. The authors searched for the determinants of such path-breaking diversifications and suggested that extra-regional linkages and internal innovation are important factors determining it, thus emphasising the role of economic and institutional factors in jumping from one point to another in the product space.

According to Rodrik (2011), the convergence gap between developed and developing countries has not closed for many developing countries. Convergence is not an automatic process, it depends on specific policies and institutional arrangements that are usually hard to identify and implement. For convergence, the structural transformation of the economy from low to high productivity activities, and to more diversified production, is necessary. When an economy achieves this and begins to be a producer of high value added, high technology products, it is on the way up. According to Rodrik, such a structural transformation usually cannot be achieved by unassisted market forces, and the active participation of governments is necessary.

Paus (2009) compared China and Latin American countries in terms of the middle income trap and mentioned that, although China currently has a lower level of per capita GDP than LA countries, its export basket is similar to that of a much higher income country, and thus China is in a better position confronted with the middle income trap. Paus (2009) thought that this was largely due to wise government policies applied by China to ensure structural transformation.

Kanchoochat and Intarakumnerd (2014) in their survey of middle income trap, also emphasised the importance of the sophistication level of the production and export structure of the country to escape the middle income trap. The authors classified the policy advice in the literature to avoid MIT into

three: i) those emphasising the role of achieving proper education and institutions thus giving the state a minimum role, ii) those emphasising the role of export composition and comparative advantage, usually seeing the state as a facilitator, iii) those emphasising the role of innovative technologies and suggesting that state should have an active role in enhancing capability accumulation, industrial upgrading and the production of higher technology products.

There are also studies questioning the very existence of a middle income trap. Examining the literature on the subject, Wade (2016) said that there is not enough evidence to conclude that there is a middle income trap, and that the countries in middle income levels are more prone to growth slowdowns in comparison to low or high income countries. However, he also observed that "if we use the idea in a looser and more metaphorical sense to mean that countries in a broad middle-income band (divided into lower and upper-middle) have a higher probability of experiencing sharp slowdowns and sustained lower than average growth for a decade or more than either low or high-income countries, it is 'real enough' to be taken seriously by national policy makers and international development organizations" (Wade 2016, p. 27)

Ye and Robertson (2016) developed a test of whether a country was in a middle income trap or not and concluded that according to the test results there was little evidence of MIT, as only seven countries happened to be candidates for MIT out of the 46 middle income countries. The test depended on time series analysis of the growth path of countries relative to a rich reference country, "specifically, a necessary condition for country *i* to be in a MIT is that the expected value, or long term forecast, of *i*'s per-capita income relative to the reference country is time invariant and lies within the middle-income band" (Ye and Robertson 2016, p. 175). They classified the country in MIT if its growth rate prematurely converged before its income reached the level of rich reference country (the US in their analysis).

Bulman, Eden and Nguyen (2017) also questioned the existence of a middle income trap, suggesting that there is not enough evidence that middle income countries are more likely to stagnate than countries at other income levels. The authors ran growth regressions of low and middle income countries and their results did not support the common theoretical MIT view that innovation and human capital accumulation are more important growth factors for middle income countries than low income countries. However, they concluded that there are different policy choices and different growth fundamentals between successful middle income countries who "escaped to high income" and who continued to be in middle income status, namely higher

TFP growth, faster transformation from agriculture to industry, higher export shares, lower inflation and decreases in inequality and dependency ratios (Bulman et al. 2017).

This article examined Poland's export structure as a successful case of escaping or near- escaping from the middle income trap in the very recent past. Felipe et al. (2012) listed Poland among those countries that are not in the middle income trap but can fall into it if they cannot achieve high growth rates. Yet the authors also made the observation that, "at the rates their income per capita is growing, Poland can make it to high income in 2013". On the other hand, as of 2011, according to the World Bank criteria, Poland was included among the high income countries. Thus, the country represents an interesting threshold case of falling into the middle income trap versus reaching high income status.

According to the World Bank (2017), reforms of the transition from communism was important for Poland's success. Poland improved the institutions, especially the rule of law, the property rights, democratic accountability, and basic market institutions, whilst EU accession and membership reinforced the process. The country achieved stability and resilience as a result of sound macroeconomic policies, ensured competition in the domestic market and successfully connected to global and regional markets (World Bank 2017). Wojnicka-Sycz (2018) considered the transformation of Poland from a command economy to a market economy as a huge success, stressing that Poland has one of the lowest levels of unemployment in the EU, the annual average growth rate in 1995-2016 was 4.1%, and in 2015 GDP in terms of purchasing power was 250% higher than its 1990 level.

Poland modernized its production base and achieved high growth rates, especially in recent years. The country has valuable natural resources, a well-developed network of environmentally protected areas, a stable macroeconomic situation, a fast growing economy and an increasing education level of its work force (Bialek and Oleksiuk 2016). Poland has strong economic and investment ties with Germany and other high income EU countries, serving as a cheap, high quality production platform for them (Orenstein 2014).

Felipe et al. (2010) calculated the index of opportunities of developed and developing countries based on their capability to undergo structural transformation. They analysed countries based on four dimensions of characteristics of their export basket: sophistication, diversification, standardness and the possibility for exporting with comparative advantage over other products. The authors described Poland as one of the most successful in all these criteria and third after China and India in the overall index.

Hare (2019) concluded that "Poland's transition experience remains one of the most impressive in the region, and the country's income level did catch up significantly with the EU average, though many observers still find the rate and extent of this catch up quite disappointing" (Hare 2019, p. 219).

Poland is naturally not without problems; the country struggles to close the productivity gap with more developed EU member states, there are frequent changes in legislation, the level of innovativeness is unsatisfactory, the share of high and medium technology products in production and exports are low, and there is a relatively high risk of poverty and social exclusion (Bialek and Oleksiuk 2016). According to the study, the country will most likely fell into the middle income trap.

Michalski (2018), examining the technology structure of Polish production and exports, concluded that the Polish economy is still severely exposed to threat of MIT, providing evidence that there is a trade surplus in resources and labour-intensive products, and low-tech and medium-tech products using old technologies. On the other hand, Poland has a trade deficit in high-tech products. The country attracted foreign investment, but multinational companies seem to be uninterested in developing a skills base of Polish workers. Poland is unable to commercialize the outcomes of its domestic innovative efforts, which is a typical syndrome of the middle income trap (Michalski 2018).

Hence, it seems that there is no consensus in the literature on whether the country is in MIT or not. Poland is an interesting threshold case, with some successes and some problems common to many upper middle income countries. Since the export structures of countries are very important determinants of their income level, and many studies on MIT indicated the importance of the sophistication level of exports, this author focused on the export structure of Poland.

This article tested the hypothesis that a middle income country, to be able to escape MIT and to reach high income status, has to change its export structure to include more sophisticated products. High growth performance goes in tandem with the successful transformation in export structure. To test this hypothesis, Poland is an important case in point; is it is a large middle income country that has just passed to high income status from some points of view, or has it not yet passed that threshold but is close to it? Still both points of view agree that Poland has experienced an important transformation in its economic structure and experienced high growth rates for a long time. The author's hypothesis is that this must reflect on the transformation of Poland's export structure towards a higher level of sophistication. By observing the growth performance Poland experienced in recent decades and the related

literature on the subject, the hypothesis is that the export basket of Poland must have changed from lower value added, primary and resource based products to higher value added, more sophisticated, medium or high technology products.

The main contribution of the article is combining the product space analysis methodology developed by Hidalgo et al. (2007) with the market analysis methodology developed by the Boston Consulting Group (1970), and revealed comparative advantage methodology developed by Balassa (1986). This enables to obtain a more complete picture of the existing diversification and sophistication level, and the future possibilities of Poland's export basket, both taking into consideration the ease of diversification of its existing capabilities and the situation of the products that country may want to diversify in the world markets. This complete picture enables both a clearer thinking on deciding to which higher sophistication sectors in terms of ease of transformation to diversify to, and at the same time creates a sharper view on whether it will be worth diversifying into these products in terms of market structure. An important question is: is it a market with growth potential, and will there be possibilities to gain competitive advantage?. Even if Poland successfully diversifies into producing a higher sophistication product, if it cannot sell that product competitively in world markets or the market of the product is declining globally, that diversification achievement will not benefit Poland much in terms of its economic growth. Therefore, in formulating development policies, product space analysis always needs to be combined with market analysis. Later, based on results of the author's analysis, strategies are suggested for Poland's diversification.

3. METHODOLOGY

3.1. Product space

The sophistication level of products is seen to be a major determinant of the income level of countries, thus it is important to measure it. Traditionally, technology classifications were used to measure sophistication level. The technology intensity of the industries is judged using various criteria like R&D as a share of sales, employment share of scientists and engineers in total or R&D employment, number of patents taken by industry, and technology embodied in the inputs used by the industry (Lall et al. 2005). The classifications often also use technical experts' knowledge of technologies and rankings (Lall et al. 2005). Yet technology classification has some disadvantages; first of all it is often done at a quite aggregate level, usually two digit classifications,

therefore many different technology levels of products under such a classification are ignored.

In particular, after fragmentation of production, some parts of products are produced in different countries, so, although a developing country may be just assembling a high-tech product with its cheap labour advantage, since it seems to be the exporter of the product in trade statistics, the country's export structure appears to be sophisticated. In order to be able to differentiate this, process information in addition to product information is required, which is missing (Lall et al. 2005). Another problem with technology classifications is that it ignores the quality differences between countries producing products that are seemingly under the same technology classification. Moreover, technology analysis requires industry data which are not commonly available for all countries and at detailed levels; on the other hand, trade data are much more available for a large number of countries, at very detailed levels (Lall et al. 2005).

Kaplinsky and Paulino (2005) examined unit price changes in products as an indicator of technology and innovation content, under the assumption that rising unit prices reflect growing product innovation and/or margins protected by entry barriers. The authors suggested evaluating unit price changes together with market share changes, such a combination of rising unit prices and rising market shares may indicate the existence of product rents and a appropriate path of innovation. However, a deficiency of using unit prices as an indicator of technology is that it makes the strong assumption that all changes in unit prices of industries are due to technological changes and innovation, and other factors that can affect unit prices such as demand changes, non-technological barriers to entry, process innovation, fragmentation of value chain, and policy based trade distortions either do not have an important effect on unit prices, or their effects are equal in all industries (Lall et al. 2005). Henn, et al. (2015) developed estimates of export quality by estimating a reduced form of unit price and import equations, thus removing from unit prices the effects of the income level of exporter and importer (to account for cost differences) and distance (exports to distant destinations are tilted towards higher priced goods, due to higher shipping costs). The authors also calculated 'quality ladders' as an indicator of the country's position in the quality upgrading potential of products.

The study by Lall et al. (2005) was among the first to use an outcome based measure of technology levels of the products, based on the idea that "an export is more sophisticated the higher the average income of its exporter" (Lall et al. 2005, p. 5). The sophistication index of a product is calculated as the weighted average of incomes of exporters of that product, the weights being each

country's share of world exports. The logic is that high income countries export products that can be competitive with high wages, for which technology is usually a necessary factor, among others like advanced marketing, design, packaging and branding skills, logistics and proximity advantages, fragmentability of production processes, information and familiarity with export markets, existence of natural resources, infrastructure (especially ICT) and value chain organization (Lall et al., 2005). In index technology this is an important factor, but its role cannot be differentiated from the role of other factors (Lall et al., 2005).

To assess industry relatedness, Neffke et al. (2011) used a co-occurrence based measure, i.e. "revealed relatedness", using plant level micro data. The revealed relatedness index was based on the ratio in which different industries exist in the portfolios of same manufacturing plants. If two industries happen to be together frequently in the same plant, it is usually due to the fact that the production processes of one generate economies of scope for one another; the same machinery and employees with similar skills can be employed in the production capacity of both industries. The high degree of variety among related industries in the region and inter-industry trade linkages with other regions increase knowledge spillovers, learning opportunities, and thus the diversification possibilities of firms to new industries (Neffke et al. 2011).

Poland is a country newly graduating to a high income level. This study firstly analysed the export structure of Poland using various indices suggested in the literature, and tried to provide a picture of the degree of sophistication and competitiveness of its export products. Next, some policy advice was offered to improve the export product base to reach higher levels of sophistication and competitiveness.

In recent years the product space approach has been developed and brought an original and insightful understanding to the subject. This study also adopted the product space approach and calculated the indices suggested in the literature, details of which are shown below.

The first article on product space was by Hidalgo et al. (2007), according to which the growth of economies depends on their upgrading of the products they make and export. To manufacture new products, the necessary technology, capital, institutions and skills are adapted from the existing ones, and some are nearer to those that will be newly produced and some are further away, in a hypothetical 'product space', where some parts are denser, and some sparser. Highly sophisticated products are placed in the dense parts of the product space with more connections, and low-sophistication products are placed in the periphery of the product space with more distance to the sophisticated products. The development level of a country was determined to a large extent

by its ability to move from the periphery to the dense core by travelling the distance between the less sophisticated products and the more sophisticated ones. This is an outcome based on the measure of similarity of product; rather than looking at the physical similarities between products or their inputs, the similarity measure is based on trading outcomes (Abdon and Felipe 2011).

One of the important aspects of the product space approach is that it takes into consideration the path dependency created by the current structure of export products, as not all products have the same potential to create long-term growth. Specializing in higher value added goods will bring higher economic growth (Record et al. 2010). Traditional trade theories such as Ricardo or Hecksher-Ohlin, implicitly assume that it is most efficient for the country to specialize and export in line with its factor endowments, while the long-term growth implications of this are ignored.

According to Hidalgo et al. (2007) and Hidalgo and Hausmann (2011), the new products that a country develops depend substantially on the capabilities already available in that country. The authors aimed to link countries with the capabilities they have, and the products to capabilities they require. They questioned the Dixit-Stiglitz assumptions (Dixit and Stiglitz 1977) that the cost of product development is independent of any characteristics of the product, and the independence of the relationship between a particular product and the previous productive history of a country. As the authors emphasise, the cost of developing a regional jet aircraft cannot be the same for a country who produces only raw cocoa and coffee than for a country who developed transcontinental aircraft and the combustion engine.

According to Hidalgo and Hausman (2011), products use combinations of potentially many non-tradable capabilities as inputs. Products differ in the variety of capabilities they require, and countries differ in their posession of various capabilites. The authors defined the “quiescence trap”, namely countries with few capabilities will find it difficult to produce new products, for example if a complex product requires 30 different capabilities and a poor country has 10 capabilities, even if it develops, 5, 10, or 15 new capabilities, it will not be able to make that product. On the other hand, a rich country with 25 capabilities out of the required 30, would have the incentive to develop 5 new capabilities and produce the output. This meaning that countries with few abilities have less incentive to develop new capabilities, and thus small initial differences between countries in terms of capability endowments would be amplified over time (Hidalgo and Hausman 2011).

Hausman and Klinger (2006) pointed out that product space is not smooth and countinous, rather in some areas it is dense, and in some areas it is quite sparse. The density of the area in the product space near the area of a country

which has a comparative advantage is very important in the structural transformation of that country.

Hidalgo et al. (2007) defined the proximity of the products as "the minimum of the pairwise conditional probabilities of a country exporting a good, given that it exports another":

$$\phi_{i,j} = min\left\{P\left(RCAx_i|RCAx_j\right), P\left(RCAx_j|RCAx_i\right)\right\}. \quad (1)$$

Thus, RCA is Balassa's (1986) definition of revealed comparative advantage calculated as the share of the product in a country's export basket relative to the product's share in total world exports.

To test whether countries produce new products that are nearer to the existing product structure, Hidalgo et al. (2007) calculated density as the average proximity of a new potential product j to a country's current product structure:

$$\omega_j^k = \frac{\sum_i x_i \phi_{ij}}{\sum_i \phi_{ij}} \quad (2)$$

Here, $x_i = 1$ if $RCA_{ki} > 1$, that is, to find the average proximity of new product *j* to the current production structure of the country, the authors added proximity of product *j* to the products i that the country can produce with comparative advantage, and divided it with the total proximity of the new product to all the other products.

Abdon et al. (2010) ranked 5,107 products and 124 countries in terms of product complexity. According to these calculations, chemicals and allied industries, electrical machinery, plastics, rubber, metal products and transportation are the most complex products; they are at the same time located in a densely connected core, with many nearby products. The least complex product groups of footwear/headgear, textiles, vegetable products, raw hides, skins, leather and furs, foodstuffs, animal and animal products are in the periphery of the product space, in less connected areas. Thus, it is more difficult for the countries producing least complex products to achieve development by transiting to higher value added nearby products. As expected, the major exporters of high complexity products are high income countries and the major exporters of low complexity products are low income countries.

Changing the line of the product, and entering a new industry, is difficult especially for the leading companies, as the process involves many fixed costs in terms of securing requisite inputs, infrastructure needs, research and

development capabilities, regulatory services, workforce with relevant experience, geographic location, production technology, distribution channels etc. These costs increase with the distance between existing production techno-logies and those planned to be produced. Once these costs are incurred, it becomes a public good, and the firms that follow can more easily operate in the industry without incurring these fixed costs (Hausman and Klinger 2006).

There is a market failure of a public goods kind, potential innovators cannot internalize the benefit of entering into new product lines to the next generations or to other existing industries. There could even be stagnation in the process of structural transformation if there are no goods at the right distance sufficiently attractive for any of the companies to pay for the fixed adjustment cost. The nearby goods may be downscaled (have a lower price than the current good) and upscaled goods may be too far away. Thus, there is a need for regulation from the viewpoint of a social planner with a longer time horizon, even inter-generational horizon, therefore government intervention is necessary (Hausman and Klinger 2006).

For pertinent case studies using the product space approach, one can refer to Abdon and Felipe (2011), Fortunato et al. (2015), Record et al. (2010), Cruz and Ricker (2012), Violata and Davidsons (2008), Bayudan-Decaycuy (2012) and Kali et al. (2013).

Hausmann et al. (2007) measured the sophistication of export products and the sophistication level of the export basket of a country, using the PRODY and EXPY concepts. The PRODY of a product is the weighted average of the GDP per capita of the countries exporting these products, where the weights are the RCA of the country for that product. The EXPY of a country is the average PRODY of the export basket of the country. There have been criticisms about how successful PRODY and EXPY are in measuring the degree of sophistication, for instance some low-tech products seem to be sophisticated just because many developed nations produce them (e.g. bacon and ham) and PRODY and EXPY do not take into consideration quality differences (World Bank 2014). PRODY and EXPY ignore value chains, and which phase of production is performed in which country; a high-tech product may seem to have low sophistication just because its final assembly is carried out in a developing country and exported from it (the World Bank, 2014). PRODY and EXPY also ignore global demand for the products; if a country tries to diversify to a high PRODY product, there is no guarantee that it will find enough demand for that product. Therefore, sophistication analyses should always go hand-in-hand with market analysis. This study tried to do this by adding market information to sophistication analyses.

To answer these problems with PRODY and EXPY, Hidalgo and Hausmann (2009), Hausmann and Hidalgo (2011) defined ubiquity indices. This study also calculated the ubiquity of each product using the formula given by Hidalgo and Hausmann (2009). Adjacency matrix M_{cp} was defined by Hidalgo and Hausmann (2009) as taking $M_{cp} = 1$ if country c is a significant exporter of product p and taking the value of 0 if otherwise. The authors defined a significant exporter as having an RCA value greater than 1. Balassa's (1964) definition of RCA was used: the ratio of the export share of the product in the country's total exports to the share of the product in the global markets. Then, to calculate the indices about diversification of the countries and the ubiquity level of their products, the authors used an iterative method they called "the method of reflections", and characterized the countries through vector $k_c = (k_{c,0}, k_{c,1}, k_{c,2},\ldots, k_{c,N})$, and the products by vector $k_p = (k_{p,0}, k_{p,1}, k_{p,2},..., k_{p,N})$.

Here, $k_{c,0}$ and $k_{p,0}$ are defined in the equations below, where $k_{c,0}$ represents the level of diversification of a country (the number of products exported by that country with comparative advantage), whilst $k_{p,0}$ the ubiquity of a product (the number of countries exporting that product with comparative advantage):

$$k_{c,0} = \sum_{p} M_{cp} \tag{3}$$

$$k_{p,0} = \sum_{c} M_{cp} \tag{4}$$

Other variables of the vectors were calculated, using the method of reflections:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_{p} M_{cp} k_{p,N-1} \tag{5}$$

$$k_{p,N} = \frac{1}{k_{p,0}} \sum_{c} M_{cp} k_{c,N-1} \tag{6}$$

The generalized measures of diversification of the countries were shown by the even variables of the country vector $k_c = (k_{c,0}, k_{c,1}, k_{c,2},....,k_{cN})$, and the generalized measures of ubiquity of their exports by the odd variables of that vector. The product vector's even variables $k_p = (k_{p,0}, k_{p,1}, k_{p,2},..., k_{p,N})$ represent the product's ubiquity and the ubiquity of other related products, whereas the odd variables show the diversification of the countries exporting those products (Hidalgo and Hausmann 2009, p. 10571). The values of $k_{p,N}$ and $k_{c,N}$ converge to mean as N increase. After enough iterations, the rankings of the variables remain unchanged (Hidalgo and Hausmann 2009).

Hidalgo and Hausmann (2009) described the interpretation of the first two levels of these indices as below:

Table 1

Descriptions of Ubiquity and Diversification Measures

Definition	Description
$k_{c,0}$	Number of products exported by country c (competitively)
	How many products are exported by country c?
$k_{p,0}$	Number of countries exporting product p (competitively).
	How many countries export product p?
$k_{c,1}$	Average ubiquity of the products exported by country c.
	How common are the products exported by country c?
$k_{p,1}$	Average diversification of the countries exporting product p.
	How diversified are the countries that export product p?

Source: Hidalgo and Hausmann (2009).

3.2. Market and competitiveness analysis

As mentioned previously, product space analysis should be combined with market analysis to be able to perceive the complete picture and to formulate better policies.

This study added market share, revealed comparative advantage and the Growth–Share Matrix analysis to better understand the sectoral export performance and competitiveness of Poland.

To calculate the RCA of Poland and other countries, the study used the Balassa (1986) method, where c denotes the country and i denotes the product:

$$\mathrm{RCA}(\mathrm{c},\mathrm{i}) = \frac{\mathrm{Exports}(\mathrm{c},\mathrm{i}) / \mathrm{Total\ Exports}(\mathrm{c})}{\mathrm{Total\ World\ Exports}(\mathrm{i}) / \mathrm{Total\ World\ Exports}} \tag{7}$$

The RCA (Revealed Comparative Advantage) of a country in a product is measured by the product's share in total exports of that country, over the product's share in total world exports. If the index is greater than 1, it means that the country exports more of that product in proportion to its total exports than the world average; thus more successful in that product than the world average. Hence, 1 is usually used as the threshold indicator of a country having comparative advantage in the export of that good.

The Growth–Share Matrix was developed by B. Henderson of the Boston Consulting Group at the beginning of the 1970s as a planning model for the firm and activity portfolios of holdings, and afterwards was used widely by many companies in their decision-making processes. According to Reeves et al. (2015), in the late 1970s and early 1980s about half of all the Fortune 500

companies used the BCG matrix, which helps companies to evaluate the performance of their business unit regarding the dimensions of market share and growth rate.

Table 2

BCG Growth-Share Matrix

		Relative Market Share	
Annual Rate of Market Growth		High	Low
	High	Stars	Question Marks
	Low	Cash Cows	Dogs

Source: Henderson (1970).

According to Henderson (1970), a holding company, if it wants to be successful, should have a portfolio of products with different growth rates and market shares. To be able to have a high market share, investment must be made. Since in high share markets companies have higher margins, these markets can provide cash flow to the company. The growth of the market reflects the attractiveness of the industry, and relative market share shows the competitive advantage. Each product has its own life cycle and companies have products at various levels of this life cycle; managing different risks and returns and forming a balanced portfolio of activities are important for companies (Ioana et al. 2009).

According to Reeves et al. (2015), in today's world, market share is not a sufficient indicator of competitiveness; in rapidly changing environments the ability to adapt to changing circumstances or shaping them, become new drivers of competitive advantage.

This concept can be applied to countries as well. They are competing in the world markets with their products, and for some products the world markets are growing at a high rate, while for some at a low rate. The BCG Growth-Share Matrix can also guide countries in shaping their export products portfolio.

The BCG Growth-Share Matrix comprises four components: stars, cash cows, question marks and dogs.

Stars: These are sectors with high potential. Since the companies' market share is high, earnings are high, and at the same time, since the market growth is notable, so is expenditure. In the future, the growth rate of the market will decline and the sector will serve as a cash cow to firm/country if the firm/country can keep up its high share. If the leader position is lost, the sector may become a dog. Star sectors are important to the firm/country, every firm/country needs to have some.

Cash cows: These are sectors with low growth rates where the firm/country has a high market share. Since the firm/country is the market leader, it earns more than necessary to remain in the market. Excess cash milked from the cash cows can be invested in stars. Usually firms/countries think that investing in their capacity is not worthwhile in these sectors since the sector does not have a future.

Dogs (or pets): Both the sector's growth rate is low and the firm/country has a low share in it. Since the potential of the sector is low, the firm/country should not invest in it. Since its market share is also low, it does not generate much money either. The firm/country should exit from the sector in time when it becomes unable to generate enough money to break even in the sector.

Question Marks: Since the sector is growing fast, investment is necessary, on the other hand, since the market share of the firm/country is low, the sector does not generate enough money. The sector can grow better in the future, thus, if the firm/country invests in it and gain a market share, it can become a star. However, there is a risk of the low or declining growth of the sector in the future, in which case the investment may be wasted. Careful planning and forecasting is important to decide whether it is worth making large enough investments so as to make the company become the market leader in the sector.

4. RESULTS AND INTERPRETATION

In this section the export structure of Poland is evaluated. For this purpose, k_c of Poland and k_p of products it exported were analysed and product space analyses were combined with market share and competitiveness analysis.

The data were SITC Rev. 3 classification 4-digit product level data taken from the UN Comtrade database. In nearly all studies in the literature, 4-digit level is preferred due to being both detailed enough to make the necessary product analysis, and plain enough to be able to formulate sectoral policies.

In Appendix Table A1, the kc20 ranking of countries, and in Appendix Table A2 the kc19 rankings of the countries for 2015 and 1995 are shown. Each iteration of the method of reflections refines the ranking and usually the rankings converge in 18-20 iterations which leads to better interpretations (Hidalgo and Hausmann 2009; Abdon et al. 2010). Thus this analysis was based on 19 and 20 iterations for both the kc and kp indices. The even variables of kc represent the diversification of countries, and the odd variables represent the ubiquity of their exports. The even variables of kp represent the product's ubiquity and the odd variables of kp represent the diversification of the countries exporting these products.

According to the kc20 rankings, as of 2015 the most diversified countries were Japan, Switzerland and Taiwan. Poland was 35th in the ranking of 150 countries, while Iraq, Afghanistan, Sudan and Angola were the least diversified countries. In 1995 the top ranking was more or less similar. The USA's fall from 8th rank to 13thplace attracted attention. Poland dropped from 31th position to 35th in the past 21 years.

The kc19 of a country, being an odd number, represents the average ubiquity of the products exported by country c, i.e. how common are the products exported by the country. Thus an increasing number means that the country has a comparative advantage in the products competitively exported by many countries. Table A2 gives the scores in ascending order.

In 2015 the countries that are exporting the least ubiquitous products were Iraq, Japan, Switzerland, Taiwan, South Korea and Singapore; those producing the most common products were Afghanistan, Sudan, Ethiopia, the Maldives and Guinea. Poland was 37th, while in 1995 the country's ranking was 32. Another significant change in ranking was the fall of the USA – from being 8th in 1995 to 14th in 2015. The situation of Iraq is interesting in that in 2015 the country was exporting the least ubiquitous products, well above the high income countries. The reason was that, although the country can export only four products with comparative advantage, being the only exporter of product 2114 (goatskins) with an RCA greater than 1 globally, its export basket's average ubiquity dropped significantly. This is one of the indicators that ubiquity does not always mean high technology or high sophistication. Therefore this study again emphasises the importance of making product space analyses together with unit price and market analyses.

In Table A3, Poland's kc20 score is compared to that of some countries that became high income after 1990, those that are upper middle income and not yet in the middle income trap, and the countries that are in the middle income trap according to the classification of Felipe et al. (2012). Mauritius, Chile, Argentina, Greece, Portugal and Spain are less diversified than Poland, despite being high income countries. Among those that are upper middle income and not yet in the middle income trap, all the countries except for China, Thailand, Hungary and Mexico have less diversification than Poland. Among countries in MIT, only Malaysia is more diversified than Poland.

Table A4 shows product rankings for each product, kp20, and technology classification. In 2015, the kp19 and kp20 rankings were very similar, so this study used kp20. Since it is an even reflection, kp20 represents ubiquity of the products. The technology classification was taken from UNCTAD, defined on the SITC Rev. 3, 3-digit products. The UNCTAD, basing its calculations on Lall (2000), classified commodities into 11 categories: i) Primary products,

ii) Resource-based manufactures: agro-based, iii) Resource-based manufactures: other, iv) Low technology manufactures: textile, garment and footwear, v) Low technology manufactures: other products, vi) Medium technology manufactures: automotive, vii) Medium technology manufactures: process, viii) Medium technology manufactures: engineering, xi) High technology manufactures: electronic and electrical, x) High technology manufactures: other, xi) Unclassified products (UNCTAD 2017).

As expected, the most ubiquitous products were primary products or resource based products, but the least ubiquitous products were not high-tech, except for 8719, liquid crystal devices. There is even one primary product, goat skins, due to fact that only one country can produce it with comparative advantage. Thus, for a middle income developing country, wanting to diversify to higher value added products and increase sophistication of its export basket, the ubiquity of the products cannot be the only guide.

In Table A5 the rankings of high technology products (according to UNCTAD classification) are given (since classification is in 3 digits, as an approximation, the rank of the average for the 4-digit sectors in the respective 3-digit ones are taken); the rankings of high technology products in terms of their ubiquity were not very high.

4.1. Revealed Comparative Advantage Analysis of Poland's exports

In Table A6, for 2015 and 1995, Poland's 40 export products that have the highest RCA are given. It should be noted that many of the highest RCA and highest export share products are still either primary, agro-resource based or low-tech. The only high technology product in Poland's first 40 RCA is "7611 Television receivers" with a considerable RCA of 5.44.

On the other hand, as of 2015, Poland has a considerable RCA in some medium technology sectors, like "7753 Dishwashing machines of the household type", "7751 Household-type laundry equipment, n.e.s., whether or not electrical", "5832 Monofilament of polymers of vinyl chloride", "5534 Preparations for oral or dental hygiene, including denture fixative pastes and powders", "5812 Tubes, pipes and hoses, rigid", "7831 Motor vehicles for the transport of ten or more persons, including the driver","7932 Ships, boats and other vessels". The average kp20 rank of the top 40 products in Poland is the highest RCA of 568, which is around the world average.

In nearly all sectors, Poland improved its RCA considerably. The sectors whose RCA increased most are "451 Rye, unmilled", "353 Fish (including fillets), smoked, whether or not cooked before or during the smoking process", "7753 Dishwashing machines of the household type" and "7751 Household-

type laundry equipment, n.e.s., whether or not electrical". In particular, in medium tech engineering products i.e. dishwashing machines and laundry equipment, Poland gained a sizeable RCA of 16.4 and 14.3 respectively from virtually non-existent exports.

Among the highest 40 RCA products, since 1995, RCA declined in 11 sectors. Except for "7932 Ships, boats and other vessels", all are either primary products or resource based agro or low-tech products; thus it can be said that the decline of RCA in these products is part of a healthy transformation process towards higher technology products.

In Table A7, Poland's RCA in high technology sectors as of 2015, in comparison to 1995, are given. Among those, as of 2015, Poland has an RCA higher than one in eleven sectors, "7611 Television receivers, colour", "7782 Electric filament or discharge lamps", "7523 Digital processing units", "7128 Parts for the turbines of subgroup 712.1", "7783 Electrical equipment, n.e.s., for internal combustion engines and vehicles; parts thereof", "7189 Engines and motors, n.e.s. (e.g. wind engines and hot air engines) parts of these", "7781 Batteries and electric accumulators, and parts thereof", "7169 Parts, n.e.s., suitable for use solely or principally with the machines falling within group 716", "7162 Motors (other than motors of an output not exceeding 37.5 W) and generators, direct current", "7163 Motors (other than motors of an output not exceeding 37.5 W) and generators, alternating current", and "7711 Transformers, electrical".

In three high technology sectors, as of 2015, Poland had nearly zero exports, "7925 Spacecraft (including satellites) and spacecraft launch vehicles", "7591 Parts and accessories of the photocopying and thermocopying apparatus 751.3","7521 Analogue or hybrid (analogue-digital) data-processing machines".

In nearly all high technology sectors, there were notable increases in RCA. The sectors in which Poland increased its RCA the most between 1995 and 2015 were:"7611 Television receivers, colour","7523 Digital processing units","7128 Parts for the turbines of subgroup 712.1","7783 Electrical equipment, n.e.s., for internal combustion engines and vehicles; parts thereof","7781 Batteries and electric accumulators, and parts thereof" and "7162 Motors (other than motors of an output not exceeding 37.5 W) and generators, direct current". In all these sectors, Poland had nearly no RCA in 1995. This shows the successful transformation of Poland, at least in some sectors, towards high technology products.

The sectors which, although having RCA above 1 in 1995, lost out most in their RCA between 1995 and 2015, were "7761 Television picture tubes, cathode-ray" and "5423 Medicaments containing alkaloids or derivatives

thereof but not containing hormones". There was also a considerable RCA decline in "5413 Antibiotics, not put up as medicaments of group 542"and "5415 Hormones, natural or reproduced by synthesis; derivatives thereof".

Table A8 lists the first 50 products with highest share in world exports and Poland's RCA and export share in them in 2015. They are mainly high tech products and medium tech automotive and medium tech engineering products.

In three of the high share, high technology products, Poland has considerable market power, "7611 Television receivers, colour", "7932 Ships, boats and other vessels (other than pleasure craft, tugs, pusher craft, special-purpose vessels and vessels for breaking up)"and "7523 Digital processing units, whether or not presented with the rest of a system". In "7712 Other electric power machinery; parts of the electric power machinery of group 771" also, Poland has an RCA close to 1.

In nearly all of the highest world share medium tech automotive products, Poland has competitive power. In "7843 Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783" and "7821 Motor vehicles for the transport of goods", Poland has of RCAs 2.34 and 1.23, respectively. In "7812 Motor vehicles for the transport of persons, n.e.s.", also the RCA is not low, at 0.74.

There are 10 medium technology engineering products in the world's highest 50 export share sectors and in 6 of them Poland has an RCA greater than 1: "7731 Insulated (including enamelled or anodized) wire, cable (including co-axial cable) and other insulated electric conductors", "7139 Parts, n.e.s, for the internal combustion piston engines of subgroups 713.2, 713.3 and 713.8", "7149 Parts of the engines and motors of heading 714.41 and subgroup 714.8", "7726 Boards, panels (including numerical control panels)", "8131 Lamps and lighting fittings (including searchlights and spotlights), n.e.s." and "7478 Taps, cocks, valves and similar appliances, n.e.s.".

There are 2 medium technology processing products in the world's highest 50 export share sectors, "5822 Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforce" and "5989 Chemical products and preparations, n.e.s."; Poland had an RCA of 1.42 in the first one, and 0.83 in the second one.

Analysis of the export structure of the country using RCA and product space approaches showed that Poland is achieving a healthy transformation towards medium technology automotive and engineering products and high technology products. The country already gained comparative advantage in a number of high technology and medium technology products that have a high share in world trade. The products from Poland which lost RCA since 1995

are mostly primary, resource based and low technology products. Thus, there is a transformation in the production and export structure of the country, and this transformation is probably one of the most important factors that contributed to Poland's escape (or near escape, according to some) the middle income trap and become a high income country.

4.2. BCG Growth-Share Matrix Analysis of Poland's exports

Table A9 presents the world's highest growing 50 sectors between 2005 and 2015, their average increase in world trade share, Poland's share in the world exports of that product, the technology classification of the product, the kp20 ranking of the product (from least to most ubiquitous) and BCG classification for Poland[2]. The products whose world market share grew fastest were "5416 Glycosides; glands or other organs and their extracts", "8973 Jewellery of gold, silver or platinum group metals (except watches and watch-cases)", "3431 Natural gas, liquefied" and "7522 Digital automatic data-processing machines". Among the top 100 highest growing sectors, 10 are high technology electronic, 9 high technology other, 13 medium technology engineering, 9 medium technology processing, 9 low technology textile, 13 low technology other, 18 primary products, 7 agro-based resources, 11 resource based other, and 1 is unclassified (paintings, drawings).

Among the 993 sectors Poland export, 175 are stars and 285 are question marks. Among the 50 highest growing sectors, just 17 are stars for Poland, the others are question marks, which means that Poland has a high market share in 17 high growth sectors, while in others a low market share. Among the star sectors of Poland, only 2 are high technology electronic, "7783 Electrical equipment, n.e.s., for internal combustion engines and vehicles; parts thereof" and "7181 Batteries and electric accumulators, and parts thereof". Among these stars 4 are medium technology engineering, 4 are primary products, 3 are low tech-other, 2 are medium technology processing, 1 is resource based agro and 1 is low tech-textile. Among Poland's stars, "7783 Electrical equipment, n.e.s." (kp20 rank 122) is the least ubiquitous, followed by "7478Taps, cocks, valves and similar appliances, n.e.s." and "7726 Boards, panels (including numerical control panels), consoles, desks, cabinets and other bases". The average kp20 ranking of Poland's stars was 521, so ubiquity of the star products of the country is around the world average.

Among the 175 cash cows of Poland, the first 40 in terms of share of Poland in world exports of the sector are given in Table A10. Out of these, 11 are

[2] The author regards Poland as having a high share in a market if it has a market share greater than 1.07, i.e. Poland's total exports share in world exports.

resource based agro (mostly wood and wood products), 9 are primary products (mostly meat, copper, zinc, tin), 4 are medium-tech engineering (dishwashers, laundry equipment, ships, refrigerators), 4 are low-tech other (candles, envelopes, wooden furniture), 3 are resource-based other (coke, glass, wool based products), 3 are high-tech electronic (televisions, lamps, digital processing units), 2 is medium-tech processing (monofilaments and tubes, pipes, hoses), 1 is medium-tech automotive (motor vehicles) and 1 is low-tech textile (leather articles). Poland is a country with rich forest resources and some mines. The country has also competitive advantage in many consumer electronics products. Although, the world trade share of these products is declining, Poland can still take advantage of its market power in these sectors and use the cash generated from exports in these sectors to improve the sophistication of its export basket.

Among the 993 sectors in which Poland has exports, 358 are dogs. The top 40 dog sectors in terms of share of Poland in world exports in the sector are given in Table A11. Since in both these sectors, the world market share is declining and Poland has a low market share, they are not worth further investment. The country should divest itself of these sectors when they stop generating enough cash and use the resources in faster growing sectors of global economy. Out of these sectors, 11 are low technology, 6 resource-based, 3 primary, 18 medium technology and just 2 are high-tech sectors.

Out of the 993 sectors in which Poland has exports, 285 are question marks. The top 40 question mark sectors in terms of share of Poland in world exports of the sector are given in Table A12, of which 8 are resource-based and primary, 17 medium technology, 14 low technology, and just one "7712- Other electric power machinery; parts of the electric power machinery of group 771", is a high-tech sector. Poland should examine these sectors in detail, and try to predict future growth potential of the sectors, the big exporters in world markets, the probability of gaining a sizeable share from them in the world markets if it invests, and how much investment will be necessary to gain the high share and will the expected future revenues be worth it.

In Table A13 densities, i.e. average proximity, of high technology products to the country's current product structure were calculated for Poland, using the definition by Hidalgo et al. (2007):

Hidalgo et al. (2007) calculate density as average proximity of a new potential product j to a country's current product structure:

$$\omega_j^k = \frac{\sum_i x_i \phi_{ij}}{\sum_i \phi_{ij}} \tag{8}$$

Here, $x_i=1$ if $RCA_{ki}>1$, i.e. to find the average proximity of new product j to the current production structure of the country, the authors added the proximity of j to the products i that country can produce with comparative advantage, and then divided it to the total proximity of the new product to all the other products.

In Table A13, the average proximities of biggest world trade share products to Poland's current product structure are given for 2015 and 1995, respectively. Among the 100 highest world trade share products, Poland has a comparative advantage in 39 of them. All of these are stars or cash cows. Among them, 5 are high technology products : "7611 Television receivers, colour","7932 Ships, boats and other vessels (other than pleasure craft, tugs, pusher craft, special-purpose vessels and vessels for breaking up)","7523 Digital processing units, whether or not presented with the rest of a system", "7783 Electrical equipment, n.e.s., for internal combustion engines and vehicles; parts thereof" and "7781 Batteries and electric accumulators, and parts thereof"; 8 products are low technology, 18 are medium technology and 8 are primary or resource based.

Out of the remaining 61 in which Poland does not have RCA, the first 5 products that are closest to Poland's exports structure are primary or low tech goods like fruits, some garments and footwear. The sixth is "5429 Medicaments n.e.s", which is high technology and Poland's RCA in that sector, although lower than 1, is fairly good at 0.69. Thus there can be opportunities for Poland in this sector, in 1995 the RCA of Poland in that sector was 0.89. The reasons for this decline should be further explored. In 17th place there is another high technology sector, "8746-Automatic regulating or controlling instruments and apparatus", but this is a dog sector for Poland, meaning low market share in a non-growing market. Thus, whether the diversification into that sector is worthwhile or not should be investigated; RCA increased from 0.17 in 1995 to 0.79 in 2015. In 20th, 23th and 29th places there are high-tech sectors of respectively, "7929 Parts, n.e.s. (not including tyres, engines and electrical parts), of the goods of group 792", "7712 Other electric power machinery; parts of the electric power machinery of group 771" and "7788 Electrical machinery and equipment, n.e.s.". The first two are question mark sectors and the last is a dog. Hence the first two may be worth investing in, especially 7712, whose RCA is already close to 1, namely 0.92, and reached that point from 0.44 in 1995. The RCA of 7929 is also not very low at 0.45, so there is already some capacity there and it may be worth further investment. There has been also a very significant improvement in RCA since 1995 from 0.08 to 0.45. Out of the 61 products for which Poland does not have competitive power, 23 are high technology. The high technology products which are

furthest from the existing production structure of Poland are: “7763 Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices”, “8719 Liquid crystal devices, n.e.s.; lasers (other than laser diodes); other optical appliances and instruments, n.e.s.” and “7764 Electronic integrated circuits and microassemblies”. Even though these products are distant, there is a considerable improvement in RCA in sector 7763, namely between 1995 and 2015 from 0.04 to 0.4. These results show Poland’s capacity to build new capabilities even in some far-placed high technology products.

In nearly all products, Poland’s export structure increased its proximity, i.e. its export structure has become nearer to the highest world trade share products. The sectors in which Poland is increasing its proximity the most are:“7139 Parts, n.e.s, for the internal combustion piston engines of subgroups 713.2, 713.3 and 713.8”, “7523 Digital processing units, whether or not presented with the rest of a system”, “7726 Boards, panels (including numerical control panels)”, “7638 Sound-recording and other sound-reproducing apparatus; video-recording or reproducing apparatus” and “7611 Television receivers, colour”. Out of the first five sectors which increased their proximity the most, two are high technology electronic products: “7523 Digital processing units, whether or not presented with the rest of a system” and “7611 Television receivers, colour”, and the others are medium technology engineering products. All of the first five are cash cows except for “7726 Boards, panels (including numerical control panels)”, which is a star sector.

The proximity of Poland’s exports decreased in 6 of the 100 highest world trade share products : “3212 Other coal”, “7239 Parts, n.e.s., of the machinery of group 723”, “8453 Jerseys, pullovers, cardigans, waistcoats and similar articles, knitted or crocheted”, “8442 Suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts” “8414 Trousers, bib and brace overalls, breeches and shorts” and “8514 Other footwear with uppers of leather or composition leather”. Among these sectors only “7239 Parts, n.e.s., of the machinery of group 723” is a medium technology engineering product. Coal is a primary product and all the others are low technology textile products. This is another indication that Poland’s export structure is becoming distanced from lower value added products and is getting closer to medium technology engineering and automotive products and even to some high technology products.

Graphs A1 and A2 (taken from Atlas Media) show how much more connected Poland’s export structure became in the product space between 1995 and 2015. Graph A3 and Graph A4 show tree maps of the export structure of Poland between 1995 and 2015. The decreased share of primary products like coal, copper, clothing and the increasing share of medium and high technology products like cars and electronic products are apparent.

CONCLUSION

The transition from being a middle income country to becoming a rich country requires high growth rates sustained for long periods of time, but usually this is not easy for many middle income countries, 'trapped' into middle income for a long time before becoming a rich country. The "middle income trap" concept was first introduced by Gill and Kharas (2007), and afterwards its various definitions and an extensive literature on the subject were developed.

Poland's case is interesting in that, although the country has been indicated among those that are in danger of falling into middle income trap a few years ago, nowadays most studies list it among rich countries. Thus Poland's case was examined in this article as a successful escape (or at the very least, a near escape) from MIT.

Although in the literature many factors that cause MIT were examined and various policy proposals were prepared for middle income countries, the level of sophistication of production and the export basket of a country is one of the most frequently stated determinants of whether a middle income country graduates into a high income level or falls into a middle income trap. To be able to escape the latter, nearly all studies emphasise the importance of the structural transformation of production and the export basket of a country from low value added, low technology activities to high technology activities, and producing its own technology and innovative products rather than copying them from elsewhere.

For this reason, this article searched for keys to the success story of Poland among its trade patterns. In analysis the author used the product space approach first developed by Hidalgo et al. (2007), and added market analysis, mainly using the revealed comparative advantage of Balassa (1986) and the Growth-Share Matrix of Boston Consulting Group, first formulated by Henderson (1970).

One of the important aspects of the product space approach is that it takes into consideration the path dependencies created by the current structure of export products as not all products have the same potential to create long term growth. To produce new goods, the necessary technology, capital, institutions and skills are adapted from the existing products and some are nearer to the newly produced and some are further away in a hypothetical 'product space'. However, this approach lacks the market aspect. Analysis of sophistication of a country's exports should always go hand-in-hand with market analysis, otherwise a middle income country aiming to reach competitiveness in high value added, high technology goods may not find enough demand for its products in the world markets.

This article combines a market analysis technique frequently used by holding companies with the product space approach. According to the Growth-Share Matrix approach of Henderson (1970), a company, if wants to be successful, should have a portfolio of products with different growth rates and market shares. To be able to obtain a high market share, investment must be carried out. Yet, since in high share markets firms have higher margins, these markets can provide them with cash flow. In this article the analysis was conducted for the export portfolio of Poland.

Product space and market analyses show that in nearly all sectors, between 1995 and 2015, Poland improved its RCA considerably, especially in medium-tech engineering products. Nearly all of the products which experienced a decline in RCA were either primary products or agro-based resources or low-tech products. Thus, it can be said that the change of RCA of the products in the export basket is part of the healthy transformation process towards higher technology products.

In the high technology sectors, as of 2015, Poland had an RCA greater than 1 in 11 sectors. Moreover, in nearly all the high technology sectors, there were significant increases in RCA. In three of the high-tech sectors with a large share in global trade, Poland has considerable market power, and in nearly all of the world's highest medium tech automotive products, Poland has a competitive power.

Among the 100 highest world trade share products, Poland has comparative advantage in 39 of them, 5 of which are high technology products. Out of the 993 sectors of Poland's export, 175 are stars, 285 are question marks, 175 are cash cows and 358 dogs. The author made policy suggestions taking into consideration the global market share of these products and their technology classification. Poland should consider further investment in its high technology star sectors in which it has a high market share and the world market for the product is also fast-growing. There are a lot of dog sectors with a low world market growth rate and in which Poland has a low share, hence the country should consider moving resources from these sectors into the sectors with better prospects.

When the proximity of Poland's export structure is compared in terms of its proximity to the highest world trade share products between 1995 and 2015, it was observed that Poland's export structure is moving far away from lower value added products and getting closer to medium technology engineering and automotive products, and even to some high-tech products.

To sum up, analyses of Poland's export structure using the product space approach showed that Poland is achieving a healthy transformation towards medium technology automotive and engineering products and some high technology products. It has already gained comparative advantage in a number

of high technology and medium technology products that have a high share in world trade. The products where Poland lost RCA since 1995 are mostly primary, resource based and low technology products. Thus, there is a transformation in the production and export structure, which is probably one of the most important factors that gave Poland the edge in escaping from MIT and becoming a high income country. To improve its position in world markets, Poland should also carefully examine the market structure of its exports. It may be time for divesting of some dog sectors and using resources to continue the transformation to higher technology star sectors. Poland should also examine the prospects in question mark sectors and evaluate whether it will worth investing in some of them. In planning the transformation of its export structure, the country should take into consideration the fact that investing in the sectors closest to its current export structure (in terms of proximity calculations) would be more cost efficient.

The analyses in this article confirmed the initial hypothesis to a great extent. Poland, throughout its development experience, has achieved a certain transformation towards increasing the sophistication level of its export basket, which was diversified into higher value added medium-high technology sectors, and continues to diversify its export structure towards high technology sectors. This suggests that Poland is on the correct path to escape the middle income trap, if it has not done so already. The contribution of this article was to combine export sophistication analysis with market analysis, which is missing in product space analysis. Market analysis combined with product space analysis can guide government policies for various sectors, enabling Poland to explore higher sophistication products that it can easily diversify into, given its existing capabilities, and products which also have growth potential in world markets so that it will be worth effort .

In the future, the scope of the article can be extended into micro analysis. Poland, in planning to which sectors/products it wants to diversify, should first examine the macro analysis performed here, as well as product space, market share/growth potential and RCA analysis. Then it should explore more deeply how to help its firms produce these products to establish and gain competitiveness in world markets. The microanalysis of firm level data becomes important here. The analysis of the microeconomic foundations of macroeconomics became especially popular in recent decades as company level data become increasingly available and the processing capabilities of the software has increased. Indeed, examining the microeconomic foundations of macroeconomics facilitated better understanding of the dynamics behind macroeconomics. The microeconomic analysis of the structure of the existing firms, their capabilities, the transformations needed to able to produce higher value added, diversified products will be also necessary. This analysis will

help the government to formulate policies to address educational needs of the employees, to provide the necessary infrastructure and public goods, and to provide coordination and the necessary guidance for businesses.

Another aspect to explore in future work is domestic content and value chain analysis. Value chains are becoming important in world production and trade. A country can transform its export basket towards higher value added products by taking part in global value chains, but if its part in the value chain is in low value added sections of the production process, any gains from it will be limited. Poland has established strong links with global value chains, but domestic content in exports of many medium-high and high technology sectors is declining (Michalski 2018). Domestic content analysis and how to increase domestic value added of the country in the value chains are important future possible areas of study, in order to formulate better development policies for the Polish economy.

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APPENDIX

Table A1

kc20 scores of countries

Ranking	kc20-1995	Country
1	221.256719	Japan
2	221.256605	Germany
3	221.256602	Sweden
4	221.256596	Switzerland
5	221.25653	Austria
6	221.256526	Finland
7	221.256513	UK
8	221.256469	USA
9	221.256447	France
10	221.256439	Italy
…	…	…
…	…	…
31	221.256250	Poland
…	…	…
…	…	…
114	221.255903	Burkina Faso
115	221.255887	Malawi
116	221.255862	Uganda
117	221.255862	Niger
118	221.255855	Madagascar
119	221.255839	Burundi
120	221.255822	Kiribati
121	221.25582	Maldives
122	221.255809	Sudan
123	221.255757	Ethiopia

Ranking	kc20-2015	Country
1	219.573618	Japan
2	219.5736	Switzerland
3	219.573579	Taiwan
4	219.573567	South Korea
5	219.573562	Singapore
6	219.573557	Germany
7	219.573519	Sweden
8	219.573505	Finland
9	219.573503	Austria
10	219.573497	Czech Rep.
…	…	…
…	…	…
35	219.573413	Poland
…	…	…
…	…	…
141	219.573162	Greenland
142	219.57316	Nicaragua
143	219.573153	Guinea
144	219.573153	Mongolia
145	219.573135	Maldives
146	219.573121	Ethiopia
147	219.573116	Angola
148	219.573078	Sudan
149	219.573077	Afghanistan
150	219.571673	Iraq

Source: calculations done by author using trade statistics of UN Comtrade.

Table A2

kc19 scores of countries

Ranking	kc19-1995	Country	Ranking	kc19-2015	Country
1	21.45424479	Japan	1	26.48923069	Iraq
2	21.45425969	Germany	2	26.48925522	Japan
3	21.45426018	Sweden	3	26.48925782	Switzerland
4	21.45426081	Switzerland	4	26.48926190	Taiwan
5	21.45426935	Austria	5	26.48926366	South Korea
6	21.4542699	Finland	6	26.48926417	Singapore
7	21.45427151	UK	7	26.48926501	Germany
8	21.45427713	USA	8	26.48927074	Sweden
9	21.45428004	France	9	26.48927288	Finland
10	21.45428102	Italy	10	26.48927349	Austria
…	…	…	…	…	…
…	…	…	…	…	…
32	21.45430540	Poland	37	26.48928788	Poland
…	…	…	…	…	…
…	…	…	…	…	…
114	21.45434999	Burkina Faso	141	26.48932547	Angola
115	21.45435187	Malawi	142	26.48932639	Ecuador
116	21.4543552	Uganda	143	26.4893271	Greenland
117	21.45435524	Niger	144	26.48932732	Mongolia
118	21.45435605	Madagascar	145	26.48932776	Nicaragua
119	21.45435808	Burundi	146	26.48932848	Guinea
120	21.45436004	Kiribati	147	26.48933144	Maldives
121	21.45436056	Maldives	148	26.48933383	Ethiopia
122	21.45436204	Sudan	149	26.48933658	Sudan
123	21.45436875	Ethiopia	150	26.48934033	Afghanistan

Source: calculations done by author using trade statistics of UN Comtrade.

Table A3

Country comparisons of kc20

Countries which became high income after 1990		Countries that are Upper Middle Income and not yet in the Middle Income Trap	
	Rank in kc20 2015		Rank in kc20 2015
S. Korea	4	Turkey	55
Taiwan	3	China	31
Greece	73	Thailand	27
Ireland	29	Bulgaria	52
Portugal	50	Hungary	15
Spain	45	Poland	35
Argentina	87	Costa Rica	66
Chile	93	Mexico	33
Mauritius	97	Oman	99

Countries in the Upper Middle Income Trap

	Rank in kc20_2015
Malaysia	28
Uruguay	80
Saudi Arabia	42

Source: Felipe et al. (2012).

Table A4

Highest and lowest kp20 products and their technology classifications

Rank	Com Code	Commodity Name	kp20 2015	Tech. Class
1	2114	Goatskins	26.4892307	Primary Products
2	8855	Watch movements, complete and assembled	26.4892657	Medium Tech: Engineer.
3	7312	Machining centres, unit construction machines	26.4892672	Medium Tech: Engineer.
4	8826	Photographic plates and film	26.4892684	Medium Tech: Process
5	7133	Internal combustion piston engines	26.4892704	Medium Tech: Engineer.
6	5742	Epoxide resins	26.4892706	Medium Tech: Process
7	7316	Machine tools for deburring, sharpening, grinding, Honing, lapping, polishing	26.4892708	Medium Tech: Engineer.
8	7311	Machine tools for working any material by removal of material	26.4892712	Medium Tech: Engineer.
9	5985	Chemical elements doped for use in electronics	26.4892728	Medium Tech: Process
10	8719	Liquid crystal devices, n.e.s.; lasers; other optical appliances	26.4892729	High Tech: Other
…	…	…	…	…
…	…	…	…	…
1012	0721	Cocoa beans	26.4893128	Primary Products
1013	4222	Palm oil and its fractions	26.4893137	Resource Based Manuf: Agro
1014	6545	Fabrics, woven, of jute or of other textile bast fibres	26.4893139	Low Tech: Textile. garm.
1015	2631	Cotton (other than linters), not carded or combed	26.4893141	Primary Products
1016	0711	Coffee, not roasted	26.4893143	Primary Products
1017	0725	Cocoa shells, husks, skins and other cocoa waste	26.4893147	Primary Products
1018	2879	Ores and concentrates of other non-ferrous base metals	26.4893154	Resource Based Manuf: Other
1019	2861	Uranium ores and concentrates	26.4893184	Resource Based Manuf: Other
1020	2225	Sesame (Sesamum) seeds	26.4893184	Primary Products
1021	2641	Jute and other textile bast fibres, raw or retted	26.4893216	Resource Based Manuf: Agro

Source: calculations done by author using trade statistics of UN Comtrade.

Table A5

High technology products and their kp20 rank

Com Code	Commodity Name	Rank (kp20)
716	Rotating electric plant & parts thereof, n.e.s.	324
718	Other power generating machinery & parts, n.e.s.	289
751	Office machines	341
752	Automatic data processing machines, n.e.s.	305
759	Parts, accessories for machines of groups 751, 752	431
761	Television receivers, whether or not combined	686
764	Telecommunication equipment, n.e.s.; & parts, n.e.s.	336
771	Electric power machinery, and parts thereof	387
774	Electro-diagnostic appa. for medical sciences, etc.	97
776	Cathode valves & tubes	225
778	Electrical machinery & apparatus, n.e.s.	206
525	Radio-actives and associated materials	365
541	Medicinal and pharmaceutical products, excluding 542	247
542	Medicaments (incl. veterinary medicaments)	350
712	Steam turbines & other vapour turbin., parts, n.e.s.	151
792	Aircraft & associated equipment; spacecraft, etc.	425
871	Optical instruments & apparatus, n.e.s.	87
874	Measuring, analysing & controlling apparatus, n.e.s.	145
881	Photographic apparatus & equipment, n.e.s.	360

Source: calculations done by author using trade statistics of UN Comtrade.

Table A6

Poland's Highest RCA products, their technology class and kp20 rank

Com Code	Commodity Name	Share in Poland Exp 2015	RCA 2015	RCA 1995	Tech. Class	Rank kp20
1	2	3	4	5	6	7
353	Fish (including fillets), smoked, whether or not cooked before or during the smoking process	0.3627	29.3527	5.2906	Resource Based: Agro	710
451	Rye, unmilled	0.0408	25.2696	0.4957	Primary Products	204
3250	Coke and semi-coke (including char) of coal, of lignite or of peat	0.6168	20.4761	31.3113	Resource Based: Other	661
7753	Dishwashing machines of the household type	0.3854	16.4400	0.0000	Medium Tech: Engineer.	73
6963	Razors and razor-blades (including razor-blade blanks in strips)	0.4611	14.4457	0.9069	Low Tech: Other	538
7751	Household-type laundry equipment, n.e.s., whether or not electrical	0.8882	14.3036	0.0629	Medium Tech: Engineer.	368
6351	Packings and cable-drums of wood; wooden box pallets and the like	0.2059	11.2802	29.1765	Resource Based: Agro	574
583	Fruit and nuts, uncooked or cooked by steaming or boiling in water, frozen	0.2474	10.8843	38.5232	Resource Based: Agro	723
6872	Tin and tin alloys, worked	0.0276	10.6919	0.1835	Primary Products	325
459	Buckwheat, millet and canary seed; other cereals, unmilled, n.e.s.	0.0583	9.8048	0.6353	Primary Products	875
124	Meat of horses, asses, mules or hinnies, fresh, chilled or frozen	0.0174	9.4379	7.1112	Primary Products	688
1222	Cigarettes containing tobacco	1.1062	8.5426	0.3313	Resource Based: Agro	783
129	Meat and edible meat offal, fresh, chilled or frozen, n.e.s.	0.0429	7.8851	13.0231	Primary Products	651
8993	Candles; matches, pyrophoric alloys, articles of combustible materials; smokers' requisites	0.2452	7.4862	1.7867	Low Tech: Other	675
6349	Wood, simply shaped, n.e.s.	0.0117	7.0305	33.4925	Resource Based: Agro	627
6647	Safety glass, consisting of toughened (tempered) or laminated glass	0.3746	6.8319	0.5280	Resource Based: Other	339
8932	Builders' ware of plastics	0.5508	6.7089	3.9070	Low Tech: Other	568
123	Meat and edible offal of the poultry of subgroup 001.4	0.9240	6.4606	1.8534	Primary Products	541
175	Meat and offal (other than liver), of swine, prepared or preserved, n.e.s.	0.1284	6.3407	3.7266	Resource Based: Agro	367
8212	Mattress supports; articles of bedding or similar furnishings	0.5553	6.3316	4.3317	Low Tech: Other	779

Table 6A, cont.

1	2	3	4	5	6	7
8211	Seats (other than those of heading 872.4)	2.6507	6.2769	7.7154	Low Tech: Other	505
739	Food preparations containing cocoa, n.e.s.	0.5328	6.2264	3.1434	Resource Based: Agro	584
6359	Manufactured articles of wood, n.e.s.	0.2176	6.1971	11.0524	Resource Based: Agro	637
5832	Monofilament of which any cross-sectional dimension exceeds 1 mm...of polymers of vinyl chloride	0.0980	6.1921	0.2616	Medium Tech: Process	509
4217	Rape, colza or mustard oil and fractions thereof	0.2069	5.9101	0.6486	Resource Based: Agro	397
2450	Fuel wood (excluding wood waste) and wood charcoal	0.0460	5.8593	11.8485	Primary Products	706
5534	Preparations for oral or dental hygiene, including denture fixative pastes and powders	0.1870	5.7111	0.9718	Medium Tech: Process	544
6353	Builders' joinery and carpentry of wood, including cellular wood panel	0.5470	5.6646	3.9665	Resource Based: Agro	530
981	Homogenized food preparations	0.0357	5.5622	6.6259	Resource Based: Agro	547
5812	Tubes, pipes and hoses, rigid	0.2153	5.5491	0.6758	Medium Tech: Process	690
8922	Newspapers, journals and periodicals, whether or not illustrated or containing advertising material	0.1398	5.5332	0.2704	Unclassified	287
251	Birds' eggs, in shell, fresh, preserved or cooked	0.1431	5.5200	0.2270	Primary Products	709
7611	Television receivers, colour (including video monitors and video projectors)	2.5634	5.4385	0.4316	High Tech: Electronic	552
2121	Mink skins, raw, whole, with or without head, tail or paws	0.1948	5.4176	0.2403	Primary Products	419
7831	Motor vehicles for the transport of ten or more persons, including the driver	0.4949	5.3069	0.2876	Medium Tech: Automotive	513
599	Juice of any single fruit (other than citrus) or vegetable	0.2633	5.2994	10.9859	Resource Based: Agro	924
7932	Ships, boats and other vessels	2.5842	5.2648	6.9196	Medium Tech: Engineer.	453
2483	Wood of coniferous species	0.0549	5.1988	2.8263	Resource Based: Agro	606
1213	Tobacco refuse	0.0083	5.1635	0.4579	Primary Products	976
6422	Envelopes, letter cards, plain postcards and correspondence cards, of paper or paperboard	0.0308	5.0208	0.5423	Low Tech: Other	577

Source: calculations done by author using trade statistics of UN Comtrade.

Table A7

Poland's RCA in high technology sectors (as of 2015, in comparison to 1995)

Com Code	Commodity Name	Poland RCA 2015	Poland Exp Share 2015	Poland RCA 1995	Poland Exp Share 1995
1	2	3	4	5	6
7611	Television receivers, colour	5.4385	2.5634	0.4316	0.2079
7782	Electric filament or discharge lamps	4.4697	0.3765	4.1524	0.5846
7523	Digital processing units	3.4894	1.3737	0.0137	0.0083
7128	Parts for the turbines of subgroup 712.1	3.3400	0.0974	0.0000	0.0000
7783	Electrical equipment, n.e.s., for internal combustion engines and vehicles; parts thereof	1.8864	0.5140	0.2830	0.0686
7189	Engines and motors, n.e.s. (e.g., wind engines and hot air engines); parts of these	1.4764	0.1696	0.6253	0.0426
7781	Batteries and electric accumulators, and parts thereof	1.3726	0.3807	0.1816	0.0449
7169	Parts, n.e.s., suitable for use solely or principally with the machines falling within group 716	1.3299	0.1467	0.5640	0.0606
7162	Motors (other than motors of an output not exceeding 37.5 W) and generators, direct current	1.1992	0.0749	0.1447	0.0072
7163	Motors (other than motors of an output not exceeding 37.5 W) and generators, alternating current	1.0452	0.1664	1.3977	0.2046
7711	Transformers, electrical	1.0347	0.1077	0.5012	0.0658
7712	Other electric power machinery; parts of the electric power machinery of 771	0.9243	0.4229	0.4387	0.1564
7121	Steam turbines and other vapour turbines	0.8970	0.0103	0.0000	0.0000
8746	Automatic regulating or controlling instruments and apparatus	0.7894	0.1650	0.1721	0.0360
7787	Electrical machines and apparatus, having individual functions, n.e.s.; parts thereof	0.7511	0.1900	0.1755	0.0385
7526	Input or output units for automatic data-processing machines	0.7363	0.0985	0.0214	0.0174
5429	Medicaments, n.e.s.	0.6871	1.3127	0.8907	0.6105
8743	Instruments and apparatus for measuring or checking the flow, level, pressure or other	0.6580	0.0906	0.6723	0.0628
7649	Parts and accessories suitable for division 76	0.6578	0.7428	0.2734	0.3075
7642	Microphones and stands therefor; loudspeakers	0.6443	0.1189	0.3929	0.0670
7784	Electromechanical tools for working in the hand	0.6394	0.0523	0.2106	0.0243
7511	Typewriters and word-processing machines	0.6355	0.0002	0.0342	0.0006
8749	Parts and accessories for machines, appliances, instruments and apparatus, n.e.s.	0.5744	0.0120	0.6177	0.0137

Table 7A, cont.

1	2	3	4	5	6
7788	Electrical machinery and equipment, n.e.s.	0.5637	0.1546	0.6884	0.3185
7643	Transmission apparatus for radio-telephony, radio-telegraphy, radio-broadcasting or television	0.5463	0.7560	0.0111	0.0054
8744	Instruments and apparatus for physical or chemical analysis	0.5419	0.1421	0.0755	0.0130
7527	Storage units, whether or not presented with the rest of a system	0.4832	0.1869	0.0296	0.0218
7512	Calculating machines; accounting machines, postage-franking machines, ticket-issuing machines and similar	0.4539	0.0110	0.0498	0.0034
7929	Parts, n.e.s. (not including tyres, engines and electrical parts), of 792	0.4461	0.2461	0.0828	0.0446
7165	Generating sets	0.4382	0.0751	0.9863	0.1004
8741	Compasses; other navigational instruments and appliances	0.4369	0.0465	0.0658	0.0074
5419	Pharmaceutical goods, other than medicaments	0.4050	0.0560	0.4240	0.0462
7763	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices	0.4021	0.2261	0.0393	0.0155
7599	Parts and accessories suitable for 751.1, 751.2, 751.9 and 752	0.3993	0.2752	0.0249	0.0477
7529	Data-processing equipment, n.e.s.	0.3919	0.0581	0.0199	0.0044
8745	Measuring, controlling and scientific instruments, n.e.s.	0.3227	0.0244	0.3888	0.0300
7922	Aeroplanes and other aircraft, mechanically-propelled, not exceeding 2,000 kg	0.3094	0.0033	0.6921	0.0064
5421	Medicaments containing antibiotics or derivatives thereof	0.2852	0.0372	0.2703	0.0337
7522	Digital automatic data-processing machines	0.2803	0.2204	0.0773	0.0272
5411	Provitamins and vitamins, natural or reproduced by synthesis	0.2650	0.0083	0.2042	0.0172
7641	Electrical apparatus for line telephony or line telegraphy	0.2545	0.0233	0.0663	0.0326
7161	Electric motors of an output not exceeding 37.5 W	0.2356	0.0170	0.0812	0.0100
7741	Electrodiagnostic apparatus	0.2126	0.0284	0.0477	0.0055
7923	Aeroplanes and other aircraft, mechanically-propelled, exceeding 2,000 kg but not exceeding 15,000 kg	0.2098	0.0191	0.2736	0.0403
8742	Drawing, marking-out or mathematical calculating instruments	0.2006	0.0536	0.1511	0.0319
7513	Photocopying apparatus incorporating an optical system or of the contact type	0.1999	0.0414	0.0061	0.0011
5422	Medicaments containing hormones or other products of subgroup 541.5	0.1886	0.0588	0.2603	0.0290

5414	Vegetable alkaloids, natural or reproduced by synthesis, and their salts, ethers, esters and other derivatives	0.1855	0.0029	0.0159	0.0003
7924	Aeroplanes and other aircraft, mechanically-propelled, not exceeding 15,000 kg	0.1778	0.1494	0.0631	0.0405
7519	Other office machines	0.1679	0.0057	0.0053	0.0004
7921	Helicopters	0.1590	0.0079	0.6526	0.0258
7648	Telecommunications equipment, n.e.s.	0.1459	0.0175	0.0306	0.0077
7164	Electric rotary converters	0.1379	0.0002	0.0000	0.0000
5423	Medicaments containing alkaloids or derivatives thereof but not containing hormones	0.1320	0.0068	3.3200	0.0722
7762	Other electronic valves and tubes	0.1183	0.0012	0.2299	0.0466
5416	Glycosides; glands or other organs and their extracts	0.1114	0.1065	0.2644	0.0407
5251	Radioactive chemical elements and radioactive isotopes	0.1077	0.0069	0.0661	0.0052
7181	Hydraulic turbines and water-wheels, and parts thereof	0.1000	0.0012	0.5789	0.0074
7612	Television receivers, black and white or other monochrome	0.0964	0.0000	0.0000	0.0000
7928	Aircraft, n.e.s. (including dirigibles, balloons, gliders, etc.) and associated equipment	0.0959	0.0014	0.6115	0.0077
7742	Apparatus based on the use of X-rays or of alpha, beta or gamma radiations	0.0883	0.0133	0.0627	0.0089
8747	Oscilloscopes, spectrum analyzers and other instruments and apparatus for measuring or checking electrical quantities	0.0801	0.0113	0.2344	0.0453
7764	Electronic integrated circuits and microassemblies	0.0610	0.1722	0.0372	0.1101
7768	Piezoelectric crystals, mounted; parts, n.e.s., of the electronic components of group 776	0.0503	0.0080	0.0306	0.0061
7786	Electrical capacitors, fixed, variable or adjustable (pre-set)	0.0395	0.0065	0.0615	0.0145
5415	Hormones, natural or reproduced by synthesis; derivatives thereof	0.0327	0.0033	0.7368	0.0314
5259	Stable isotopes and their compounds	0.0147	0.0001	0.0000	0.0000
5413	Antibiotics, not put up as medicaments of group 542	0.0042	0.0003	0.7652	0.1035
7761	Television picture tubes, cathode-ray	0.0023	0.0000	4.1036	0.7257
7187	Nuclear reactors, and parts thereof; fuel elements (cartridges), non-irradiated, for nuclear reactors	0.0004	0.0000	0.0164	0.0003
7521	Analogue or hybrid (analogue-digital) data-processing machines	0.0000	0.0000	0.0613	0.0010
7591	Parts and accessories of the photocopying and thermocopying apparatus 751.3	0.0000	0.0000	0.0310	0.0046
7925	Spacecraft (including satellites) and spacecraft launch vehicles	0.0000	0.0000	0.0000	0.0000

Source: calculations done by author using trade statistics of UN Comtrade.

Table A8

Top 50 highest share in world exports and Poland's RCA and export share in them

Com Code	Commodity Name	World Sec Shares	Share in PL Exp	RCA PL	Tech Class
1	2	3	4	5	6
7812	Motor vehicles for the transport of persons, n.e.s.	4.5074	3.3373	0.7404	Medium Tech: Automotive
3330	Petroleum oils and oils obtained from bituminous minerals, crude	3.5530	0.0486	0.0137	Primary Products
7764	Electronic integrated circuits and microassemblies	2.8211	0.1722	0.0610	High Tech: Electronic
7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	2.1788	5.1089	2.3449	Medium Tech: Automotive
5429	Medicaments, n.e.s.	1.9103	1.3127	0.6871	High Tech: Other
7643	Transmission apparatus for radio-telephony, radio-telegraphy, radio-broadcasting or television	1.3839	0.7560	0.5463	High Tech: Electronic
7649	Parts and accessories suitable for use solely or principally with the apparatus of division 76	1.1292	0.7428	0.6578	High Tech: Electronic
5416	Glycosides; glands or other organs and their extracts	0.9558	0.1065	0.1114	High Tech: Other
7924	Aeroplanes and other aircraft, mechanically-propelled (other than helicopters), of an unladen weight exceeding 15,000 kg	0.8403	0.1494	0.1778	High Tech: Other
7522	Digital automatic data-processing machines	0.7863	0.2204	0.2803	High Tech: Electronic
6672	Diamonds (other than sorted industrial diamonds)	0.7819	0.0012	0.0016	Resource Based: Other
3432	Natural gas, in the gaseous state	0.7259	0.0000	0.0000	Primary Products
7284	Machinery and mechanical appliances specialized for particular industries, n.e.s.	0.7024	0.3507	0.4993	Medium Tech: Engineer.
7821	Motor vehicles for the transport of goods	0.6895	0.8485	1.2306	Medium Tech: Automotive
7599	Parts and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with the machines of subgroups 751.1, 751.2, 751.9 and group 752	0.6892	0.2752	0.3993	High Tech: Electronic

8973	Jewellery of gold, silver or platinum group metals	0.6798	0.0260	0.0383	Low Tech: Other
7731	Insulated (including enamelled or anodized) wire, cable (including co-axial cable) and other insulated electric conductors	0.6611	1.3228	2.0009	Medium Tech: Engineer.
3431	Natural gas, liquefied	0.5986	0.0000	0.0000	Primary Products
7725	Electrical apparatus for switching or protecting electrical circuits	0.5820	0.4918	0.8449	Medium Tech: Engineer.
7763	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices	0.5622	0.2261	0.4021	High Tech: Electronic
7929	Parts, n.e.s. (not including tyres, engines and electrical parts), of the goods of group 792	0.5517	0.2461	0.4461	High Tech: Other
8722	Instruments and appliances used in medical, surgical or veterinary sciences	0.5437	0.2889	0.5313	Medium Tech: Engineer.
5157	Other heterocyclic compounds; nucleic acids	0.5218	0.0587	0.1125	High Tech: Other
7932	Ships, boats and other vessels (other than pleasure craft, tugs, pusher craft, special-purpose vessels and vessels for breaking up)	0.4909	2.5842	5.2648	High Tech: Other
8719	Liquid crystal devices, n.e.s.; lasers (other than laser diodes); other optical appliances and instruments, n.e.s.	0.4804	0.0052	0.0107	High Tech: Other
7611	Television receivers, colour	0.4713	2.5634	5.4385	High Tech: Electronic
7712	Other electric power machinery; parts of the electric power machinery of group 771	0.4575	0.4229	0.9243	High Tech: Electronic
7132	Internal combustion piston engines for propelling vehicles	0.4261	1.3806	3.2400	Medium Tech: Engineer.
8211	Seats (other than those of heading 872.4), whether or not convertible into beds, and parts thereof	0.4223	2.6507	6.2769	Low Tech: Other
7149	Parts of the engines and motors of heading 714.41 and subgroup 714.8	0.4158	0.7122	1.7128	Medium Tech: Engineer.
7139	Parts, n.e.s, for the internal combustion piston engines of subgroups 713.2, 713.3 and 713.8	0.4064	0.7603	1.8706	Medium Tech: Engineer.
3212	Other coal	0.3958	0.3729	0.9423	Primary Products
7523	Digital processing units, whether or not presented with the rest of a system	0.3937	1.3737	3.4894	High Tech: Electronic

Table 8A, cont.

1	2	3	4	5	6
8939	Articles of plastics, n.e.s.	0.3927	0.7237	1.8429	Low Tech: Other
6842	Aluminium and aluminium alloys, worked	0.3919	0.4072	1.0389	Primary Products
7527	Storage units, whether or not presented with the rest of a system	0.3867	0.1869	0.4832	High Tech: Electronic
989	Food preparations, n.e.s.	0.3647	0.6247	1.7128	Resource Based: Agro
7726	Boards, panels (including numerical control panels)	0.3535	0.4267	1.2071	Medium Tech: Engineer.
8996	Orthopaedic appliances (including crutches, surgical belts and trusses)	0.3449	0.1886	0.5470	Low Tech: Other
5989	Chemical products and preparations, n.e.s.	0.3373	0.2794	0.8285	Medium Tech: Process
7478	Taps, cocks, valves and similar appliances, n.e.s.	0.3262	0.3286	1.0075	Medium Tech: Engineer.
6996	Articles of iron or steel, n.e.s.	0.3184	0.7817	2.4553	Low Tech: Other
5822	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforce	0.3158	0.4490	1.4220	Medium Tech: Process
6821	Copper, refined and unrefined; copper anodes for electrolytic refining	0.3152	0.8595	2.7271	Primary Products
8131	Lamps and lighting fittings (including searchlights and spotlights), n.e.s.	0.3117	0.3192	1.0240	Medium Tech: Engineer.
5422	Medicaments containing hormones or other products of subgroup 541.5	0.3115	0.0588	0.1886	High Tech: Other
8514	Other footwear with uppers of leather or composition leather	0.3009	0.2027	0.6737	Low Tech: Textile
6911	Structures and parts of structures	0.2996	0.9453	3.1556	Low Tech: Other
2815	Iron ore and concentrates, not agglomerated	0.2955	0.0004	0.0015	Resource Based: Other
8931	Articles for the conveyance or packing of goods, of plastics; stoppers, lids, caps and other closures, of plastics	0.2896	0.6596	2.2776	Low Tech: Other

Source: calculations done by author using trade statistics of UN Comtrade.

Table A9

World's fastest growing 50 sectors between 2005-2015 and the BCG class for Poland

Code	Commodity Name	World Share Chg	PL Share World	BCG	Tech Class.	Rank
1	2	3	4	5	6	7
5416	Glycosides; glands or other organs and their extracts	0.0604	0.1194	Question Mark	High Tech: Other	132
8973	Jewellery of gold, silver or platinum group metals (except watches and watch-cases)	0.0315	0.0410	Question Mark	Low Tech: Other	571
3431	Natural gas, liquefied	0.0253	0.0000	Unclassified	Primary Products	890
7522	Digital automatic data-processing machines	0.0176	0.3002	Question Mark	High Tech: Electronic	498
8131	Lamps and lighting fittings (including searchlights and spotlights), n.e.s.	0.0152	1.0967	Star	Medium Tech: Engineer.	345
7513	Photocopying apparatus incorporating an optical system or of the contact type, and thermocopying apparatus	0.0144	0.2141	Question Mark	High Tech: Electronic	346
2222	Soya beans	0.0143	0.0015	Question Mark	Primary Products	889
7935	Light vessels, fire-floats, dredgers, floating cranes	0.0137	0.1377	Question Mark	Medium Tech: Engineer.	678
2815	Iron ore and concentrates, not agglomerated	0.0127	0.0016	Question Mark	Resource Based: Other	972
7731	Insulated (including enamelled or anodized) wire, cable (including co-axial cable) and other insulated electric conductors	0.0121	2.1430	Star	Medium Tech: Engineer.	759
7763	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices	0.0118	0.4307	Question Mark	High Tech: Electronic	99
8442	Suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts	0.0116	0.9069	Question Mark	Low Tech: Textile	983
7726	Boards, panels (including numerical control panels), consoles, desks, cabinets and other bases	0.0114	1.2928	Star	Medium Tech: Engineer.	237
6762	Bars and rods (other than those of subgroup 676.1) of iron or steel, not further worked than hot-rolled, hot-drawn or hot-extruded, but including those twisted after rolling	0.0108	1.0340	Question Mark	Low Tech: Other	781

Table 9A, cont.

1	2	3	4	5	6	7
6732	Flat-rolled products of iron or non-alloy steel, not clad, plated or coated, not further worked than hot-rolled (other than those of subgroup 673.1)	0.0108	1.0811	Star	Low Tech: Other	348
989	Food preparations, n.e.s.	0.0106	1.8343	Star	Resource Based: Agro	658
8719	Liquid crystal devices, n.e.s.; lasers (other than laser diodes)	0.0104	0.0115	Question Mark	High Tech: Other	10
8513	Footwear, n.e.s., with outer soles and uppers of rubber or plastics	0.0101	0.8274	Question Mark	Low Tech: Textile	719
7712	Other electric power machinery; parts of the electric power machinery of group 771	0.0095	0.9899	Question Mark	High Tech: Electronic	162
7764	Electronic integrated circuits and microassemblies	0.0095	0.0654	Question Mark	High Tech: Electronic	47
7284	Machinery and mechanical appliances specialized for particular industries, n.e.s.	0.0091	0.5347	Question Mark	Medium Tech: Engineer.	11
2831	Copper ores and concentrates	0.0086	0.0000	Question Mark	Resource Based: Other	981
8996	Orthopaedic appliances (including crutches, surgical belts and trusses)	0.0084	0.5858	Question Mark	Low Tech: Other	234
8311	Handbags, whether or not with shoulder-strap (including those without handle)	0.0081	0.2423	Question Mark	Low Tech: Textile	755
8722	Instruments and appliances used in medical, surgical or veterinary sciences	0.0080	0.5690	Question Mark	Medium Tech: Engineer.	398
6734	Flat-rolled products of iron or non-alloy steel, not clad, plated or coated, not further worked than cold-rolled (cold-reduced)	0.0078	0.5759	Question Mark	Low Tech: Other	372
6911	Structures (excluding prefabricated buildings of group 811) and parts of structures	0.0076	3.3796	Star	Low Tech: Other	360
8515	Other footwear, with uppers of textile materials	0.0074	0.5645	Question Mark	Low Tech: Textile	869
4222	Palm oil and its fractions	0.0073	0.0055	Question Mark	Resource Based: Agro	1013
412	Other wheat (including spelt) and meslin, unmilled	0.0073	1.9900	Star	Primary Products	629

7436	Filtering or purifying machinery and apparatus, for liquids or gases	0.0069	1.0654	Question Mark	Medium Tech: Engineer.	238
813	Oilcake and other solid residues	0.0069	0.6166	Question Mark	Primary Products	908
7478	Taps, cocks, valves and similar appliances, n.e.s.	0.0068	1.0790	Star	Medium Tech: Engineer.	173
5629	Fertilizers, n.e.s.	0.0062	1.2472	Star	Medium Tech: Process	825
5532	Beauty or make-up preparations for the care of the skin	0.0058	2.4166	Star	Medium Tech: Process	573
449	Maize (not including sweet corn), unmilled, other	0.0055	0.4738	Question Mark	Primary Products	816
7783	Electrical equipment, n.e.s., for internal combustion engines and vehicles; parts thereof	0.0055	2.0203	Star	High Tech: Electronic	122
7285	Parts, n.e.s., of the machines and mechanical appliances of headings 723.48, 727.21 and 728.41 through 728.49	0.0052	0.3385	Question Mark	Medium Tech: Engineer.	14
8424	Dresses	0.0052	1.3511	Star	Low Tech: Textile	813
6811	Silver (including base metals clad with silver), unwrought, unworked or semi-manufactured	0.0050	3.4865	Star	Primary Products	612
112	Meat of bovine animals, frozen	0.0047	1.2842	Star	Primary Products	957
8853	Wrist-watches, pocket watches and other watches (including stop-watches), with case of precious metal	0.0046	0.0765	Question Mark	Medium Tech: Engineer.	202
579	Fruit, fresh or dried, n.e.s.	0.0046	0.6604	Question Mark	Primary Products	928
577	Edible nuts	0.0046	0.0876	Question Mark	Primary Products	1010
8744	Instruments and apparatus for physical or chemical analysis	0.0044	0.5804	Question Mark	High Tech: Other	26
7781	Batteries and electric accumulators, and parts thereof	0.0044	1.4700	Star	High Tech: Electronic	412
819	Food wastes and prepared animal feeds, n.e.s.	0.0043	1.5169	Star	Primary Products	689
7642	Microphones and stands therefor; loudspeakers, whether or not mounted in their enclosures	0.0043	0.6900	Question Mark	High Tech: Electronic	401
8939	Articles of plastics, n.e.s.	0.0042	1.9738	Star	Low Tech: Other	354
8854	Wrist-watches, pocket watches and other watches (including stop-watches), other than those of subgroup 885.3	0.0042	0.1422	Question Mark	Medium Tech: Engineer.	672

Source: calculations done by author using trade statistics of UN Comtrade.

Table A10

Poland's Cash Cows (top 40 sectors)

Com Code	Commodity Name	RCA 2015	PL Share 2015	World Share Chg	BCG	Tech Class.
451	Rye, unmilled	25.2696	27.0636	-0.0001	Cash Cow	Primary Products
3250	Coke and semi-coke (including char) of coal, of lignite or of peat	20.4761	21.9298	-0.0027	Cash Cow	Resource Based: Other
7753	Dishwashing machines of the household type	16.4400	17.6072	-0.0004	Cash Cow	Medium Tech: Engineer.
7751	Household-type laundry equipment, n.e.s., whether or not electrical	14.3036	15.3190	-0.0048	Cash Cow	Medium Tech: Engineer.
6351	Packings and cable-drums of wood; wooden box pallets and the like	11.2802	12.0810	-0.0003	Cash Cow	Resource Based: Agro
6872	Tin and tin alloys, worked	10.6919	11.4509	-0.0002	Cash Cow	Primary Products
124	Meat of horses, asses, mules or hinnies, fresh, chilled or frozen	9.4379	10.1080	-0.0002	Cash Cow	Primary Products
1222	Cigarettes containing tobacco	8.5426	9.1491	-0.0012	Cash Cow	Resource Based: Agro
129	Meat and edible meat offal, fresh, chilled or frozen, n.e.s.	7.8851	8.4449	-0.0002	Cash Cow	Primary Products
8993	Candles; matches, pyrophoric alloys, articles of combustible materials; smokers' requisites	7.4862	8.0177	-0.0002	Cash Cow	Low Tech: Other
6349	Wood, simply shaped, n.e.s.	7.0305	7.5296	0.0000	Cash Cow	Resource Based: Agro
6647	Safety glass, consisting of toughened (tempered) or laminated glass	6.8319	7.3169	-0.0005	Cash Cow	Resource Based: Other
8932	Builders' ware of plastics	6.7089	7.1852	-0.0005	Cash Cow	Low Tech: Other
175	Meat and offal (other than liver), of swine, prepared or preserved, n.e.s.	6.3407	6.7908	0.0000	Cash Cow	Resource Based: Agro
6359	Manufactured articles of wood, n.e.s.	6.1971	6.6371	-0.0006	Cash Cow	Resource Based: Agro
5832	Monofilament of polymers of vinyl chloride	6.1921	6.6317	-0.0012	Cash Cow	Medium Tech: Process
6353	Builders' joinery and carpentry of wood	5.6646	6.0668	-0.0017	Cash Cow	Resource Based: Agro
5812	Tubes, pipes and hoses, rigid	5.5491	5.9431	0.0000	Cash Cow	Medium Tech: Process
8922	Newspapers, journals and periodicals, whether or not illustrated or containing advertising material	5.5332	5.9261	-0.0037	Cash Cow	Unclassified

7611	Television receivers, colour (including video monitors and video projectors)	5.4385	5.8246	-0.0051	Cash Cow	High Tech: Electronic
7831	Motor vehicles for the transport of ten or more persons, including the driver	5.3069	5.6837	-0.0001	Cash Cow	Medium Tech: Automotive
7932	Ships, boats and other vessel	5.2648	5.6385	-0.0004	Cash Cow	Medium Tech: Engineer.
2483	Wood of coniferous species	5.1988	5.5679	-0.0005	Cash Cow	Resource Based: Agro
1213	Tobacco refuse	5.1635	5.5300	0.0000	Cash Cow	Primary Products
6422	Envelopes, letter cards, plain postcards and correspondence cards, of paper or paperboard	5.0208	5.3773	-0.0005	Cash Cow	Low Tech: Other
6345	Fibreboard of wood or other ligneous materials	4.8500	5.1943	-0.0023	Cash Cow	Resource Based: Agro
6635	Slag-wool, rock-wool and similar mineral wools; exfoliated vermiculite, expanded clays,…	4.7906	5.1307	-0.0001	Cash Cow	Resource Based: Other
242	Processed cheese, not grated or powdered	4.7897	5.1297	-0.0003	Cash Cow	Resource Based: Agro
111	Meat of bovine animals, fresh or chilled	4.6962	5.0296	-0.0005	Cash Cow	Primary Products
7752	Household-type refrigerators and food freezers (electrical and other)	4.5237	4.8449	-0.0009	Cash Cow	Medium Tech: Engineer.
2123	Heads, tails, paws and other pieces or cuttings, suitable for furriers' use	4.5006	4.8201	0.0000	Cash Cow	Primary Products
7782	Electric filament or discharge lamps	4.4697	4.7871	-0.0049	Cash Cow	High Tech: Electronic
8215	Furniture, n.e.s., of wood	4.4038	4.7165	-0.0033	Cash Cow	Low Tech: Other
6824	Copper wire	4.3862	4.6976	-0.0009	Cash Cow	Primary Products
6863	Zinc and zinc alloys, worked	4.2234	4.5233	-0.0002	Cash Cow	Primary Products
6292	Other articles of leather or of composition leather	3.7590	4.0258	-0.0005	Cash Cow	Resource Based: Agro
8921	Books, pamphlets, maps and globes, printed (not including advertising material)	3.5514	3.8036	-0.0056	Cash Cow	Unclassified
2485	Wood of non-coniferous species	3.5415	3.7929	-0.0010	Cash Cow	Resource Based: Agro
7523	Digital processing units, whether or not presented with the rest of a system	3.4894	3.7371	-0.0012	Cash Cow	High Tech: Electronic
6129	Other articles of leather or of composition leather	3.4434	3.6878	-0.0003	Cash Cow	Low Tech: Textile

Source: calculations done by author using trade statistics of UN Comtrade.

Table A11

Poland's Dogs (top 40 sectors)

Com Code	Commodity Name	RCA 2015	PL Share 2015	World Share Chg	BCG	Tech Class
8519	Parts of footwear	0.992633	1.063103	-0.00101	Dog	Low Tech: Textile
7732	Electrical insulating equipment	0.985228	1.055173	-8.8E-05	Dog	Medium Tech: Engineer
8428	Singlets and other vests, slips, petticoats, briefs, panties, nightdresses,	0.97384	1.042976	-0.00089	Dog	Low Tech: Textile
6728	Semi-finished products of alloy steel	0.965807	1.034372	-0.00246	Dog	Medium Tech: Process
5743	Polycarbonates, alkyd resins and other polyesters	0.959883	1.028029	-0.0048	Dog	Medium Tech: Process
7456	Mechanical appliances (whether or not hand-operated) for projecting, dispersing or spraying liquids or powders;	0.959338	1.027445	-0.001	Dog	Medium Tech: Engineer
8416	Singlets and other vests, underpants, briefs, nightshirts, pyjamas, bathrobes, dressing-gowns and similar articles	0.952926	1.020577	-0.00096	Dog	Low Tech: Textile
841477	Trousers, bib and brace overalls, breeches and shorts	0.940186	1.006933	-0.00093	Dog	Low Tech: Textile
6781	Wire of iron or non-alloy steel	0.933553	0.999829	-0.00064	Dog	Low Tech: Other
7842	Bodies (including cabs), for the motor vehicles of groups 722, 781, 782 and 783	0.923748	0.989328	-0.00089	Dog	Medium Tech: Auto
2652	True hemp (Cannabis sativa L.), raw or processed but not spun; tow and waste of true hemp	0.923525	0.989089	-5.7E-06	Dog	Resource Based: Agro
544	Tomatoes, fresh or chilled	0.903453	0.967592	-8.8E-05	Dog	Primary
7481	Transmission shafts (including camshafts and crankshafts) and cranks	0.899853	0.963737	-0.00014	Dog	Medium Tech: Engineer
7468	Other ball- or roller bearings (including combined ball-/roller bearings)	0.898927	0.962745	-0.00018	Dog	Medium Tech: Engineer
7121	Steam turbines and other vapour turbines	0.896957	0.960635	-8.3E-05	Dog	High Tech: Other
5731	Polyvinyl chloride	0.895817	0.959414	-0.00205	Dog	Medium Tech: Process
7239	Parts, n.e.s., of the machinery of group 723 (excluding heading 723.48) and of subgroup 744.3	0.885361	0.948216	-0.00631	Dog	Medium Tech: Engineer
6343	Plywood consisting solely of sheets of wood, each ply not exceeding 6 mm thickness	0.884286	0.947065	-0.00128	Dog	Resource Based: Agro
7413	Industrial or laboratory furnaces and ovens, etc., and parts thereof	0.880186	0.942673	-0.00163	Dog	Medium Tech: Engineer

6341	Veneer sheets and sheets for plywood (whether or not spliced) and other wood sawn lengthwise,	0.876633	0.938868	-0.00161	Dog	Resource Based: Agro
6213	Vulcanized rubber thread and cord; plates, sheets, strip, rods and profile shapes, of unhardened vulcanized rubber	0.875101	0.937227	-0.00039	Dog	Resource Based: Agro
6584	Bedlinen, table linen, toilet linen and kitchen linen	0.872268	0.934193	-0.00081	Dog	Low Tech: Textile
7281	Machine tools specialized for particular industries; parts and accessories thereof	0.862363	0.923585	-0.00553	Dog	Medium Tech: Engineer
6563	Gimped yarn, and strip and the like of heading 651.77 or 651.88, gimped	0.851889	0.912367	-0.00047	Dog	Low Tech: Textile
7863	Containers (including containers for the transport of fluids)	0.848864	0.909127	-0.00083	Dog	Medium Tech: Process
5711	Polyethylene	0.846953	0.907081	-0.00164	Dog	Medium Tech: Process
7725	Electrical apparatus for switching or protecting electrical circuits	0.844945	0.90493	-0.00029	Dog	Medium Tech: Engineer
7373	Electric (including electrically heated gas), laser or other light or photon beam, ultrasonic, electron beam	0.835822	0.895159	-0.00229	Dog	Medium Tech: Engineer
6954	Hand tools (including glaziers' diamonds), n.e.s.; blowlamps; vices, clamps and the like	0.835707	0.895037	-0.00096	Dog	Low Tech: Other
2926	Bulbs, tubers and rhizomes of flowering or of foliage plants; cuttings, slips, live trees and other plants	0.825011	0.883582	-0.001	Dog	Primary
8448	Slips, petticoats, briefs, panties, nightdresses, pyjamas,	0.820192	0.87842	-0.00038	Dog	Low Tech: Textile
1211	Tobacco, not stemmed/stripped	0.810733	0.86829	-0.00086	Dog	Primary
5226	Other inorganic bases and metal oxides, hydroxides and peroxides	0.809067	0.866505	-0.00114	Dog	Resource Based: Other
6952	Handsaws, files, rasps, pliers, pincers, tweezers, metal-cutting shears, pipe cutters, bolt croppers	0.802296	0.859254	-1.6E-06	Dog	Low Tech: Other
7459	Other non-electrical machines, and parts thereof	0.79169	0.847895	-0.00095	Dog	Medium Tech: Engineer
8453	Jerseys, pullovers, cardigans, waistcoats and similar articles, knitted or crocheted	0.790722	0.846858	-0.00275	Dog	Low Tech: Textile
7418	Other machinery, plant and similar laboratory equipment, whether or not electrically heated	0.790506	0.846627	-0.0005	Dog	Medium Tech: Engineer
8746	Automatic regulating or controlling instruments and apparatus	0.789386	0.845427	-0.00062	Dog	High Tech: Other
5139	Carboxylic acids with additional oxygen function and their anhydrides, halides,	0.78656	0.8424	-0.00189	Dog	Medium Tech: Process
6212	Other forms and articles of unvulcanized rubber	0.785439	0.841199	-0.00028	Dog	Resource Based: Agro

Source: calculations done by author using trade statistics of UN Comtrade.

Table A12

Poland's Question Marks (top 40 sectors)

Com Code	Commodity Name	RCA 2015	PL Share 2015	World Share Chg	BCG	Tech Class
7436	Filtering or purifying machinery and apparatus, for liquids or gases	0.994781	1.065403	0.006871	Q_Mark	Medium Tech: Engineer
7484	Gears and gearing (excluding toothed wheels, chain sprockets and other transmission elements presented separately); ball screws	0.994481	1.065083	0.001732	Q_Mark	Medium Tech: Engineer
5816	Other tubes, pipes and hoses	0.987373	1.05747	0.000807	Q_Mark	Medium Tech: Process
8997	Basketware, wickerwork and other articles of plaiting materials, n.e.s.	0.982932	1.052713	0.000457	Q_Mark	Low Tech: Other
6762	Bars and rods (other than those of subgroup 676.1) of iron or steel	0.965493	1.034037	0.010813	Q_Mark	Low Tech: Other
7447	Continuous-action elevators and conveyors, for goods or materials	0.956075	1.02395	0.000869	Q_Mark	Medium Tech: Engineer
8139	Binocular cases, camera cases, musical instrument cases, spectacle cases, gun cases, holsters and similar cases, n.e.s.	0.954567	1.022335	0.001123	Q_Mark	Medium Tech: Engineer
3352	Mineral tars and products of their distillation	0.950677	1.018168	0.002176	Q_Mark	Resource Based: Other
3212	Other coal	0.942266	1.00916	0.000415	Q_Mark	Primary
2234	Linseed	0.92879	0.994727	0.00017	Q_Mark	Primary
7712	Other electric power machinery; parts of the electric power machinery of group 771	0.92431	0.98993	0.009543	Q_Mark	High Tech: Electronic
7219	Agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, n.e.s.	0.91145	0.976157	0.000555	Q_Mark	Medium Tech: Engineer
8484	Headgear and fittings therefor, n.e.s.	0.910133	0.974746	0.001079	Q_Mark	Low Tech: Textile
5821	Plates, sheets, film, foil, tape, strip and other flat shapes, self-adhesive, of plastics,	0.900472	0.9644	0.002081	Q_Mark	Medium Tech: Process
5234	Sulphides, polysulphides, dithionites, sulphoxylates, sulphites, thiosulphates, sulphates and alums	0.894274	0.957762	0.000235	Q_Mark	Resource Based: Other
6942	Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter pins, washers	0.884958	0.947784	0.003041	Q_Mark	Low Tech: Other
2511	Waste and scrap of paper or paperboard	0.883119	0.945814	0.000512	Q_Mark	Resource Based: Agro
6661	Quicklime, slaked lime and hydraulic lime	0.871652	0.933534	0.001226	Q_Mark	Low Tech: Other
8411	Overcoats, car coats, capes, cloaks, anoraks (including ski jackets), windcheaters, wind jackets and similar articles	0.869312	0.931027	0.001379	Q_Mark	Low Tech: Textile
8442	Suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers	0.846762	0.906877	0.01156	Q_Mark	Low Tech: Textile

7485	Flywheels and pulleys (including pulley blocks)	0.842295	0.902092	0.000774	Q_Mark	Medium Tech: Engineer
2911	Bones, horns, ivory, hooves, claws, coral, shells and similar products	0.832828	0.891953	0.000178	Q_Mark	Primary
5989	Chemical products and preparations, n.e.s.	0.82845	0.887265	0.000705	Q_Mark	Medium Tech: Process
7472	Valves for oleohydraulic or pneumatic transmissions	0.828114	0.886904	0.000295	Q_Mark	Medium Tech: Engineer
589	Fruit, nuts and other edible parts of plants otherwise prepared or preserved,	0.825851	0.88448	0.002103	Q_Mark	Resource Based: Agro
7112	Auxiliary plant for use with boilers of subgroup 711.1 or 812.1	0.820219	0.878449	0.000352	Q_Mark	Medium Tech: Engineer
5799	Waste, parings and scrap, of plastics… other	0.813085	0.870809	2.85E-05	Q_Mark	Medium Tech: Process
5121	Acyclic monohydric alcohols	0.787308	0.843202	0.000226	Q_Mark	Medium Tech: Process
7415	Air-conditioning machines comprising a motor-driven fan and elements for changing the temperature and humidity,	0.786337	0.842162	0.001437	Q_Mark	Medium Tech: Engineer
8454	T-shirts, singlets and other vests, knitted or crocheted	0.776682	0.831821	0.001149	Q_Mark	Low Tech: Textile
6763	Bars and rods (other than those of subgroup 676.1) of iron or steel, not further worked than cold-formed or cold-finished	0.773251	0.828146	0.001511	Q_Mark	Low Tech: Other
8513	Footwear, n.e.s., with outer soles and uppers of rubber or plastics	0.772508	0.827351	0.010092	Q_Mark	Low Tech: Textile
8413	Jackets and blazers	0.769545	0.824178	0.000323	Q_Mark	Low Tech: Textile
5741	Polyacetals and other polyethers	0.767969	0.82249	0.001313	Q_Mark	Medium Tech: Process
8441	Overcoats, car coats, capes, cloaks, anoraks (including ski jackets), windcheaters, wind jackets and similar articles	0.766725	0.821158	0.000555	Q_Mark	Low Tech: Textile
6968	Knives with cutting blades, serrated or not (including pruning knives)	0.765484	0.819828	0.000163	Q_Mark	Low Tech: Other
5815	Tubes, pipes and hoses, not reinforced or otherwise combined with other materials, with fittings	0.764976	0.819284	0.000197	Q_Mark	Medium Tech: Process
5236	Phosphinates (hypophosphites), phosphonates (phosphites), phosphates and polyphosphates	0.764482	0.818755	0.000239	Q_Mark	Resource Based:Other
6572	Non-wovens, whether or not impregnated, coated, covered or laminated, n.e.s.	0.756533	0.810242	0.000862	Q_Mark	Low Tech: Textile
7937	Tugs and pusher craft	0.755421	0.809051	0.001518	Q_Mark	Medium Tech: Engineer

Source: calculations done by author using trade statistics of UN Comtrade.

Table A13

Density (average proximity) of highest world share products to Poland's export structure

Com Code	Commodity Name	World Sec Shares	RCA PL	Prox PL 2015	Prox PL 1995	Tech Class	BCG Class
1	2	3	4	5	6	7	8
8211	Seats (other than those of heading 872.4), whether or not convertible into beds, and parts thereof	0.4223	6.2769	0.5077	0.4213	Low Tech: Other	Star
7731	Insulated (including enamelled or anodized) wire, cable (including co-axial cable) and other insulated electric conductors	0.6611	2.0009	0.5002	0.4196	Medium Tech: Engineer.	Star
8215	Furniture, n.e.s., of wood	0.2892	4.4038	0.4870	0.4154	Low Tech: Other	Cash Cow
8931	Articles for the conveyance or packing of goods, of plastics; stoppers, lids, caps and other closures, of plastics	0.2896	2.2776	0.4856	0.3414	Low Tech: Other	Star
484	Bread, pastry, cakes, biscuits and other bakers' wares	0.1835	3.3771	0.4848	0.3869	Resource Based: Agro	Star
6911	Structures and parts of structures	0.2996	3.1556	0.4842	0.3859	Low Tech: Other	Star
6251	Tyres, pneumatic, new, of a kind used on motor cars	0.2309	2.6035	0.4793	0.3788	Resource Based: Agro	Star
6996	Articles of iron or steel, n.e.s.	0.3184	2.4553	0.4775	0.3955	Low Tech: Other	Star
5542	Organic surface-active agents (other than soap)	0.1896	2.5554	0.4755	0.3796	Medium Tech: Process	Star
7611	Television receivers, colour	0.4713	5.4385	0.4747	0.2676	High Tech: Electronic	Cash Cow
412	Other wheat (including spelt) and meslin, unmilled	0.2279	1.8581	0.4737	0.3362	Primary Products	
7726	Boards, panels (including numerical control panels)	0.3535	1.2071	0.4734	0.2578	Medium Tech: Engineer.	Star
6842	Aluminium and aluminium alloys, worked	0.3919	1.0389	0.4731	0.3503	Primary Products	Cash Cow
989	Food preparations, n.e.s.	0.3647	1.7128	0.4698	0.3044	Resource Based: Agro	Star
6841	Aluminium and aluminium alloys, unwrought	0.2440	1.1201	0.4677	0.3859	Primary Products	Cash Cow
8939	Articles of plastics, n.e.s.	0.3927	1.8429	0.4666	0.2746	Low Tech: Other	Star
8942	Children's toys	0.2017	1.0113	0.4641	0.3087	Low Tech: Other	Star
5822	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforce	0.3158	1.4220	0.4635	0.2849	Medium Tech: Process	Cash Cow
7139	Parts, n.e.s, for the internal combustion piston engines of subgroups 713.2, 713.3 and 713.8	0.4064	1.8706	0.4631	0.2357	Medium Tech: Engineer.	Cash Cow

8131	Lamps and lighting fittings (including searchlights and spotlights), n.e.s.	0.3117	1.0240	0.4613	0.4141	Medium Tech: Engineer.	Star
7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	2.1788	2.3449	0.4593	0.2553	Medium Tech: Automotive	Cash Cow
6991	Locksmiths' wares, safes, strongboxes, etc., and hardware, n.e.s., of base metal	0.2676	1.7925	0.4553	0.3020	Low Tech: Other	Star
7758	Electrothermic appliances, n.e.s.	0.2527	2.1993	0.4520	0.3068	Medium Tech: Engineer.	Star
579	Fruit, fresh or dried, n.e.s.	0.1846	0.6166	0.4476	0.3832	Primary Products	
5532	Beauty or make-up preparations for the care of the skin (other than medicaments)	0.2550	2.2564	0.4438	0.2985	Medium Tech: Process	Star
7783	Electrical equipment, n.e.s., for internal combustion engines and vehicles; parts thereof	0.2725	1.8864	0.4401	0.2762	High Tech: Electronic	Star
7728	Parts suitable for use solely or principally with the apparatus falling within subgroups 772.4, 772.5 and 772.6	0.2150	1.1988	0.4399	0.2332	Medium Tech: Engineer.	Star
6417	Paper, paperboard, cellulose wadding and webs of cellulose fibres	0.1846	2.2591	0.4360	0.2696	Resource Based: Agro	Cash Cow
7821	Motor vehicles for the transport of goods	0.6895	1.2306	0.4343	0.2565	Medium Tech: Automotive	Cash Cow
7781	Batteries and electric accumulators, and parts thereof	0.2773	1.3726	0.4339	0.3226	High Tech: Electronic	Star
7478	Taps, cocks, valves and similar appliances, n.e.s.	0.3262	1.0075	0.4337	0.3077	Medium Tech: Engineer.	Star
813	Oilcake and other solid residues	0.1795	0.5757	0.4322	0.2598	Primary Products	Question Mark
7638	Sound-recording and other sound-reproducing apparatus; video-recording or reproducing apparatus	0.2636	1.0408	0.4301	0.2208	Medium Tech: Engineer.	Cash Cow
6821	Copper, refined and unrefined; copper anodes for electrolytic refining	0.3152	2.7271	0.4280	0.3852	Primary Products	Star
8414	Trousers, bib and brace overalls, breeches and shorts	0.1998	0.9402	0.4259	0.4341	Low Tech: Textile	Dog
8514	Other footwear with uppers of leather or composition leather	0.3009	0.6737	0.4247	0.4257	Low Tech: Textile	Dog
8454	T-shirts, singlets and other vests, knitted or crocheted	0.2529	0.7767	0.4240	0.3987	Low Tech: Textile	Question Mark
5429	Medicaments, n.e.s.	1.9103	0.6871	0.4225	0.3569	High Tech: Other	Question Mark
7523	Digital processing units, whether or not presented with the rest of a system	0.3937	3.4894	0.4189	0.1964	High Tech: Electronic	Cash Cow
7431	Air or vacuum pumps, air or other gas compressors, ventilating or recycling hoods	0.2483	1.2387	0.4178	0.2432	Medium Tech: Engineer.	Star

Table 13A, cont.

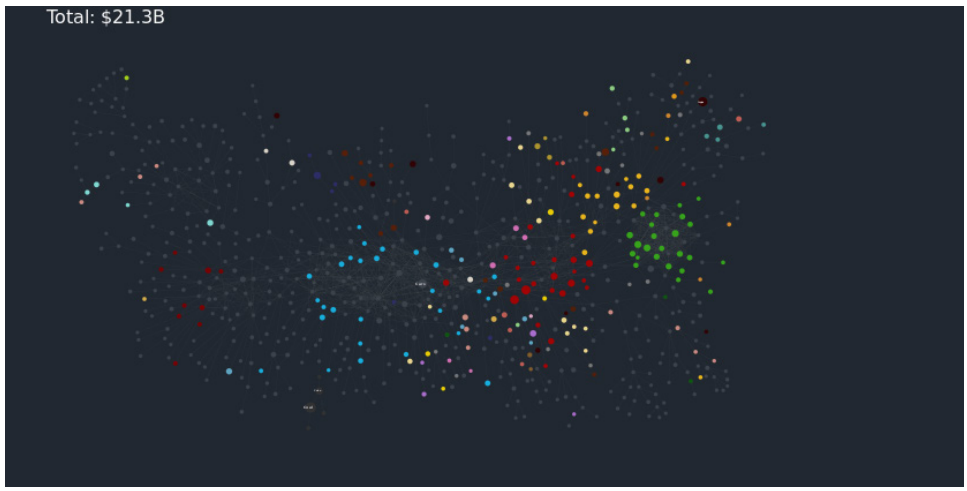
1	2	3	4	5	6	7	8
1124	Spirits; liqueurs and other spirituous beverages	0.2160	0.4251	0.4142	0.3429	Resource Based: Agro	Question Mark
7132	Internal combustion piston engines for propelling vehicles	0.4261	3.2400	0.4136	0.2440	Medium Tech: Engineer.	Cash Cow
8453	Jerseys, pullovers, cardigans, waistcoats and similar articles, knitted or crocheted	0.2763	0.7907	0.4133	0.4241	Low Tech: Textile	Dog
5711	Polyethylene	0.2790	0.8470	0.4129	0.3378	Medium Tech: Process	Dog
7415	Air-conditioning machines comprising a motor-driven fan and elements for changing the temperature and humidity	0.2330	0.7863	0.4105	0.2096	Medium Tech: Engineer.	Question Mark
7832	Road tractors for semi-trailers	0.2156	1.6352	0.4101	0.2382	Medium Tech: Automotive	Star
7812	Motor vehicles for the transport of persons, n.e.s.	4.5074	0.7404	0.4076	0.2555	Medium Tech: Automotive	Dog
7932	Ships, boats and other vessels (other than pleasure craft, tugs, pusher craft, special-purpose vessels and vessels for breaking up)	0.4909	5.2648	0.4057	0.3938	High Tech: Other	Cash Cow
7725	Electrical apparatus for switching or protecting electrical circuits	0.5820	0.8449	0.4053	0.2920	Medium Tech: Engineer.	Dog
1121	Wine from fresh grapes	0.2383	0.0146	0.4043	0.3657	Resource Based: Agro	Dog
7436	Filtering or purifying machinery and apparatus, for liquids or gases	0.2801	0.9948	0.4037	0.2604	Medium Tech: Engineer.	Question Mark
5986	Organic chemical products, n.e.s.	0.1893	1.3088	0.4009	0.2508	Medium Tech: Process	Star
8442	Suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts	0.2083	0.8468	0.4001	0.4109	Low Tech: Textile	Question Mark
7149	Parts of the engines and motors of heading 714.41 and subgroup 714.8	0.4158	1.7128	0.3877	0.2210	Medium Tech: Engineer.	Cash Cow
3330	Petroleum oils and oils obtained from bituminous minerals, crude	3.5530	0.0137	0.3876	0.3384	Primary Products	Dog
8746	Automatic regulating or controlling instruments and apparatus	0.2091	0.7894	0.3868	0.2497	High Tech: Other	Dog
8513	Footwear, n.e.s., with outer soles and uppers of rubber or plastics	0.1951	0.7725	0.3857	0.3066	Low Tech: Textile	Question Mark
2831	Copper ores and concentrates	0.2474	0.0000	0.3837	0.3240	Resource Based: Other	Question Mark
7929	Parts, n.e.s. (not including tyres, engines and electrical parts), of the goods of group 792	0.5517	0.4461	0.3823	0.2373	High Tech: Other	Question Mark
5751	Polymers of propylene or of other olefins	0.2278	0.7052	0.3809	0.3137	Medium Tech: Process	Question Mark

2222	Soya beans	0.2813	0.0014	0.3804	0.2176	Primary Products	Question Mark
7712	Other electric power machinery; parts of the electric power machinery of group 771	0.4575	0.9243	0.3763	0.2701	High Tech: Electronic	Question Mark
6942	Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter pins, washers	0.2069	0.8850	0.3697	0.3243	Low Tech: Other	Question Mark
7232	Mechanical shovels, excavators and shovel-loaders, self-propelled	0.1791	0.3124	0.3696	0.2394	Medium Tech: Engineer.	Dog
8722	Instruments and appliances used in medical, surgical or veterinary sciences	0.5437	0.5313	0.3669	0.2534	Medium Tech: Engineer.	Question Mark
5989	Chemical products and preparations, n.e.s.	0.3373	0.8285	0.3656	0.2557	Medium Tech: Process	Question Mark
3432	Natural gas, in the gaseous state	0.7259	0.0000	0.3652	0.2570	Primary Products	
7788	Electrical machinery and equipment, n.e.s.	0.2743	0.5637	0.3649	0.2205	High Tech: Electronic	Dog
7285	Parts, n.e.s., of the machines and mechanical appliances of headings 723.48, 727.21 and 728.41 through 728.49	0.2706	0.3161	0.3589	0.2224	Medium Tech: Engineer.	Question Mark
6956	Knives and cutting blades, for machines or for mechanical appliances	0.1907	0.4582	0.3582	0.2569	Low Tech: Other	Dog
7452	Dishwashing machines (other than household-type)	0.1812	0.5122	0.3484	0.2244	Medium Tech: Engineer.	Dog
7239	Parts, n.e.s., of the machinery of group 723	0.2610	0.8854	0.3467	0.3605	Medium Tech: Engineer.	Dog
5416	Glycosides; glands or other organs and their extracts	0.9558	0.1114	0.3454	0.2593	High Tech: Other	Question Mark
8973	Jewellery of gold, silver or platinum group metals	0.6798	0.0383	0.3400	0.2837	Low Tech: Other	Question Mark
8996	Orthopaedic appliances (including crutches, surgical belts and trusses)	0.3449	0.5470	0.3398	0.2347	Low Tech: Other	Question Mark
5422	Medicaments containing hormones or other products of subgroup 541.5	0.3115	0.1886	0.3384	0.3025	High Tech: Other	Question Mark
8742	Drawing, marking-out or mathematical calculating instruments	0.2671	0.2006	0.3382	0.2306	High Tech: Other	Question Mark
7527	Storage units, whether or not presented with the rest of a system	0.3867	0.4832	0.3377	0.1825	High Tech: Electronic	Dog
7935	Light vessels, fire-floats, dredgers, floating cranes, and other	0.2043	0.1286	0.3374	0.2889	High Tech: Other	Question Mark
7643	Transmission apparatus for radio-telephony, radio-telegraphy, radio-broadcasting or television	1.3839	0.5463	0.3371	0.2312	High Tech: Electronic	Dog
7522	Digital automatic data-processing machines	0.7863	0.2803	0.3331	0.2061	High Tech: Electronic	Question Mark
7642	Microphones and stands therefor; loudspeakers	0.1845	0.6443	0.3289	0.2744	High Tech: Electronic	Question Mark

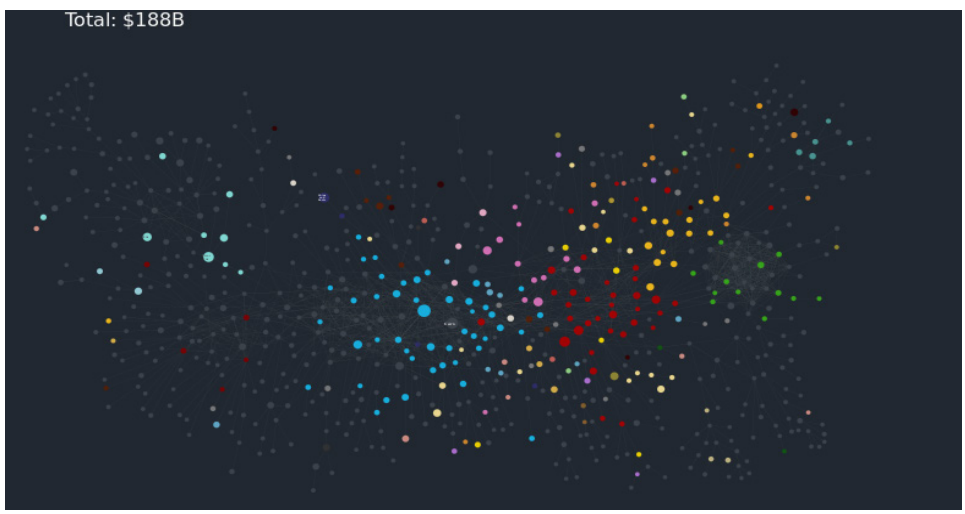
Table 13A, cont.

1	2	3	4	5	6	7	8
7649	Parts and accessories suitable for use solely or principally with the apparatus of division 76	1.1292	0.6578	0.3274	0.2838	High Tech: Electronic	Dog
2815	Iron ore and concentrates, not agglomerated	0.2955	0.0015	0.3233	0.2718	Resource Based: Other	Question Mark
7284	Machinery and mechanical appliances specialized for particular industries, n.e.s.	0.7024	0.4993	0.3223	0.1926	Medium Tech: Engineer.	Question Mark
7787	Electrical machines and apparatus, having individual functions, n.e.s.; parts thereof	0.2530	0.7511	0.3193	0.2176	High Tech: Electronic	Dog
8744	Instruments and apparatus for physical or chemical analysis	0.2622	0.5419	0.3176	0.1903	High Tech: Other	Question Mark
7924	Aeroplanes and other aircraft, mechanically-propelled (other than helicopters), of an unladen weight exceeding 15,000 kg	0.8403	0.1778	0.3173	0.2190	High Tech: Other	Question Mark
7722	Printed circuits	0.2619	0.0767	0.3104	0.2834	Medium Tech: Engineer.	Dog
6672	Diamonds (other than sorted industrial diamonds)	0.7819	0.0016	0.2982	0.2328	Resource Based: Other	Dog
7599	Parts and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with the machines of subgroups 751.1, 751.2, 751.9 and group 752	0.6892	0.3993	0.2917	0.2203	High Tech: Electronic	Dog
3212	Other coal	0.3958	0.9423	0.2897	0.3647	Primary Products	Question Mark
5157	Other heterocyclic compounds; nucleic acids	0.5218	0.1125	0.2879	0.2419	High Tech: Other	Dog
7144	Reaction engines	0.2276	0.0641	0.2871	0.2320	Medium Tech: Engineer.	Dog
5112	Cyclic hydrocarbons	0.2209	0.3936	0.2821	0.2775	Resource Based: Other	Dog
7513	Photocopying apparatus incorporating an optical system or of the contact type, and thermocopying apparatus	0.2070	0.1999	0.2723	0.2263	High Tech: Electronic	Question Mark
3431	Natural gas, liquefied	0.5986	0.0000	0.2693	0.2301	Primary Products	
7764	Electronic integrated circuits and microassemblies	2.8211	0.0610	0.2504	0.1954	High Tech: Electronic	Question Mark
8719	Liquid crystal devices, n.e.s.; lasers (other than laser diodes); other optical appliances and instruments, n.e.s.	0.4804	0.0107	0.2487	0.2074	High Tech: Other	Question Mark
7763	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices	0.5622	0.4021	0.2463	0.2168	High Tech: Electronic	Question Mark

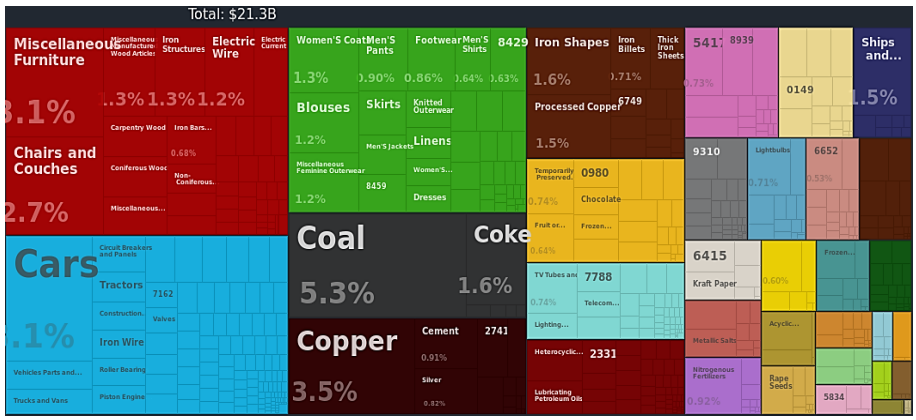
Source: calculations done by author using trade statistics of UN Comtrade.



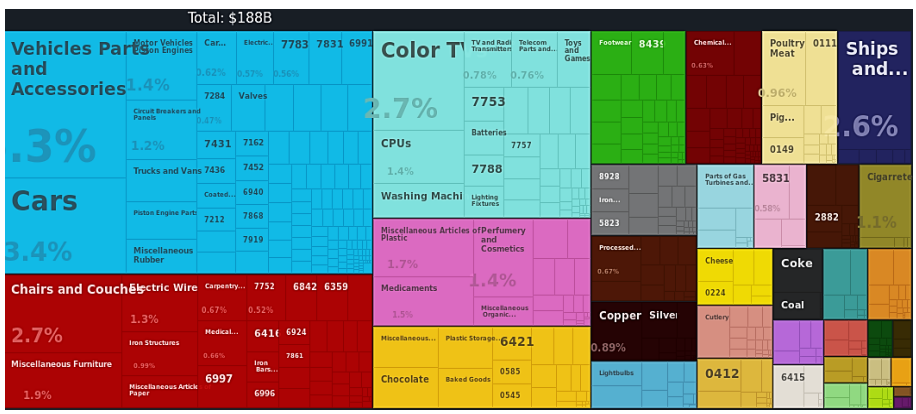
Graph A1. Poland's export structure in product space (1995)
https://atlas.media.mit.edu/en/visualize/network/sitc/export/pol/all/show/1995/



Graph A2. Poland's Export Structure in Product Space (2015)
https://atlas.media.mit.edu/en/visualize/network/sitc/export/pol/all/show/2015/



Graph A3. Tree map of Poland's export structure (1995)
https://atlas.media.mit.edu/en/visualize/tree_map/sitc/export/pol/all/show/1995/



Graph A4. Tree map of Poland's export structure (2015)
https://atlas.media.mit.edu/en/visualize/tree_map/sitc/export/pol/all/show/2015/