

САЯСИ ҒЫЛЫМДАР
ПОЛИТИЧЕСКИЕ НАУКИ
POLITICAL SCIENCE



ГРНТИ 11.09

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Export Diversification in Kazakhstan: Structural Change of Exports from 1995 to 2015

Abstract. The principle objective of this study is to reveal the dynamics of the change in export diversification over the period from 1995 to 2015. The analysis is based on export data at SITC two-digit, three-digit and four-digit industrial disaggregation. In order to measure the export diversification Herfindahl-Hirschman, Ogive, Shannon and absolute Gini indices were used. The results suggest that the levels of export concentration were rising together with the share of oil exports in total exports during 1995-2015. However, the results show that during the period from 1995 to 2005 the exports of Kazakhstan were concentrating much faster than during the rest of the sample period.

Keywords. Diversification, concentration, oil exports, indices, industrialization, structural change

Introduction. In recent years, the issue of export diversification has received significant interest in the context of economic policy making. The term “export diversification” basically means increasing the variety of exported goods in order to decrease the degree of dependence from a small number of sources of export income. One of the most precise definitions of export diversification would be expressed as not specializing exports in a limited number of export commodities, as pointed out by [1]. For countries that specialize in a small range of export goods uncertainties of commodity prices create additional risks for economic growth.

The issue of export diversification became a subject of intense academic discussion and research since 1950s. For instance, it has been found that concentration in the exports of primary commodities leads to deteriorating terms of trade and slowdown in economic growth [2 and 3]. According to many studies, export diversification is linked to per capita income [4, 5]. Some analysis showed that not only export growth led to economic growth, but export composition also mattered [6]. Particularly, more diversified exports lead to higher per capita income. Over a long period of time, the price of non-processed goods with low value added would decrease relative to the price of manufactured goods with high value added, thus impoverishing the country exporting them [7]. Shifts in exports towards higher value-added activities lead to higher economic growth in the future [8].

The issue of export diversification in Kazakhstan has become of major importance during the last two decades as the share of oil grew from around 20% in 1995 to over 70% in 2007 becoming the far most dominant export commodity. During the last 10-15 years the policy of the government of Kazakhstan concerning the domestic economy has been shaped in accordance with the objectives of top priority that consisted in supporting non-oil sector of the economy. Kazakhstan’s economy mostly depends very much on revenues that come from oil and gas exports, which currently account for about 75-80% of its total exports. Therefore, in the recent years the diversification of industry and exports has been one of the principle priorities of the economic policy of Kazakhstan through many ways. The level of success of the government measures has been changing from year to year depending on various reasons. The resource-based model of the economic growth itself was in fact effective in early 2000s generating huge flows of

export revenues. However, by mid 2000s it became clear that this model was making the economy more prone to external economic volatilities. However, real active industrial policy measures were taken by the government after the crisis of 2008 [9].

The purpose of this study is to reveal the dynamics of the export diversification during the period from 1995 to 2015. The main difference of this study from others made on related issues is that it provides a precise assessment of the degree of export concentration or diversification. In order to measure the export diversification apply Herfindalh-Hirschman, Ogive, Shannon and absolute Gini indices.

Literature Review. The literature on issues of diversification of the economy and exports in Kazakhstan is abundant. The share of mineral products in the exports of Kazakhstan is overwhelming never accounting less than 65.8% [10].

However, there are very few studies, which shows the changes in export concentration or diversification in Kazakhstan within a certain period of time. Increasing export specialization of Kazakhstan during the last two decades seems to be clear. There is a sharp increase in the share of primary commodities in total exports since early 2000s. Particularly, Kazakhstan became an oil exporting country. Although this change certainly has its pros and cons. On the one hand, increasing export revenues generated very high rates of economic growth [9]. On the other hand, it made the whole economy more prone to sector-specific shocks. However, the dynamics and change of export diversification or concentration is still a largely unexplored question.

Similar studies are available for different countries. For instance, exports of Algeria and Saudi Arabia became more concentrated since 1990s whereas its opposite side Kuwait and Oman became more diversified [11]. They also found that extreme export concentration hindered economic growth and that is why effect of trade liberalization on export diversification was not only different but also complex in selected MENA countries.

The model of economic growth of the Kazakhstan was based on natural resource exports. Although the measures of the government taken after 2010 only laid to solid foundation for upcoming stages of industrialization but the real transformation were still to be achieved [9]. In autocracies, trade openness leads to exports specialization, whilst in democracies it leads to export diversification through export sophistication [12]. Improved trade liberalization enhances export diversification in developing countries.

The issue of export diversification is highly relevant for resource rich developing countries [5]. There is a number of studies that reveal the link between export diversification and economic growth. One of the most compelling studies made on data from 34 countries for the period from 1984 to 1997 confirms the statement that a 10 per cent boost in export diversity in all industries resulted in 1.3 per cent growth in a country's productivity [14]. An analysis, which included 30 semi-industrialized developing economies during 1965–1984, revealed that higher proportions of manufactured goods in exports might lead to positive and considerable impact on economic growth [15]. The positive relationship between economic growth and export diversification was presented in studies which were based on the examples of the Latin American [16]. Particularly, significantly high economic growth was reached through export diversification in Chile, Colombia, Bolivia, Uruguay and Paraguay. The link between export diversification and economic growth was confirmed for Spain between 1961 and 2000 [17]. Similar evidence has been for Cameroon [18]. A study on selected countries find that export diversification has significant positive effect on economic growth [19].

Methodology and Data. In order to measure diversification of exports this study uses four widely used indices. The Herfindahl-Hirschman Index [20, 21] used in numerous studies [22 and 23] can be expressed as $HH = \left[\sum_{i=1}^n (e_i/e)^2 \right]$, where e_i is exports of industry i while e is total exports and n is the total number of industries. It is one of the widely used indexes in the study of specialization. It is very simplistic and without sophisticated mathematical operations, it adequately captures an absolute export specialization. Basically, HH index takes the sum of each industry's share in total exports raised to second power. Thus, countries that have industries equally represented in its total exports will have the minimum HH index value. It is not a strict law that it should be raised to second power. In fact, it depends on the equality tolerance of a researcher. If it is necessary to emphasize even a negligibly small deviation from the condition of the absolute equal distribution it is also accepted to raise it to the third power. Its minimum value depends on the number of industries: the more industries the smaller the minimum value is. Consequently, it reaches its maximum value, which is always equal to one if a particular industry

represents 100% of total exports. HH Index is one of the most straightforward ways of measuring the absolute diversity.

The Ogive Index is another widely used index that measures diversity and has the following mathematical expression: $O = \sum_{i=1}^n [e_i/e - 1/n]^2 / (1/n)$. For the first time it was used to measure economic diversity [24]. There are several previous studies in which the Ogive Index was used in the context of a country specialization [25, 26 and 27]. The index analyzes export diversification using equal distribution of industries in total exports as a benchmark. The Ogive Index treats each industry equally not taking into account its relative size. Therefore in case of a large variance of the relative sizes of industries the Ogive Index tends to overestimate the diversity. Another disadvantage of the Ogive Index is that it is not decomposable.

The Shannon Index [34], which is sometimes called Theil entropy index, has the following mathematical expression: $S = -\sum_{i=1}^n (e_i/e) \ln(e_i/e)$. It is one of the entropy indices used to measure inequalities in income distribution [28, 98 срп]. The SEI is expressed as the negative sum of shares of industries in total exports multiplied by the natural logarithm of shares of each single industry i . Due to the logarithm, unlike HHI the Shannon Index reduces the relative weights of large industries. This also makes it an inverse measure of specialization so that decreasing specialization leads to higher index. The Shannon Entropy Index is independent of the ordering of industries and it is decomposable.

Gini Index can be expressed in a following way: $G = 1 - \sum_{i=1}^n e_i/e (e_i/e)^{n-1} + e_i/e (1/n)^{n-1}$. Gini Index is one of the most commonly used techniques of measuring specialization [29]. It has a vast area of application even outside economics. It is traditionally used to measure various types of inequalities of distribution. This index was then adapted to concentration and specialization [30, 32-33 срп.]. In our case we use Absolute Gini Index. In order to measure the Gini Index the relative shares of industries are ranked in ascending order for obtaining the Lorenz curve. In case of an the absolute Gini Index the perfect diversification benchmark is $1/n$. Hence, the ordering would be $e_i/n > e_{(i-1)}/n$. The Lorenz curve is obtained through ordering the progressive totals of $1/n$ on x-axis and ordering the progressive totals of e_i and connecting the points. The Gini Index shows the difference between existing distribution of exports and equal distribution of exports across industries. The minimum value of the Gini Index is reached when the shares of industries in total exports are equal. In this case the Lorenz curve would be a 45 degree line. The maximum value of the Gini Index would be $(n-1)/n$ converging towards 1. The absolute Gini Index is not decomposable. The four above mentioned indices are widely known and often used techniques of measuring diversification, concentration, specialization, distribution inequalities etc. There are a number of alternative indices and measurement techniques used for the same purpose, such as the Export Diversification [4 and 8]. The choice of an index often depends on the context of research, data availability or is a matter of preference.

Table 1 (Source: Comtrade)

Table 3: Top ten largest industries in exports in 1995, 2005 and 2015 at four-digit level of SITC disaggregation.

1995			2005			2015		
SITC code	Industry	% share	SITC code	Industry	% share	SITC code	Industry	% share
7192	Pumps and centrifuges	2.4	6748	Oth. Coated iron or steel plates etc under 3 mm	1.0	6811	Silver, unworked or partly worked	1.1
6861	Zinc and zinc alloys, unwrought	3.1	6861	Zinc and zinc alloys, unwrought	1.1	0460	Meal and flour of wheat or of meslin	1.1
6831	Nickel and nickel alloys, unwrought	3.3	5136	Other inorganic bases and metallic oxides	1.5	6861	Zinc and zinc alloys, unwrought	1.3
5136	Other inorganic bases and metallic oxides	4.4	3214	Coal /anthracite, bituminous/	1.6	0410	Wheat and meslin, unmilled	1.5
6713	Iron and steel powders, - shot and sponge	4.5	2813	Iron ore & concentrates ex roasted iron pyrites	2.3	6715	Other ferro alloys	3.0
0410	Wheat and meslin, unmilled	5.0	3411	Gas, natural	2.5	9310	Special transactions	3.5
6714	Ferro manganese	6.9	9310	Special transactions	3.3	6821	Copper and alloys, unwrought	4.3
3214	Coal /anthracite, bituminous/	7.7	6715	Other ferro alloys	3.5	5151	Radioactive chem.elements & isotopes/comp.&mix.	5.1

6821	Copper and alloys, unwrought	12.5	6821	Copper and alloys, unwrought	5.4	3411	Gas, natural	5.2
3310	Petroleum, crude & partly refined	17.2	3310	Petroleum, crude & partly refined	62.9	3310	Petroleum, crude & partly refined	58.5

This analysis uses export data of Kazakhstan from the UN Comtrade Database for the 21-years period from 1995 to 2015 in SITC (Standard International Trade Classification) for analysis of export diversification. These data on industries are taken at three disaggregation levels: at the two, three and four digit levels. The numbers of industries involved in exports of Kazakhstan at each level of SITC disaggregation are shown in Table 1. Thus, at the two-digit level the number of industries range from 54 to 93, at the three digit level it is between 162 and 171 and at the four-digit level there are 409-500 industries. Data are taken from different SITC revisions due to availability limitations. However, the third revision was chosen whenever it was possible. Thus, over 90% of export data are taken from the four-digit disaggregation level.

Table 2 (Source: Comtrade)

	Two-digit	Three-digit	Four-digit
1995	93	165	450
1996	93	169	465
1997	56	168	451
1998	55	166	409
1999	57	167	428
2000	57	168	477
2001	57	166	468
2002	56	164	460
2003	55	165	460
2004	55	166	477
2005	54	162	473
2006	55	162	470
2007	54	165	474
2008	57	167	475
2009	56	166	472
2010	56	170	478
2011	58	170	497
2012	57	171	487
2013	58	171	494
2014	58	170	500
2015	58	170	500

Analysis and Findings. The results of the calculations are presented in Figure 1. As it can be seen the HH Index shows a clear ascending trend suggesting a rapid shift of the exports towards more concentration and less diversification throughout the period from 1995 to 2015 at all two, three and four-digit levels. Moreover, the trends of the curves on all three levels coincide with each other. However, the pattern of the HH Index is not stable throughout the sample period. The curve has a steep ascending trend between 1995 and 2005. During the period that follows after 2005 the HH Index still has an ascending trend but with considerable variations. The maximum values of the HH Index at the three levels of industrial disaggregation correspond to 2013. Interestingly, in 2015 the HH Index decreased significantly. The fluctuations of the HH Index in all three levels of industrial disaggregation coincide with the share oil in the exports of Kazakhstan. Particularly,

in SITC classification these industries are 33: Petroleum and petroleum products, 331: Petroleum, crude and partly refined and 3310: Petroleum, crude & partly refined.

Table 3 (Source: Prepared by Authors based on data from Comtrade)

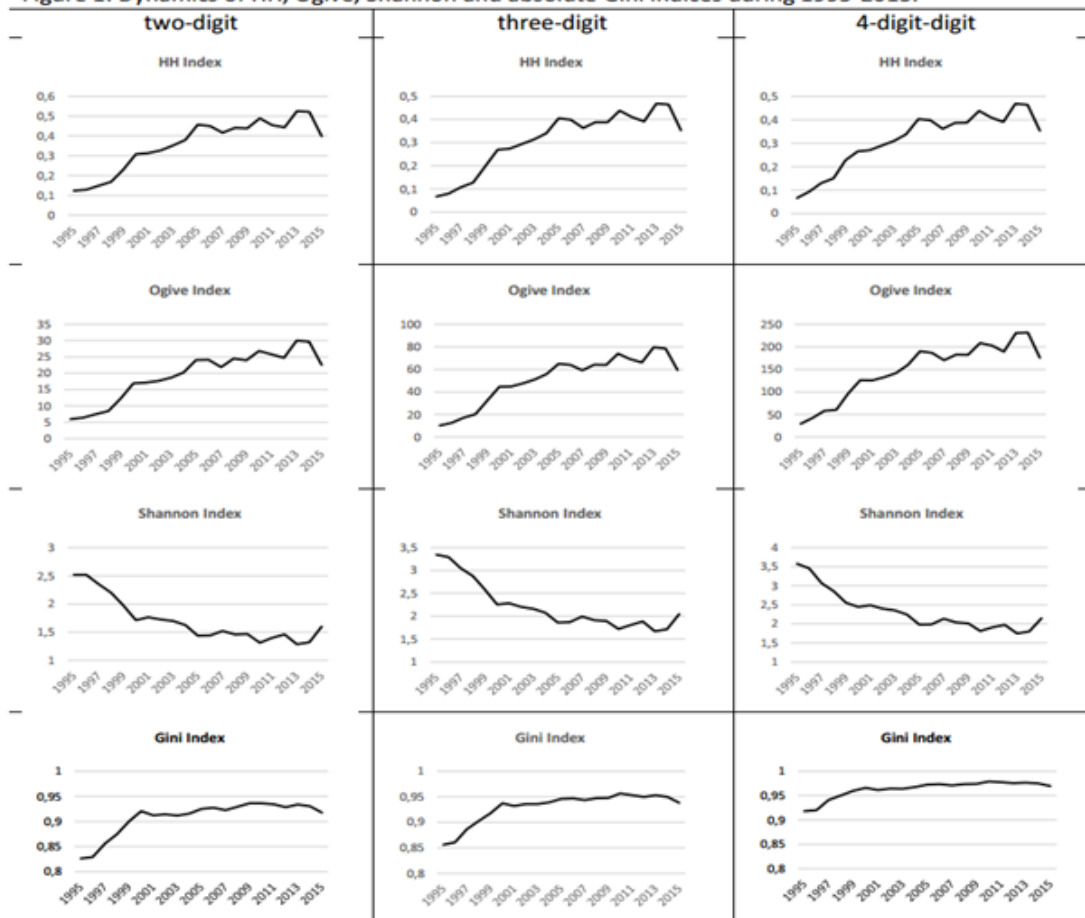
Table 2: Values of HH, Ogive, Shannon and absolute Gini indices during 1995-2015.

Year	Two-digit				Three-digit				Four-digit			
	HH	Ogive	Shann	Gini	HH	Ogive	Shannon	Gini	HH	Ogive	Shann	Gini
1995	0,124	5,923	2,519	0,779	0,067	10,117	3,348	0,620	0,067	29,047	3,578	0,735
1996	0,129	6,358	2,518	0,577	0,080	12,644	3,291	0,641	0,093	42,449	3,454	0,750
1997	0,149	7,475	2,354	0,644	0,107	17,116	3,051	0,705	0,130	57,846	3,070	0,814
1998	0,169	8,446	2,200	0,694	0,128	20,297	2,879	0,742	0,150	60,401	2,854	0,946
1999	0,230	12,357	1,976	0,910	0,199	32,365	2,583	0,780	0,228	96,648	2,553	0,870
2000	0,308	16,885	1,715	0,791	0,270	44,547	2,255	0,826	0,266	125,979	2,444	0,892
2001	0,313	17,126	1,767	0,769	0,274	44,773	2,281	0,817	0,270	125,709	2,489	0,882
2002	0,327	17,654	1,725	0,787	0,294	47,555	2,202	0,824	0,290	132,674	2,400	0,886
2003	0,351	18,667	1,699	0,775	0,314	51,127	2,158	0,822	0,310	142,015	2,352	0,880
2004	0,379	20,250	1,628	0,795	0,341	55,892	2,075	0,836	0,338	160,669	2,241	0,894
2005	0,456	24,094	1,437	0,813	0,405	64,956	1,861	0,850	0,404	190,333	1,976	0,972
2006	0,449	24,167	1,442	0,824	0,399	64,038	1,869	0,852	0,398	186,349	1,983	0,973
2007	0,415	21,843	1,521	0,806	0,363	59,193	1,994	0,843	0,361	170,396	2,136	0,971
2008	0,440	24,526	1,463	0,953	0,388	64,177	1,913	0,847	0,387	182,998	2,041	0,973
2009	0,438	23,959	1,469	0,835	0,389	63,881	1,896	0,850	0,387	182,254	2,010	0,973
2010	0,488	26,843	1,314	0,835	0,438	73,903	1,719	0,878	0,437	208,440	1,811	0,978
2011	0,455	25,819	1,401	0,831	0,410	69,099	1,807	0,871	0,409	202,759	1,906	0,973
2012	0,443	24,720	1,458	0,819	0,391	66,223	1,887	0,865	0,390	189,472	1,974	0,963
2013	0,525	29,980	1,288	0,830	0,469	79,584	1,673	0,868	0,468	230,743	1,750	0,974
2014	0,521	29,721	1,319	0,821	0,465	78,457	1,712	0,861	0,464	231,586	1,800	0,971
2015	0,399	22,531	1,599	0,789	0,353	59,434	2,050	0,832	0,353	175,886	2,145	0,903

The dynamics of the Ogive index is also presented in Figure 1. Its fluctuations match with those of the HH index. Between 1995 and 2005, the Ogive index shows a clear upsloping change at all three levels of industrial disaggregation. Between 2005 and 2012, the growth of the Ogive index is moderate. The rise of the index in 2013 is followed by its decrease in 2015. Similar to the HH index, the change of the Ogive index during the sample period is the same at all three levels of industrial disaggregation. Moreover, the change of the Ogive index throughout the given period of time coincides with the change of the share of the oil industry in the total exports of Kazakhstan.

The change of the Shannon index throughout the sample period is also shown in Figure 1. Recall that the Shannon index is an index of diversification. The higher values of the index indicate higher degrees of diversification in exports and lower values of the index mean higher concentration in exports. Amazingly, the pattern of change of the Shannon index reveals the same logic suggested by the HH and Ogive indices. The period from 1995 to 2005 is marked by rapidly decreasing diversification. By 2014, the downward sloping movement slows down and turns upward in 2015.

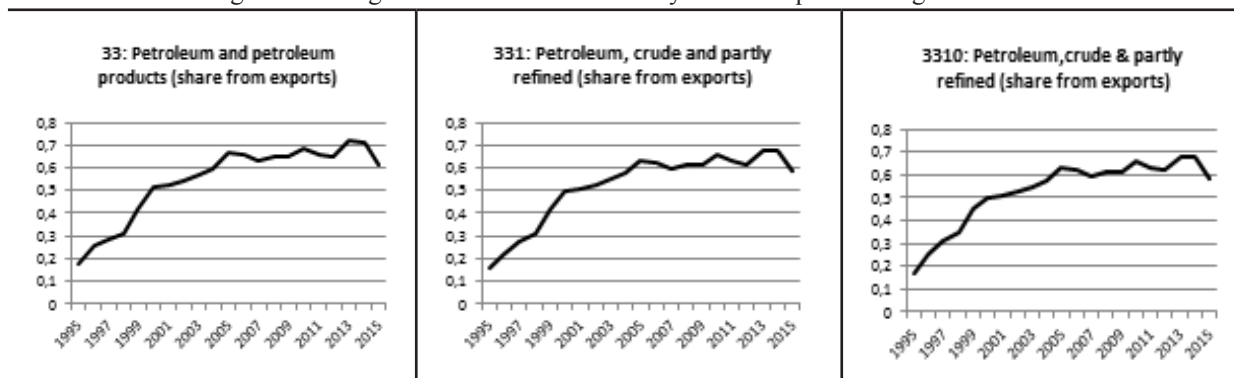
Figure 1: Dynamics of HH, Ogive, Shannon and absolute Gini indices during 1995-2015.



Source: Prepared by Authors based on data from Comtrade

A rather different pattern of change in diversification is presented by the absolute Gini index. It can be seen that the level of export concentration increases with the level of disaggregation. Moreover, unlike in HH, Ogive and Shannon indices the period of a relatively rapid export concentration, according to the Gini index, corresponds to 1995-2000 as it can be seen from Figure 1. During the whole subsequent period until 2015 the Gini index registers a rather insignificant increment in export concentration. The complete set of values of all four indices for each year is shown in Table 2.

Figure 2: Change of the share of oil industry in total exports during 1995-2015



Source: Prepared by Authors based on data from Comtrade

All the facts mentioned above indicate that the exports of Kazakhstan became more concentrated and less diversified during the period from 1995 to 2015. The export concentration process happened largely due to the increase of the share of the oil industry in the exports. Moreover as it can be found in Table 3, many other big industries represented in exports are also extractive industries, metallurgy or agriculture. More than 80% of all exports are still represented only by these industries with low value added capacity. In general terms, the dynamics of the structure of exports during 1995-2015 show that the economic policy of export diversification still falls short of desired results.

It is interesting to note that all four indices registered a decline in export concentration in 2015, which is most probably due to falling oil prices. In technical terms, this obviously can improve the dynamics of the structure of exports. However, would this be helpful in real terms and enhance the real growth of other non-oil industries with higher value added capacity? The question is of fundamental importance for the economic future of Kazakhstan as it might determine its macroeconomic performance as it does in many developing countries [31] and future economic growth [32]. Meanwhile, the policies aimed at export diversification seem to have little success making the economy weak before instability of export earnings and sector-specific adverse shocks and fluctuations in the oil price change terms of trade.

Concluding Remarks. The main purpose of this study is to reveal the dynamics and degree of export diversification during the period from 1995 to 2015. As measurement tools in this article used four indices, which are the HH, Ogive, Shannon and absolute Gini indices. The calculation are based on SITC two, three and four-digit level industrial disaggregation. The results of the calculations show that during the sample period the exports of Kazakhstan became less diversified and more concentrated rapidly. However, the indices also show that the pace of concentration of the exports was not uniform throughout the sample period. According to the results of the HH, Ogive and Shannon indices, the process of export concentration was considerably faster during 1995-2005. This process slowed down after 2005 and in 2015 there was a considerable decrease in the degree of export concentration. The Gini index shows an intense export concentration during 1995-2000 and moderate export concentration afterwards. On the other hand in 2015 all four indices used in this study registered a notable increase in diversification of exports. The most straightforward explanation for that would be the consequences of low oil prices. If that was true then negative dynamics of the prices in oil market could have certain beneficial effect on export diversification in Kazakhstan [9].

The main factor of export concentration is the growth of oil exports. There has been a tremendous growth of exports of SITC 33: Petroleum and petroleum products, 331: Petroleum, crude and partly refined and 3310: Petroleum, crude & partly refined industries during the sample period. The share of the oil sector in the total exports of Kazakhstan went from below 20% in

1995 to around 70% by 2014. The exports of Kazakhstan are overwhelmingly dominated by the industries with low value added. Thus, practically all top ten largest industries in the total exports of Kazakhstan are other extractive industries, agriculture or metallurgy. The structural changes in the exports of Kazakhstan show patterns contrary to what is pursued politically. During the period of time from 1995 to 2015 the exports of Kazakhstan became overwhelmingly dominated by the oil industry at the expense of manufacturing industries with more value added capacity. Moreover, the top ten largest exports are also mostly represented by extractive industries, metallurgy and agriculture. The revealed pattern raises concerns relative to the measures taken by the government in order to diversify the exports of the national economy. With this reference, it seems even rather plausible that there are certain mechanisms of pressure especially in mineral resource rich countries particularly experience in conducting export diversification policies [33]. However, these questions are beyond the scope of this study and would be a subject of future research in this field.

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Қазақстан экспортының әртараптандырылуы: 1995-2005 жылдары аралығындағы құрылымдық өзгерістер

Аннотация. Бұл мақаланың негізгі мақсаты 1995 жылдан 2015 жылға дейінгі кезең аралығындағы экспортты әртараптандырудың өзгеру динамикасын анықтау болып табылады. Сараптама SITC екі таңбалы, үш