

Exports as a Driving Factor of Structural Changes in the BRICS Economies: 1995 – 2012

Aleš Kocourek

Department of Economics, Faculty of Economics, Technical University of Liberec, Czech Republic

Abstract The aim of this article is to shed some light on the structural changes that have taken place during the last two decades in the five emerging markets forming the BRICS grouping. Author also tends to discuss the consequences of these changes for the grouping as a whole and for its individual members. Individual shares of nine major industries on the value added and on exports of each of the BRICS countries were calculated for each year of the period 1995 – 2012, so that then the methods of time series analysis could be applied. The results show a shift from primary manufacturing and from production of merchandise with low added value, to more sophisticated goods. In agriculture, hunting, forestry, fishing, electricity, gas, and water supplies, transport, storage, communication, public administration, education, health, and other service activities, the driving force of the restructuring is formed by the domestic customers of the five BRICS emerging markets. In the sectors of mining, quarrying, and manufacturing the foreign demand for exports plays a crucial role affecting the output of these industries. Weaker impact of exports was identified also in construction, financial intermediation, real estate, renting, and other business activities.

Keywords BRICS, Export, Gross value added, Industry, Restructuring

1. Introduction

Since 2001, when economic expert of the investment bank Goldman Sachs, Jim O'Neill [12] coined the acronym BRIC for the first time, the rapidly growing countries of the world, Brazil, Russia, India, China, and since 2011 also South Africa, have experienced a dramatic development which can be hardly described as stable or fluent [7]. From more or less a journalistic label with indistinctive common economic content of the potentially world's most successful emerging markets, the BRICS grouping has been continuously transforming itself into one of the most important players in the global policy and economy. Together the five countries represent a quarter of the world area, 40% of the world population, 20% of global GDP, and 16% of the world international trade in goods and services. All the BRICS members are connected by the disappointment from being permanently marginalized within the system of international relations and by their endeavor to transform it (especially the UN Security Council, but also the World Bank Group and the International Monetary Fund) or to rebuild it from the ground (founding a joint development bank, creating a reserve fund for mutual support of the national currencies,

planning a monetary union).

Nevertheless, the BRICS countries represent quite divergent opinions on a number of issues (be it the civil war in Syria, the global climate change, the territorial ruptures between China and India, the fear of South Africa from growing impact of China in the "Black Continent", Chinese economic expansion to Middle East and eastern Russia, Russian political intentions in Ukraine, or growing competition on the global commodity markets).

The aim of this article is to shed some light on the structural changes that have taken place in these five emerging markets during the last two decades and to discuss the consequences of these changes for the grouping as a whole and for its individual members. The focus of this article concentrates on the structure of production and structure of exports. According to Cui and Syed [4], Kojima [8] or Kocourek [5], the BRICS are continuously changing their export orientation from primary manufacturing and from production of merchandise with low added value, to more sophisticated goods. The whole group of the BRICS is gaining new competitive advantages mainly in the sector of machinery and transport equipment, but also in some others. The position of individual countries has been transforming significantly as well: China is gaining and consolidating the export positions mainly in the chemical industry (together with Russia), manufacturing, consumer goods, and of course machinery and transport equipment (together with India). de Vries et al. [19] shows that for China, India and Russia reallocation of labor across sectors is contributing to

* Corresponding author:

ales.kocourek@tul.cz (Aleš Kocourek)

Published online at <http://journal.sapub.org/economics>

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aggregate productivity growth, whereas in Brazil it is not.

The rudimentary issue for this paper is the question of the driving forces leading to these changes. Is the development in the BRICS countries determined by the demand from abroad, the demand for their exports? Or are these transformations induced by the growing domestic demand from the establishing numerous middle class? The relevance of technological spill-over effects (discussed e.g. by Puškárová [13] or Montobbio and Rampa [10]) for the BRICS remains a subject of future research and will not be discussed here.

The fundamental idea is following: If the share of a particular industry on exports of a country develops over time at a higher pace than the share of the industry on the gross value added, the structural change is predominantly driven by exports. If the pace of development of export share is lower or even of an opposite direction, then it must be the domestic demand inducing the structural shift. The influence of taxes and subsidies on individual shares of gross value added are not taken into account here.

The analysis itself is rather straightforward: The shares of each individual industrial sector on the total gross value added were calculated from the national accounts data published by United Nations Statistics Division [16] and the shares of each individual industrial sector on the total value of exports were calculated from the ComTrade statistics of the United Nations Conference on Trade and Development [15]. Since panel data analysis does not seem to provide the proper instruments for reaching the aim of this paper, the calculated shares were in the following steps analyzed using the statistical methods of time series regression analysis.

The results show a significant positive linkage between the structure of gross value added (*GVA*) and the structure of exports (*X*). Especially in the sectors of mining, quarrying, and manufacturing the foreign demand for exports plays a crucial role affecting the output of these industries. Weaker relationships were identified also in construction, financial intermediation, real estate, renting, and other business activities. In agriculture, hunting, forestry, fishing, electricity, gas, and water supplies, transport, storage, communication, public administration, education, health, and other service activities, the domestic customers of the five BRICS emerging markets represent more powerful and important driving factor than the foreign demand for the BRICS exports.

2. Research Methods

There were two major problems identified to be solved before performing the structural analysis of the BRICS itself. First of them was the problem with compatibility of the data, the second one was the question of the best indicator showing the structural relations between the gross value added and the value of exports.

2.1. Data

The data on the **gross value added** in the sector composition were provided by the United Nations Statistics Division [16]. They are recorded and published following the International Standard Industrial Classification of All Economic Activities (ISIC, rev. 3). The data are available for the period 1980 – 2012 aggregated on the level of seventeen tabulation categories (from A to Q).

For each BRICS country, each year and each of the tabulation categories (or a group of the categories) the share of the gross value added on the total gross value added of the whole economy was calculated using simple formula:

$$GVAShare_{i,t}^C = \frac{GVA_{i,t}^C}{\sum GVA_t^C}, \quad (1)$$

where *GVA* is the gross value added in the country *C* and period of time *t* (year) for the *i*-th tabulation category of industries according to ISIC (rev. 3).

The data on the structure of **exports** originate from the United Nations Conference on Trade and Development [15]. They are recorded and published following the Standard International Trade Classification (SITC, rev. 3). The data are available for the period 1995 – 2013 aggregated on the level of 259 groups. To this standard classification of international trade in goods, a structure of international trade in services was embodied. The structure of the international trade in services corresponds to the records of UNCTAD and was amended to the section 9 as a division 99 (see Appendix for details).

Using the correspondence tables developed by Affendy et al. [1] and EuroStat [5], adjusted according to Mündler [9], the data on international exports in goods and services were grouped into the seventeen categories corresponding to the ISIC, rev. 3 (see Appendix).

Then it was possible to calculate the share of exports (2) in each of the tabulation categories (or a group of the categories, since some of them are traditionally published summed up together – see Tab. 2 for details) on the total exports of the economy similarly to (1):

$$Xshare_{i,t}^C = \frac{X_{i,t}^C}{\sum X_t^C}, \quad (2)$$

where *X* is the value of exports from the country *C* in the *t*-th (year) for the *i*-th tabulation category of industries according to ISIC (rev. 3).

2.2. Correlation Analysis

The *GVAShares* and *Xshares* were calculated in every year of the period 1995 – 2012, which made it possible to investigate further their time series using the methods of regression analysis. The linear mean annual paces of change over the 18-year-long period have been estimated using

ordinary least square correlation analysis:

$$share\beta_{1i}^C = \frac{n \sum_{t=1}^n share_{i,t}^C - \sum_{t=1}^n share_{i,t}^C \sum_{t=1}^n t}{n \sum_{t=1}^n t^2 - \left(\sum_{t=1}^n t \right)^2}, \quad (3)$$

where *share* is the value of *GVAs*hare (or *Xs*hare respectively) for *i*-th category of industries according to ISIC (rev. 3) in a country *C* and *t*-th year of the 18-year-long period of time (*n* is a number of years, i.e. 18 years, from 1995 to 2012). The values of β_1 were tested for statistical significance using T-test against 95% confidence level. Only the statistically significant values of β_1 were accepted for the following outcomes of the analysis.

The positive values of *Xs*hare β_1 indicate a long-term growing significance of the particular sector or industry for export orientation of the domestic economy. The rise of the share on exports is considered to be a consequence of higher demand from abroad.

The assumption set by Caparriello [3], that in each sector the value added embodied in a good produced for export is equal to the value added of the same good produced for domestic consumption, was applied here. Therefore, the positive *GVAs*hare β_1 gives a proof of an increasing importance of the particular industry for domestic production, which can be a result either of growing domestic or of growing foreign demand for the output of this particular industry, but it can be also induced by decreasing productivity in other sectors of the economy.

Table 1. Driving Factors of Internal and External Restructuring

GVAs $\beta_1 > 0$ Xs $\beta_1 > 0$	restructuring pushed by foreign demand (exports)
GVAs $\beta_1 < Xs\beta_1$	
GVAs $\beta_1 > 0$ Xs $\beta_1 > 0$	restructuring pushed by changes in domestic demand
GVAs $\beta_1 > Xs\beta_1$	
GVAs $\beta_1 > 0$ Xs β_1 insig.	
GVAs $\beta_1 > 0$ Xs $\beta_1 < 0$	increasing export determination
GVAs β_1 insig. Xs $\beta_1 > 0$	
GVAs β_1 insig. Xs β_1 insig.	no significant change
GVAs β_1 insig. Xs $\beta_1 < 0$	decreasing export determination
GVAs $\beta_1 < 0$ Xs $\beta_1 > 0$	restructuring pulled by changes in domestic demand
GVAs $\beta_1 < 0$ Xs β_1 insig.	
GVAs $\beta_1 < 0$ Xs $\beta_1 < 0$	
GVAs $\beta_1 < Xs\beta_1$	
GVAs $\beta_1 < 0$ Xs $\beta_1 < 0$	restructuring pulled by foreign demand (exports)
GVAs $\beta_1 > Xs\beta_1$	

Especially on these grounds, it is crucial to discuss the development of both *Xs*hare β_1 and *GVAs*hare β_1 together, when searching for the driving factors of restructuring of the BRICS economies. The following table 1 classifies the

driving factors of internal structural changes into four distinctive groups and also describes what is happening in the sectors where no significant changes in the structure of *GVA* were recorded over the analyzed period (shown in bold frame).

The fundamental idea here is, that a certain industry is facing restructuring if its share on the total *GVA* is changing in time significantly. If over the same period the share of exports of the industry recorded more intensive pace of development (but in the same direction as the *GVAs*hare development), then the dynamics in foreign demand is probably enforcing the restructuring or the domestic industry. If the direction of *GVAs*hare dynamics is different from the direction of *Xs*hare development (e.g. *GVAs*hare grows and *Xs*hare declines or vice versa), then the driving power fuelling the restructuring is likely to come from the domestic market.

3. Results of the Analysis

The findings of the research for the five BRICS economies are first illustrated on a set of figures (Figure 1. – Figure 5.), where the dynamic paths of the computed *GVAs*hares and *Xs*hares are simply shown over the period 1995 – 2012 (for explanation of sectors see e.g. Tab. 2). The most interesting findings resulting from these five figures are following:

For Brazil, the Fig. 1 highlights the dropping importance of manufacturing (sector D in ISIC rev. 3) for exports as well as for gross value added. On the other hand, the rise of exports and to a lesser extent also of *GVA* generated in mining and quarrying (industry C in ISIC) was recorded as well as an increasing share of wholesale and retail trade and of hotels and restaurants (industry G+H in ISIC) on Brazilian *GVA* with basically no reflection in their share of exports.

The Fig. 2 demonstrates the orientation of Russian exports almost exclusively on mining and quarrying (sector C in ISIC) and on manufacturing (sector D in ISIC), though the share of manufacturing on *GVA* has dropped significantly over the years. Manufacturing has given up its position to the rising share of Russian financial intermediation, real estate, renting, and business activities (industry J+K in ISIC), but only on gross value added, not on exports.

The Fig. 3 indicates a steep drop in the share of agriculture and fishing (industry A+B in ISIC) on Indian *GVA* and a gentle decline of the position of manufacturing (sector D in ISIC) in Indian exports as well as on the gross value added. Both probably in favor of financial intermediation, real estate, renting, and business activities (J+K in ISIC), i.e. the tertiary sector of services, which is continuously gaining importance in India.

The Fig. 4 illustrates an extreme and even growing concentration of Chinese economic and export policy on manufacturing (industry D in ISIC), while agriculture and fishing (sector A+B in ISIC) recorded a steep fall in their share on *GVA*. Otherwise Chinese economy also witnessed positive development in wholesale and retail trade, hotels

and restaurants (industry G+H), financial intermediation, real estate, renting, and business activities (sector J+K) and obviously also in public administration and defense, compulsory social security, education, health and social work (industries L–P), but only in their shares on *GVA*.

The Fig. 5 shows South Africa went through a period of shrinking in manufacturing (industry D), both in their share on exports and on the gross value added. This decline was compensated by boom in the sector of financial intermediation, real estate, renting, and business activities (sector J+K). Generally, the structure South-African exports (correspondingly to the Chinese ones) did not change much when analyzed on this level of aggregation.

3.1. Driving Factors of the Structural Changes

The following Table 2 reveals the factors driving the changes in structure of gross value added in all the five BRICS economies following the proposed methodology summed up in the Tab. 1.

The findings resulting from the Tab. 2 confirm decreasing share of agriculture, forestry, hunting and fishing. In neither of these five countries however exports of this sector proved to be the cause of this process, it seems more probable this process is a result of growing productivity of other sectors of the BRICS economies and of relative shrinking of the domestic demand for output of this industry.

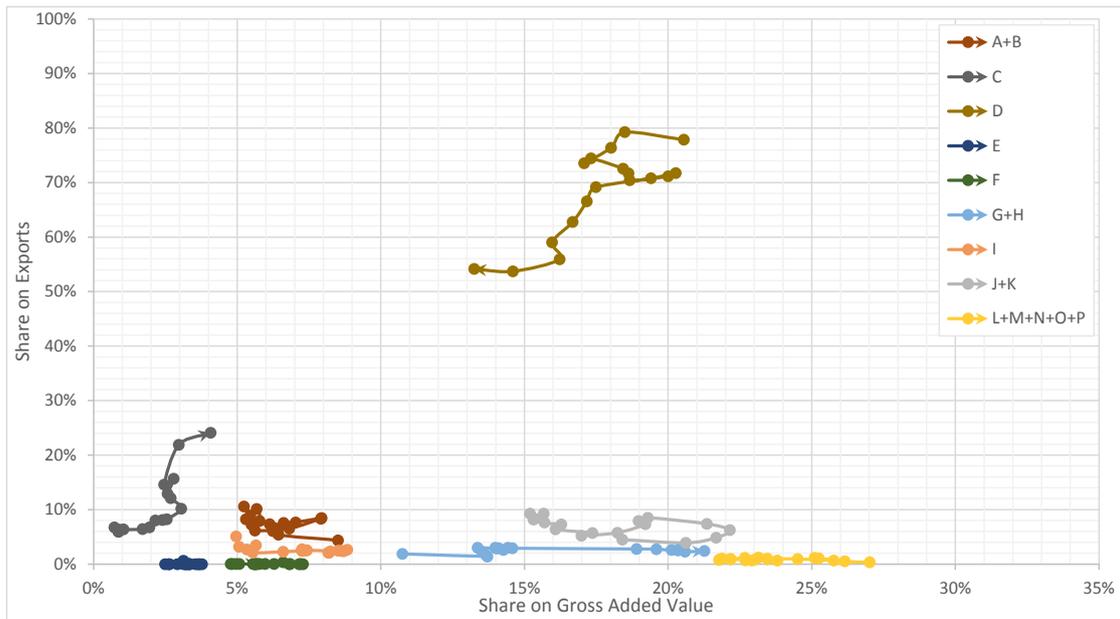


Figure 1. Brazil

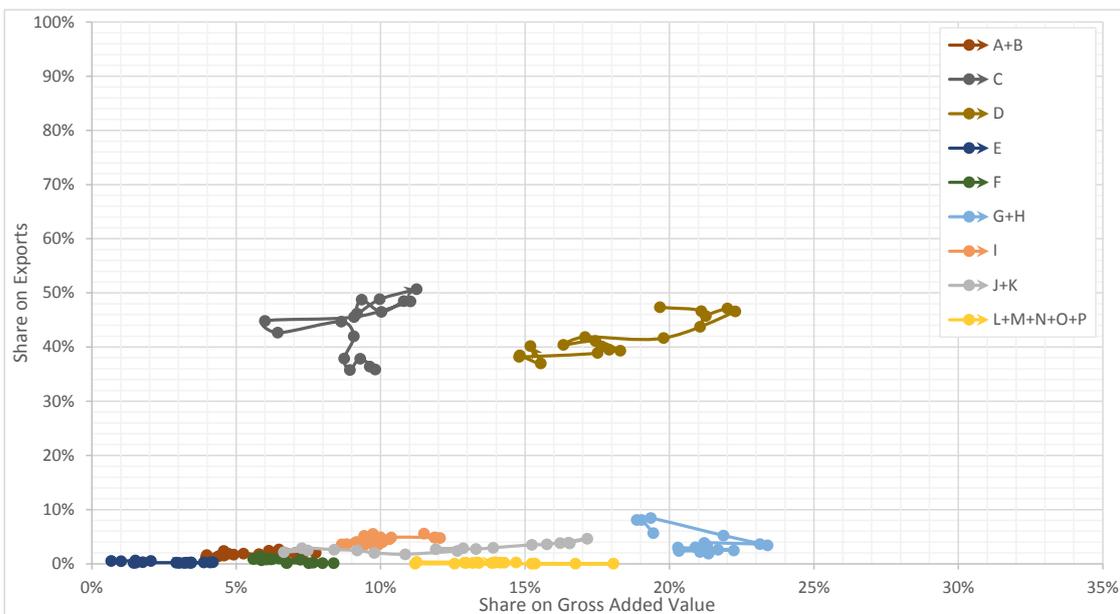


Figure 2. Russian Federation

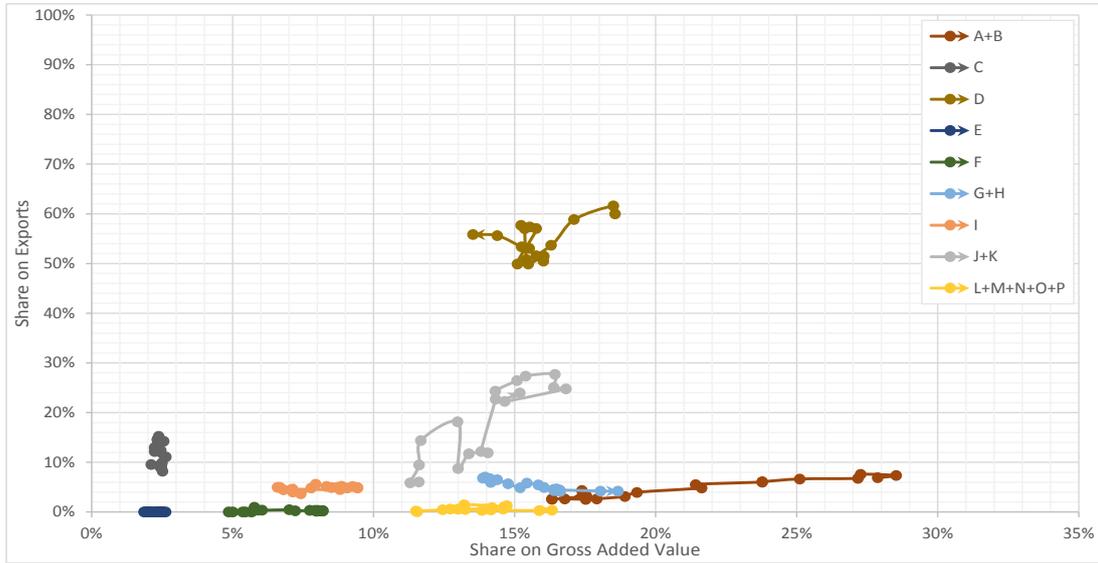


Figure 3. India

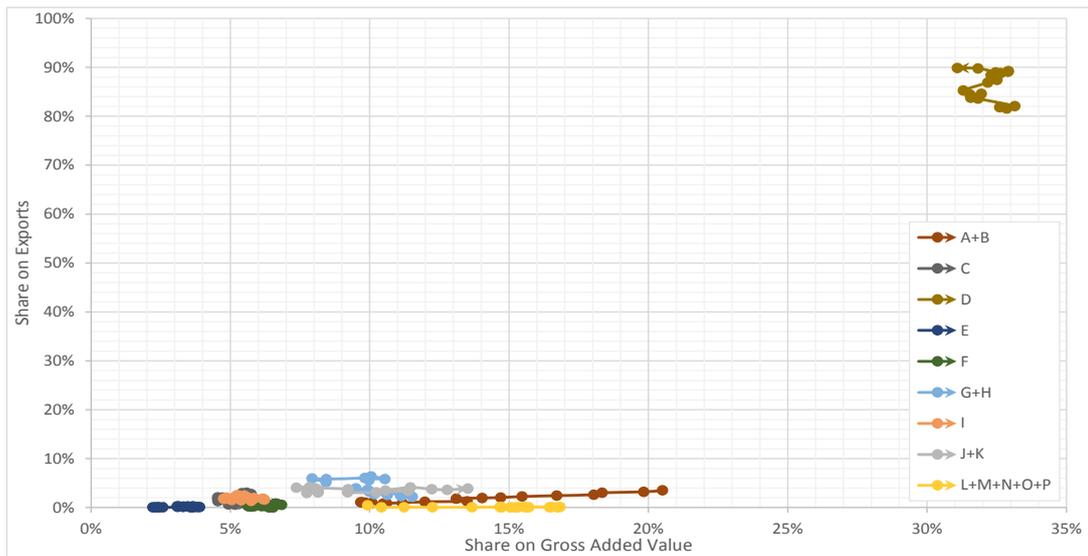


Figure 4. China

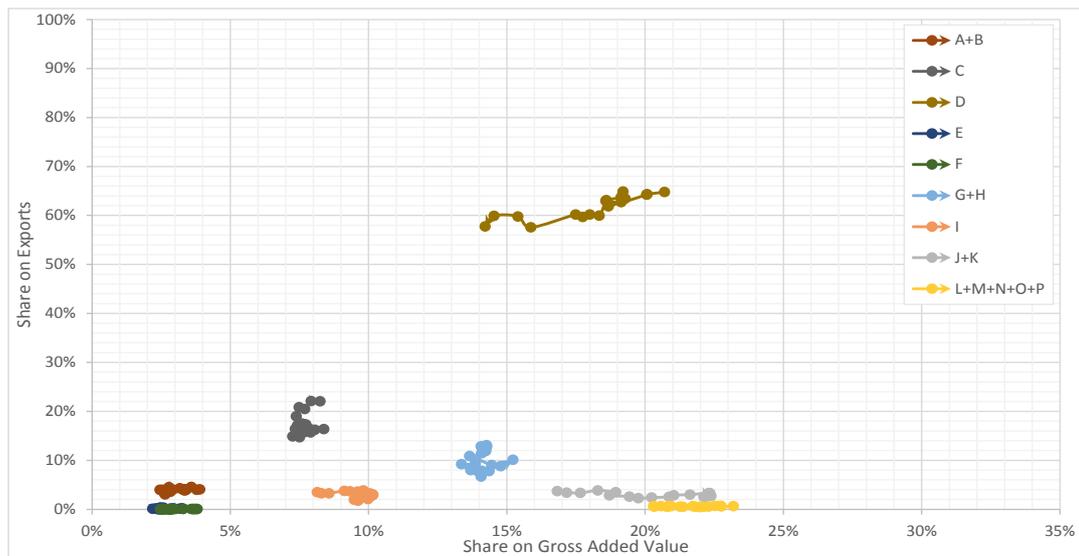


Figure 5. South Africa

Table 2. Driving Factors of Structural Changes in the BRICS

Brazil		Russian Federation		India		China		South Africa		
$GV_{Ashare}\beta_1$	$X_{share}\beta_1$									
-0.001078	0.002286	-0.002155		-0.007871	-0.003128	-0.006648	-0.001565	-0.000772		A+B
0.001860	0.010039		0.008657		-0.004031		-0.001454		0.003910	C
-0.002409	-0.014118	-0.004020	-0.005728	-0.001735	-0.003399		0.005288	-0.003286	-0.004005	D
0.000364	0.000148	0.001530	-0.000187	-0.000428		-0.000555	-0.000118	-0.000526		E
-0.001269		-0.001217	0.000620	0.002250			0.000358	0.000711	0.000049	F
0.005879			-0.003400	0.002560	-0.001840	0.001508	-0.002635	0.000473	0.001785	G+H
0.002287	-0.000795	-0.001667	-0.000976					0.000740	-0.001145	I
-0.003932	0.002093	0.006477	0.001136	0.002975	0.012434	0.003485		0.003541	-0.000431	J+K
-0.002325			0.000162	0.001429		0.002698		-0.000817		L-P

Note: All the values in the table are significant against 95% confidence level. The empty cells indicate statistically insignificant value of $X_{share}\beta_1$ or $GV_{Ashare}\beta_1$. For an easier interpretation, the background colors correspond to the classification introduced in Table 1.

Quite the same is the development in the sector of electricity, gas, and water supply, where India, China, and South Africa recorded decreasing shares on *GVA* (most probably for same reasons as in agriculture), while growing Brazilian and Russian domestic demands seem to support this sector of their economies.

As for mining and quarrying, Russian Federation and South Africa indicate a deepening export determination, Brazil recorded a significant restructuring in this sector due to foreign demand for their exports. It seems quite possible this demand for Brazilian exports is coming from China and India, as these two most populated economies of the world recorded decreasing export determination in this sector and their need for the natural resources is obviously permanently growing [16].

The booming demand for Chinese manufacturing exports is pushing the other BRICS out of the global market (see [6] for details) despite their efforts to resist. Therefore, China recorded increasing export determination and all the other four BRICS members are facing restructuring of manufacturing pulled down by diminishing exports (in Brazil supported by shrinking domestic demand).

China – probably due to their construction activities in Sub-Saharan Africa and elsewhere – recorded increasing export determination also in this specific industry [5]. In India and South Africa construction is also on the rise, but it has been pushed by the domestic demand, while in Brazil and Russian Federation this sector of economy has been pulled down mostly by domestic problems.

South Africa is becoming a wholesale and retail trade hub for the whole Sub-Saharan part of the continent, which is manifested in restructuring of this sector according to the foreign demand, on the other hand Russia is slowly losing this position in Asia. China, India, and even more Brazil witnessed strengthening of this sector so far mainly thanks to growing domestic markets.

India affirmed their leading position in the industry of services determined for exports, although Russia, China, as well as South Africa recorded faster growth of the tertiary sector share of *GVA*. Their shares on exports – however – remain negligible compared to India.

The last group of industries (public administration, defense, health, education, social services and other service activities) are predominantly a domestic matter with no significant development in exports. The only exclusion here is Russian Federation, supposedly due to their exports of arms and weapons.

4. Conclusions

The results of this paper proved a long-run export reorientation of the BRICS from elementary raw materials processing and from low added value production, to more sophisticated merchandise. With some exceptions in Russian

Federation and Brazil, the analysis generally confirms the Akamatsu's flying geese paradigm [2]. Unfortunately, the level of aggregation of the data (enforced by using the United Nations statistical databases) does not allow for a more detailed research of structural changes within the main sectors of the BRICS national economies. This issue represents an attractive field for further research when more detailed data were available or by applying the Input-Output analyses on data collected in the World Input-Output Database.

Even the findings achieved in this paper highlight some important issues: The success of Chinese export-oriented policy bears fruits for its economy and society, but also intensifies the competition, especially in the manufacturing sector. Chinese dominance as well as its size and ambitions have been already causing some fear and tensions on the Indian, Russian, as well as African side of the BRICS, challenging the very basics of the concept of the grouping as a sustainable economic entity [9].

The fact, the BRICS countries are turning more and more to the production of high value added merchandise is a consequence of their previous rapid economic growth and development. Arising middle class in their societies magnifies the domestic demand for consumer goods and services, which consequently boosts the domestic demand for investment units, business equipment, raw materials, and semi-products. This strong stabilizing factor for economic performance of these giant markets was identified especially in the sectors of agriculture, electricity, gas and water supply, construction, transport, storage, communication, wholesale & retail trade (with an exception of South Africa, where exports from this sector play a crucial role), financial services, real estate, renting and other business activities (with an exception of India, where – again – exports from this sector play the leading role).

A side effect of this continuous process can be identified in the growing dependence of Chinese and Indian economies on import of raw materials. Exports of raw materials and ores from these two Asian mega-markets are on a decline. In fact, they are absorbing the growing exports from Brazil, Russian Federation, and South Africa. In this context, a further deepening of mutual relations of the BRICS countries and strengthening the integration processes within this grouping seem sensible and advantageous for all the member states.

An important role in the complex processes of restructuring has been probably played by the foreign direct investment (although Sharma [14] shows on example of India, the influence of foreign direct investment on exports is not as significant as one would expect) and also by the changing situation in the developed market economies. Analysis of these factors and their importance for restructuring the BRICS economies open a space for further research as it has the potential to provide new arguments to the debate on the future of the BRICS.

Appendix – ISIC, rev. 3 – SITC, rev. 3 Correspondence Table

SITC	ISIC	SITC	ISIC								
001	A+B	232	D	431	D	651	D	716	D	793	D
011	D	244	D	511	D	652	D	718	D	811	D
012	D	245	A+B	512	D	653	D	721	D	812	D
016	D	246	D	513	D	654	D	722	D	813	D
017	D	247	A+B	514	D	655	D	723	D	821	D
022	D	248	D	515	D	656	D	724	D	831	D
023	D	251	D	516	D	657	D	725	D	841	D
024	D	261	D	522	D	658	D	726	D	842	D
025	D	263	D	523	D	659	D	727	D	843	D
034	D	264	D	524	D	661	D	728	D	844	D
035	D	265	A+B	525	D	662	D	731	D	845	D
036	A+B	266	D	531	D	663	D	733	D	846	D
037	D	267	D	532	D	664	D	735	D	848	D
041	A+B	268	D	533	D	665	D	737	D	851	D
042	D	269	D	541	D	666	D	741	D	871	D
043	A+B	272	C	542	D	667	C	742	D	872	D
044	A+B	273	C	551	D	671	D	743	D	873	D
045	A+B	274	C	553	D	672	D	744	D	874	D
046	D	277	C	554	D	673	D	745	D	881	D
047	D	278	C	562	D	674	D	746	D	882	D
048	D	281	C	571	D	675	D	747	D	883	L-P
054	A+B	282	C	572	D	676	D	748	D	884	D
056	D	283	C	573	D	677	D	749	D	885	D
057	A+B	284	C	574	D	678	D	751	D	891	D
058	D	285	C	575	D	679	D	752	D	892	D
059	D	286	C	579	D	681	D	759	D	893	D
061	D	287	C	581	D	682	D	761	D	894	D
062	D	288	C	582	D	683	D	762	D	895	D
071	D	289	C	583	D	684	D	763	D	896	L-P
072	D	291	A+B	591	D	685	D	764	D	897	D
073	D	292	A+B	592	D	686	D	771	D	898	D
074	A+B	321	C	593	D	687	D	772	D	899	D
075	A+B	322	C	597	D	689	D	773	D	961	D
081	D	325	D	598	D	691	D	774	D	971	D
091	D	333	C	611	D	692	D	775	D	991	I
098	D	334	D	612	D	693	D	776	D	992	G+H
111	D	335	D	613	D	694	D	778	D	993.1	I
112	D	342	D	621	D	695	D	781	D	993.2	F
121	A+B	343	C	625	D	696	D	782	D	993.3	J+K
122	D	344	D	629	D	697	D	783	D	993.4	J+K
211	D	345	E	633	D	699	D	784	D	993.5	J+K
212	A+B	351	E	634	D	711	D	785	D	993.6	J+K
222	A+B	411	D	635	D	712	D	786	D	993.7	J+K
223	A+B	421	D	641	D	713	D	791	D	993.8	L-P
231	A+B	422	D	642	D	714	D	792	D	993.9	L-P

where: 991 = Transport; 992 Travel; 993.1 = Communications; 993.2 = Construction; 993.3 = Insurance; 993.4 = Financial Services, 993.5 = Computer and Information; 993.6 = Royalties and License Fees; 993.7 = Other Business Services; 993.8 = Personal, Cultural, and Recreational Services; 993.9 = Other Government Services.

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