



UNITED NATIONS
UNIVERSITY

UNU-MERIT

Working Paper Series

#2016-016

**Structural transformation in Brazil, Russia, India, China
and South Africa (BRICS)**

Wim Naudé, Adam Szirmai and Nobuya Haraguchi

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)

email: info@merit.unu.edu | website: <http://www.merit.unu.edu>

Maastricht Graduate School of Governance (MGSoG)

email: info-governance@maastrichtuniversity.nl | website: <http://www.maastrichtuniversity.nl/governance>

Boschstraat 24, 6211 AX Maastricht, The Netherlands

Tel: (31) (43) 388 44 00

UNU-MERIT Working Papers

ISSN 1871-9872

**Maastricht Economic and social Research Institute on Innovation and Technology
UNU-MERIT**

**Maastricht Graduate School of Governance
MGSoG**

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at UNU-MERIT and MGSoG to stimulate discussion on the issues raised.



Structural Transformation in Brazil, Russia, India, China and South Africa (BRICS)*

Wim Naudé, Adam Szirmai and Nobuya Haraguchi**

1 April 2016

Abstract.

This paper provides a comparative overview of the experiences of the BRICS countries (Brazil, Russia, India, China and South Africa) with structural transformation since the 1980s. We evaluate the different outcomes in industrialisation in these countries, explore the reasons for success (and failure); we also ask what currently industrially lagging countries can learn from the BRICS in this regard, and what impact their industrialisation had on poverty reduction. We point out that important areas for future research and current challenges remain. Foremost in this is the need for BRICS to drive their further structural economic transformation through innovation, taking into consideration their stage of development and the particulars of the sectors involved. As they develop, entrepreneurship and the role of the private sector seem to become more important. The paper is based on our edited book published in 2015 by Oxford University Press '*Structural Change and Industrial Development in the BRICS*'.

Key words: Structural change, industrialisation, manufacturing, development, entrepreneurship, innovation, Brazil, Russia, India, China, and South Africa (BRICS)

JEL classifications: O14, L52, L60, L26, O32, O57

* UNU-MERIT gratefully acknowledges financial support from UNIDO for a joint research project on the BRICS.

**Wim Naudé, Maastricht School of Management/UNU-MERIT/Maastricht University and IZA, naude@msm.nl; Adam Szirmai, UNU-MERIT, szirmai@merit.unu.edu, Nobuya Haraguchi, UNIDO, N.HARAGUCHI@unido.org

1. Introduction

Structural economic transformation, the evolution of an economy's structure from low-productivity traditional activities (such as in traditional agriculture) to higher productivity modern activities (such as in manufacturing and services) is a basic requirement for development. Such transformation is desirable not only as a source of higher productivity growth and per capita income, but also to achieve greater diversity in terms of economic structure, so as to reduce a country's vulnerability to poverty and external shocks.

Many low and middle-income countries today desire structural economic transformation. How this can be marshalled remains at the forefront of the international development agenda. It has led to resurgence of interest in industrial policy in both developing and in advanced economies as well as in international development organisations (Naudé, 2010). Structural change requires policies that promote the development, adoption and use of technologies that will change what an economy produces and how it does so. Structural transformation, resulting in productivity increases and growth, trigger further processes of agglomeration and technological advances (Szirmai, 2012).

Over the last 30 years, the BRICS (Brazil, Russia, India, China and South Africa) have achieved notable structural change and poverty reduction, albeit to different degrees and in different ways. Their experiences offer interesting lessons for low and middle-income countries desiring structural change, including the growth of 'dynamic' sectors, such as manufacturing or market services. To date, however, despite a large and growing body of literature on the economies of the BRICS, few systematic and comparative empirical analyses have been carried out on the nature of structural change in the BRICS since 1980.¹ The comparative role and significance of manufacturing as an engine of growth in the BRICS and the differences between and changes within the countries' manufacturing sectors has also not yet been studied in depth. There is growing debate over the sustainability and relevance of the example set by BRICS as well as to what extent their structural transformation has had a significant and sustainable impact on poverty reduction. This paper, drawing on Naudé et al. (2015), provides an overview of recent advances in the understanding of structural transformation in the BRICS to fill these gaps.

The paper is structured as follows. In section 2 we take up an idea that is either explicit or implicit in the rest of the paper namely that manufacturing growth may be especially important for structural change and development. Why should manufacturing be special?

In section 3 we then describe the manufacturing growth and rise of the BRICS, showing them to be the diverse and not all shining examples of successful industrialisation.

¹ The exception is a paper by De Vries et al. 2011, a version of which has also been incorporated in Naudé et al. 2015.

In section 4 we investigate the causes of the successes and failures of industrialisation in the BRICS. Section 5 asks what lessons developing countries can learn from these experiences, and section 6 concludes.

2. What is so special about Manufacturing?²

There are at least five reasons (see for more detail Szirmai, 2013). Firstly, at lower levels of per capita income there is an empirical relationship between manufacturing growth and GDP growth. As GDP per capita rises, the share of manufacturing has been observed to increase until it reaches a peak. Beyond an optimum, the share of manufacturing declines as the service sector assumes a more important role in high-income economies. Second, because value added per worker in manufacturing is higher than in the agricultural sector, the transfer of resources to manufacturing carries a ‘productivity bonus’. Third, the manufacturing sector may offer special opportunities for capital accumulation. A higher level of capital per worker is one of the hallmarks of industrial development. Fourth, manufacturing may provide more opportunities for economies of scale (and scope) compared to other sectors such as agriculture or services. Finally, as was argued by among others Cornwall (1977) manufacturing might be the main driver of technological progress. Technological advance may originate in the manufacturing sector and diffuse to other sectors.

The role of the manufacturing sector in the process of structural change therefore deserves special attention. Although the current literature no longer assumes that manufacturing is the only driver of growth, and each of the five reasons for the ‘special’ nature of manufacturing may be qualified, it is still a crucial sector in economic development and the catching-up process of low and middle-income economies. As we illustrate in what follows (see section 3) manufacturing has been and still is important for economic development in the BRICS. The evolution of manufacturing in the BRICS may hold useful lessons for other countries desirous of structural change.

3. Manufacturing Growth and the Rise of the BRICS

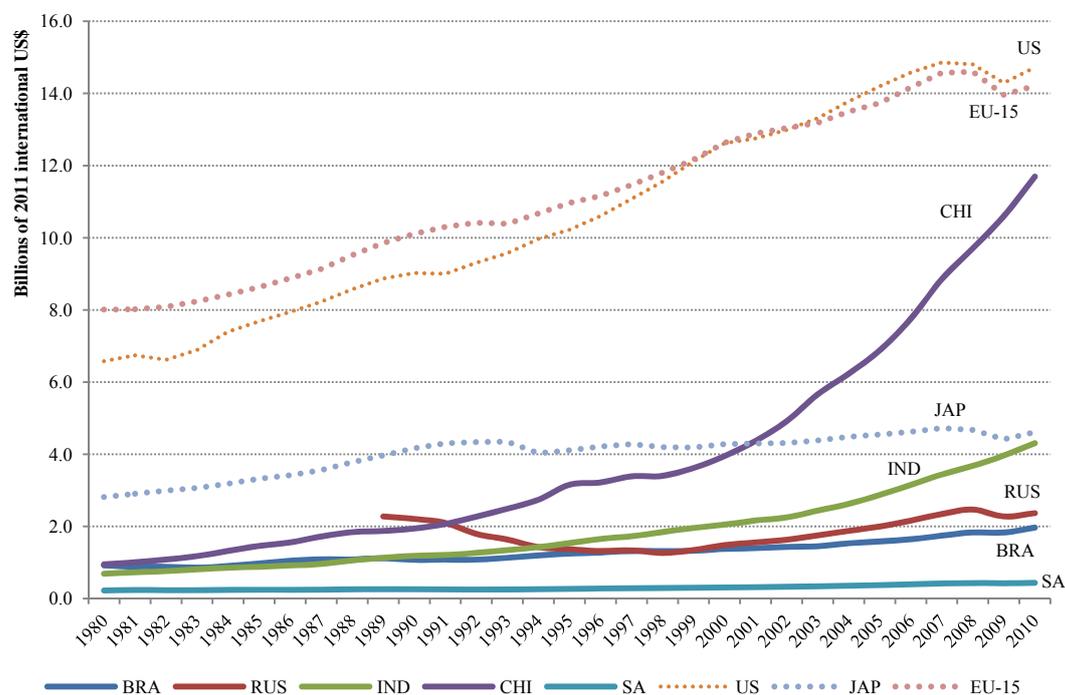
Across the BRICS the respective roles of manufacturing and services are different, the driving sectors within manufacturing are different and the patterns of and routes to industrialisation vary. In short, the experiences of the BRICS are very diverse, and not all of these countries are shining examples of successful industrialisation.

3.1 The Emergence of the BRICS

The emergence of BRICS reflects an on-going change in the international economic order. They now account for a substantial part of global GDP, global manufactured value added and global manufactured exports. Figure 1 depicts the rise of the BRICS.

² This section draws on Szirmai et al. (2013)

Figure 1: Total GDP 1980-2010. BRICS, USA, EU and Japan, (in billions of 2011 EKS PPP dollars)



Source: Naudé et al. (2015) from The Conference Board Total Economy Database.

Figure 1 shows that among the BRICS that the rise of China and India in terms of economic size has been nothing less than spectacular. Whereas their economies were at comparable levels to those of the other three BRICS in 1980, by 2010 their economies were significantly larger as measured by GDP in billions of PPP-adjusted US \$.

China is expected to overtake the US as the largest economy in the next two or three decades – if not sooner. India is expected to move to the third position by 2050. Brazil is expected to have a larger economy than Germany by 2036 and to be the world’s fifth largest economy by 2050 (Wilson and Purushothaman, 2003). Combined the economic size of these three countries in 2010 exceeds US \$ 4.7 trillion in nominal GDP terms, and US\$ 20.7 trillion in 1990 PPP adjusted GDP.³ Taken together, therefore, the BRICS are in economic terms already larger than USA and the European Union. Furthermore, BRICS contain two of the most populous countries in the world (China and India).

³ Using 1990 PPP dollars, the catch up pattern is even more pronounced and China has overtaken the USA in 2009.

3.2 The Development of the BRICS

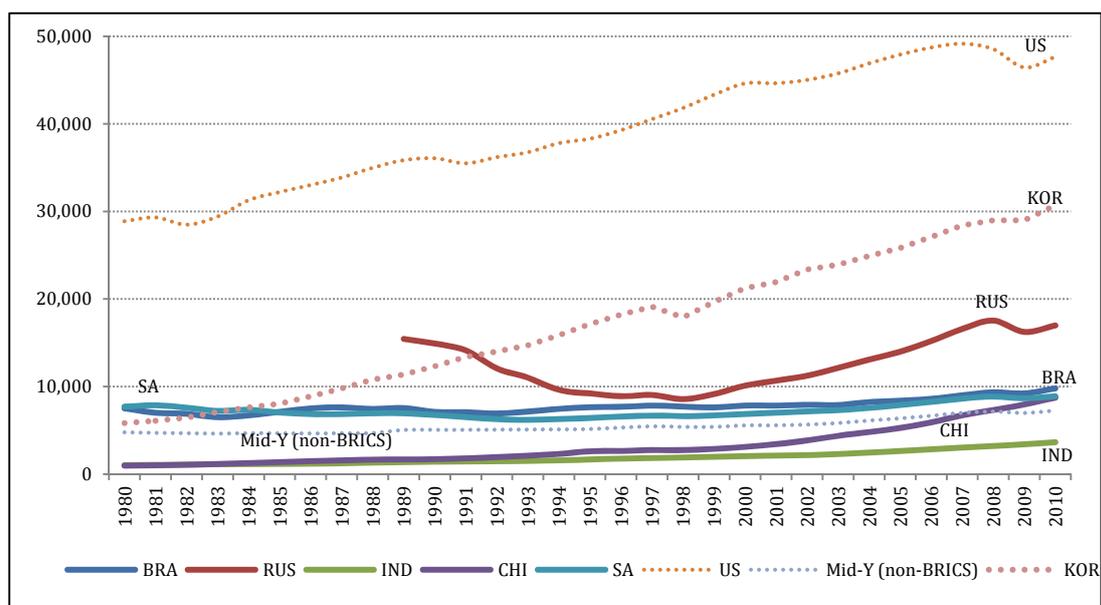
In it not only economic size that matters. A better gauge of economic development is GDP per capita. In such terms China and India (with most rapid growth and the largest populations) turn out to be much poorer than the other three countries, though rapidly catching up.

Figure 2 depicts the evolution of GDP per capita since 1980 (1989 in the case of Russia). It shows that by 2010, Russia was the wealthiest of the BRICS with a per capita GDP in 2011 PPP dollars of 16,983 PPP US\$. Russia is followed by Brazil with a per capita GDP of 9,787 dollars, South Africa with a GDP of 8,901 dollars and China with a GDP per capita of 8,741 dollars. India is by far the poorest of the BRICS with a per capita GDP of 4,649 dollars in 2010.

The following features of Figure 2 that stand out are (i) the rapid growth in GDP per capita in China, (ii) the rapid growth in Russia since 1998, following a very dramatic decline after 1989. Net growth over the whole period 1989 and 2010 was less than 0.5 per cent per year. Russia only recovered to 1989 levels of per Capita GDP around 2006. (iii) More moderate growth in India and (iv) slow growth in Brazil and especially South Africa over the whole period.

Compared to other successful catching-up countries (such as Korea) or the world technological leader (the US), the BRICS countries are still lagging far behind. The GDP per capita of Brazil, China and South Africa stands at about one fourth of the US level, while India does not even reach 10 per cent of US per capita GDP.

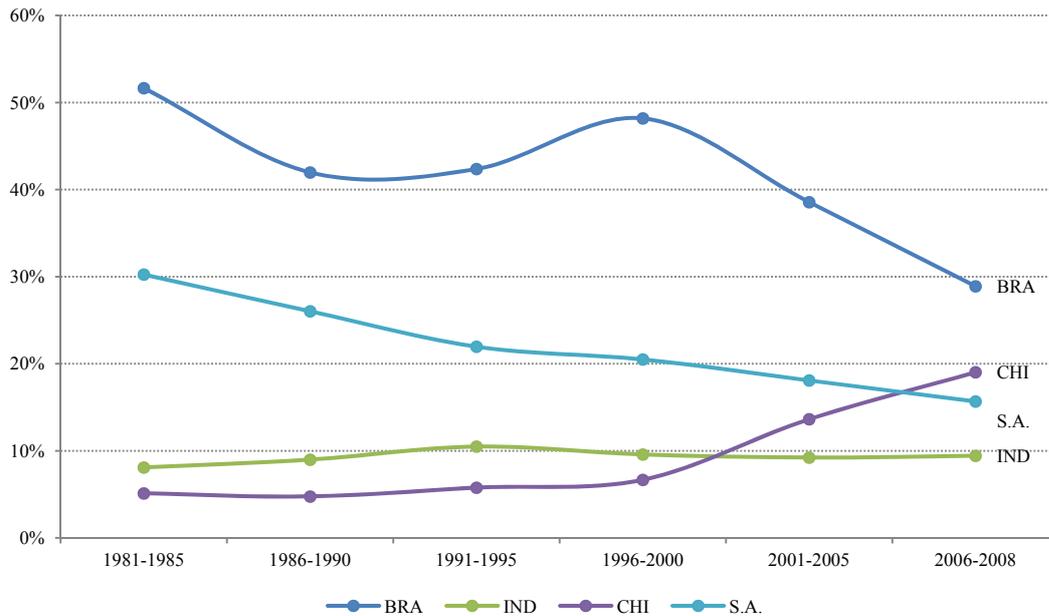
Figure 2: GDP per capita 1980-2010. BRICS, USA, South Korea and Other Mid-Income Economies (in 2011 EKS PPP dollars)



Source: Naudé et al.(2015) from The Conference Board Total Economy Database

An important driver of GDP per capita is productivity growth. Understanding the evolution of productivity in the BRICS is useful to understand how their GDP per capita has grown and how they have been, and will, continue to catch-up. In this regard in Figure 3 we present estimates of manufacturing labour productivity relative to the US during our period of analysis. This is of particular interest since labour productivity is often taken as a rough proxy for a country's technological sophistication, and labour productivity relative to the USA taken as a proxy for a country's technology gap.

Figure 3: Labour productivity relative to the US in Manufacturing Industries. BICS countries (5 year averages). 1981-2008 (US=100)



Source: Brazil, India and China: Szirmai, *Statistics of socio-economic development*, <http://www.dynamicsofdevelopment.com>; South Africa: van Dijk (2002) (extrapolated until 2008 using several sources)

Note: Comparable data for Russia is not available

Figure 3 clearly shows that the diverging trends within the BRICS. While Brazil and South Africa are falling behind (relative productivity is declining over time), China has managed to reduce the productivity gap. In India comparative productivity is about the same as it was in the early nineties. Thus it is neither catching up, nor falling behind. Both countries are, however, still very far from the US productivity level (at around 19 and 9 per cent respectively).

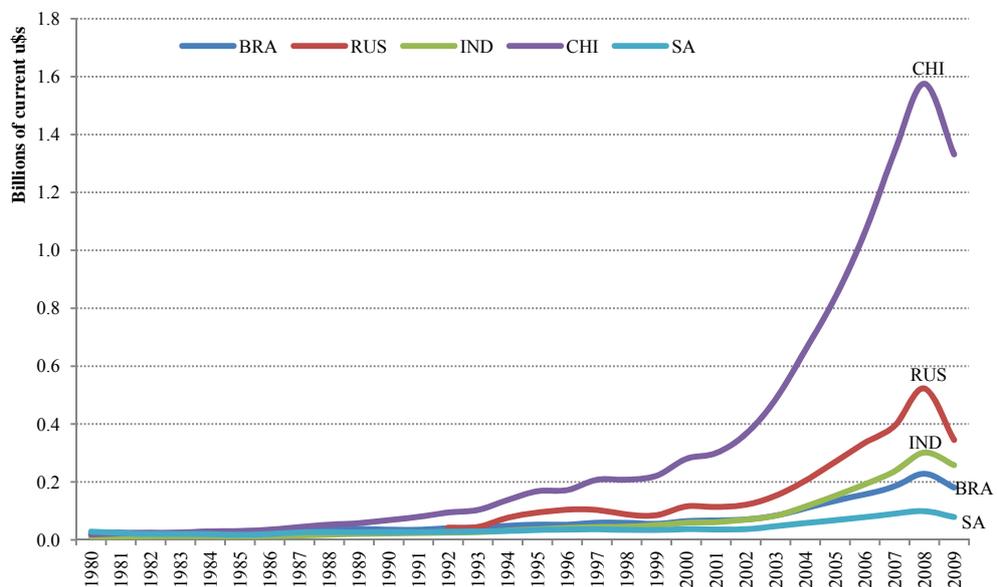
3.3 The Globalisation of the BRICS

One of the first things that come to mind when the successful BRICS (China and India) are discussed is the role that export-led growth (exporting manufactured goods) played. In the case of China especially, opening-up to the world economy at the end of the 1970s is a central part of our narrative.

India has also experienced major manufacturing export growth, but has increasingly also been exporting IT services. Russia and South Africa are well known for their resource and commodity exports. Brazil has been successful in exporting natural resources as well as certain categories of resource-based manufactured goods and some high-tech manufacturing products. These patterns of integration into the world economy have been important for the relative performance of these economies. It is well established that trade is one of the important mechanisms for access to and adoption of foreign technologies.

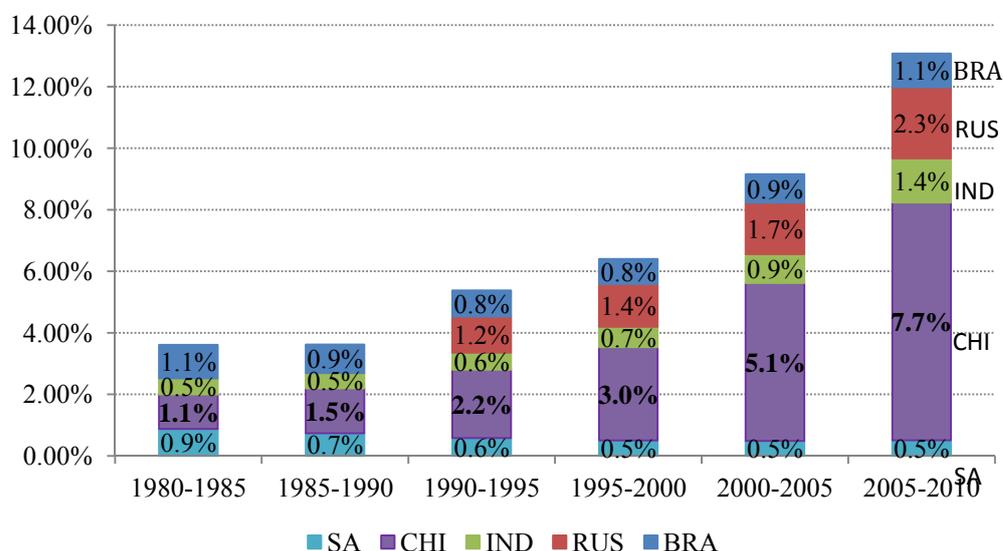
In Figure 4 we show that all BRICS have become more dependent on the global economy over time as reflected in their exports. Whereas the BRICS only accounted for less than 4 per cent of world exports during the early 1980s, by 2010 their combined share reached 13 per cent of world exports. The growth of exports in China in particular has been extraordinary. The figure shows that after China, the fastest export growth has been in Russia, India and Brazil. According to Weiss (2015) in per capita terms South Africa had the largest export value among the BRICS over the period 1980-2005. However, in current values South African exports in 2009 are only at 3.5 times their 1980 value, compared to 97 times in China.

Figure 4: Total Exports from BRICS countries. 1980-2009 (in billions of current dollars)



Source: Naudé et al. (2015) based on UNCTAD

Figure 5: Total Exports from BRICS countries (5 year averages), 1980-2010 (as % of World exports)



Source: Naudé et al. (2015) based on UNCTAD

The growing importance of the BRICS in the process of globalisation is illustrated in Figure 5, where we present their share in world’s exports. Whereas the BRICS only accounted for less than 4 per cent of world exports during the early 1980s, by 2010 their combined share reached 13 per cent of world exports. This impressive increase, however, is mainly due to the export growth of China.

The types of manufactured goods and services exported provide an interesting glimpse into the different patterns of structural change in the BRICS. In the case of services exports – significant in Brazil, India and South Africa – the main sub-sectors have been renting of machinery and equipment and other business activities in Brazil, IT services in India, and transport services in South Africa.

A breakdown of shares in manufactured exports is shown in Table 1. Looking at Table 1 we see that the most radical changes in the structure of manufactured exports have taken place in China and India. Especially China managed to transform its specialisation in manufactured exports, shifting from an export structure concentrated in labour intensive and low-tech products (mainly food and textiles) towards a structure concentrated in capital intensive and high-tech products (metal products, machinery and electrical equipment in China and chemicals and other manufacturing goods in India). Less radical changes, but in the same direction, can be observed in Brazil and South Africa, where transport equipment, machinery and electrical equipment have gained shares. In contrast, Russian manufacturing exports show a

trend towards a specialisation in refined petroleum products (driven by its oil and gas resources).

Table 1: Change in sectoral composition of manufacturing exports from BRICS. 1980-2009 (Share over manufacturing exports)

	Brazil			Russia			India			China			South Africa		
	1983	2009	Δ	1996	2009	Δ	1980	2009	Δ	1985	2009	Δ	1980	2009	Δ
<i>Food, beverages and tobacco</i>	32.8%	30.5%	-2.4	2.7%	3.3%	0.6	9.6%	5.2%	-4.4	15.7%	1.9%	-13.7	18.8%	7.1%	-11.6
<i>Textiles and textiles products</i>	4.6%	0.9%	-3.6	1.2%	0.2%	-1.0	26.6%	5.5%	-21.0	22.4%	4.9%	-17.5	1.5%	0.8%	-0.7
<i>Leather, leather and footwear</i>	6.4%	2.5%	-3.9	0.7%	0.2%	-0.5	12.1%	8.0%	-4.1	4.8%	10.4%	5.6	0.9%	0.4%	-0.5
<i>Wood and products of wood and cork</i>	1.6%	1.6%	0.0	2.2%	3.0%	0.8	0.8%	0.1%	-0.7	0.0%	0.7%	0.7	0.4%	0.3%	-0.2
<i>Pulp, paper, paper products and publishing</i>	3.3%	5.0%	1.7	4.1%	2.3%	-1.8	0.2%	0.5%	0.3	0.0%	0.9%	0.9	3.9%	3.1%	-0.7
<i>Coke, refined petroleum products, nuclear fuel</i>	7.2%	3.2%	-4.0	18.7%	40.7%	22.0	2.1%	16.2%	14.2	41.0%	1.3%	-39.6	0.6%	3.7%	3.1
<i>Chemicals and chemical products</i>	8.2%	11.5%	3.3	14.1%	11.6%	-2.5	10.6%	12.6%	2.0	5.4%	5.6%	0.2	14.5%	10.2%	-4.3
<i>Rubber and plastics products</i>	0.9%	2.3%	1.4	1.0%	0.8%	-0.2	2.2%	1.2%	-1.0	0.8%	3.4%	2.6	0.6%	1.2%	0.6
<i>Other non-metallic mineral products</i>	0.7%	1.4%	0.7	0.8%	0.8%	0.0	1.2%	1.2%	-0.1	0.2%	2.0%	1.8	1.5%	0.8%	-0.7
<i>Basic metals and metal products</i>	13.9%	13.1%	-0.8	39.0%	26.6%	-12.4	7.6%	9.9%	2.3	3.5%	8.6%	5.1	40.6%	39.1%	-1.5
<i>Machinery NEC</i>	5.9%	7.9%	2.0	3.9%	3.0%	-0.8	6.1%	4.8%	-1.3	0.9%	22.0%	21.1	4.0%	9.6%	5.7
<i>Electrical and optical equipment</i>	3.1%	5.6%	2.4	3.4%	2.9%	-0.4	3.5%	6.6%	3.1	1.5%	26.5%	25.0	1.6%	3.9%	2.4
<i>Transport equipment</i>	10.8%	13.3%	2.6	7.8%	3.2%	-4.7	14.4%	6.5%	-7.9	0.8%	5.7%	4.9	2.9%	14.4%	11.5
<i>Furniture, manufacturing n.e.c. and recycling</i>	0.5%	1.1%	0.7	0.4%	1.3%	0.9	3.1%	21.6%	18.5	3.2%	6.0%	2.8	8.3%	5.3%	-3.0
Total	100%	100%	-	100%	100%	-									

Source: UN-COMTRADE

3.4 *The Manufacturing Sector in the BRICS*

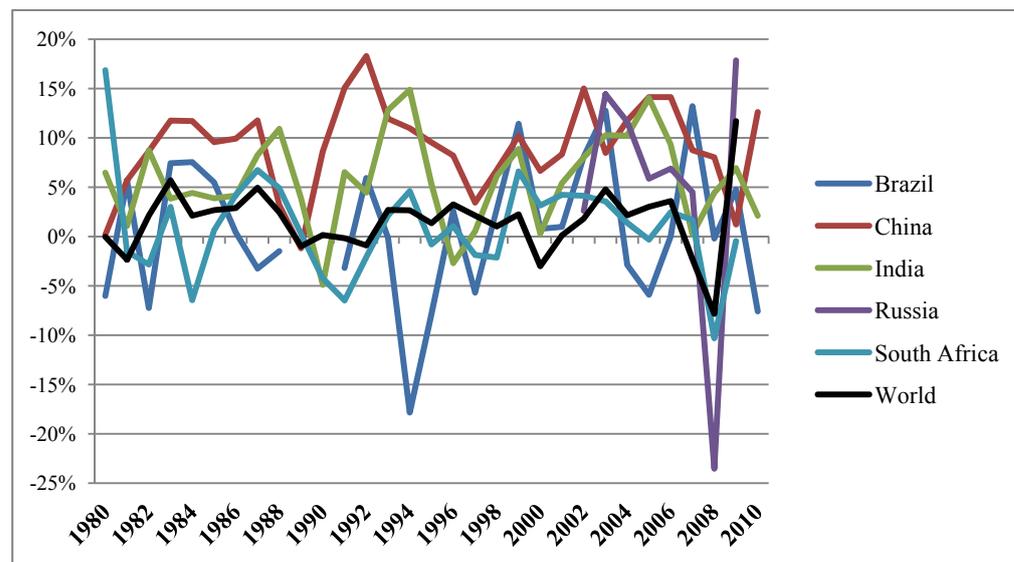
So, the BRICS have risen fast in terms of economic size, and are playing an increasingly important role in the global economy. How important has manufacturing been in this, apart from fuelling China's export-led growth? While the answer to this is complex, we can summarise here by way of providing a background, the salient features of manufacturing development and growth in the BRICS. We first present the manufacturing value added growths rates of the BRICS relative to those of the world and then look into the composition of Value Added and Employment in the BRICS in 1980⁴ and 2008 (Tables 3 and 4) and the changes that can be observed between these years (Table 5).

Figure 6 compares the manufacturing value added growth rates of BRICS with the world average. Up to 1998, it is hard to judge the BRICS' performance as a whole relative to the world. The world average line was drawn more or less between the high and low performers among the BRICS. However, from 1999 until the financial crisis in 2008, except for a few countries in a few years, all BRICS countries have consistently outperformed the world average and expanded their manufacturing production. Their high growth rates of manufacturing value added coupled with manufacturing's higher than average backward linkages with their domestic economies, which also tend to increase over time (Table 2)⁵, indicate that from the end of 1990s manufacturing in the BRICS helped drive their economic development more implied by their shares in GDP only.

⁴ In the cases of China and Russia comparable data is only available since 1987 and 1995 respectively. In what follows, our starting point for the two economies will be given by those years.

⁵ The exception being India.

Figure 6: Manufacturing value added growth rates of the BRICS and the world (%)



Source: World Development Indicators

Note: Manufacturing value added is calculated as the share of gross manufacturing value added in GDP multiplied by constant GDP (at 2000 price). The gross outputs have experienced similar growth trends.

Table 2: Backward Domestic linkages (output multiplier effects)

	1995			2005			2009		
	Agr	Serv	Man	Agr	Serv	Man	Agr	Serv	Man
Brazil	1.51	1.53	1.98	1.71	1.56	2.05	1.73	1.58	2.10
China	1.74	2.00	2.48	1.81	1.97	2.53	1.84	2.00	2.70
India	1.37	1.54	2.23	1.36	1.45	2.04	1.29	1.42	2.06
Russia	1.82	1.59	1.96	1.69	1.65	2.00	1.78	1.74	2.11
South Africa	1.69	1.58	1.98	1.94	1.80	2.13			

Source: The World Input-Output Database for Brazil, China, India and Russia. OECD STAN Input-Output Database for South Africa (available only for 1995 and 2005).

Tables 3 and 5 (below) make clear that China is the only country where the share of manufacturing in GDP increased dramatically between 1987 and 2008. By 2008, manufacturing accounted for no less 34.5 per cent of Chinese GDP. The combined industrial sector (mining, manufacturing, utilities and construction) accounted for 47.8 per cent of GDP, exceeding the share of services at 42.6 per cent.

Table 3: Sectoral shares of Value Added (at constant prices). BRICS, 1980-2008 (in %)

	Brazil		Russia		India		China		South Africa	
	1,980	2,008	1,995	2,008	1,980	2,008	1,987	2,008	1,980	2,008
<i>Agriculture</i>	4.4%	5.8%	7.6%	4.4%	36.0%	16.1%	30.0%	9.7%	3.4%	2.6%
<i>Mining</i>	1.3%	2.4%	12.8%	8.8%	2.7%	2.5%	4.0%	4.6%	13.3%	6.1%
<i>Manufacturing</i>	19.6%	17.4%	16.5%	16.9%	14.5%	16.3%	19.7%	34.5%	21.6%	18.4%
<i>Utilities</i>	2.2%	3.8%	4.5%	2.7%	1.4%	1.9%	2.3%	2.9%	1.8%	2.1%
<i>Construction</i>	8.0%	5.1%	4.8%	6.2%	7.7%	8.0%	6.4%	5.8%	4.0%	3.3%
<i>Services</i>	64.5%	65.5%	53.7%	60.9%	37.7%	55.2%	37.6%	42.6%	55.9%	67.5%
Total	100.0%									

Source: Timmer (ed) (2012), G. J. de Vries et al. (2012) and K. De Vries et al. (2013)

Table 4: Sectoral shares of Employment. BRICS, 1980-2008 (in %)

	Brazil		Russia		India		China		South Africa	
	1,980	2,008	1,995	2,008	1,980	2,008	1,987	2,008	1,980	2,008
<i>Agriculture</i>	38.4%	17.8%	27.7%	21.5%	69.5%	55.1%	58.0%	39.6%	26.0%	14.0%
<i>Mining</i>	0.5%	0.3%	1.4%	1.2%	0.5%	0.5%	1.8%	1.3%	9.4%	2.2%
<i>Manufacturing</i>	12.8%	13.0%	17.3%	13.7%	10.5%	12.3%	16.3%	18.7%	16.5%	13.1%
<i>Utilities</i>	0.8%	0.4%	1.9%	2.3%	0.2%	0.3%	0.3%	0.5%	0.9%	0.6%
<i>Construction</i>	8.9%	7.2%	7.7%	7.3%	2.1%	6.9%	4.6%	6.8%	5.2%	7.6%
<i>Services</i>	38.6%	61.3%	44.0%	54.0%	17.2%	25.0%	19.0%	33.2%	42.0%	62.5%
Total	100.0%									

Source: Timmer (ed) (2012), G. J. de Vries et al. (2015) and K. De Vries et al. (2013)

In India, there has been a modest increase in the share of manufacturing, but services have become by far the largest sector of the economy.

In Russia, the share of manufacturing remained more or less stable. In Brazil and South Africa it declined somewhat, pointing to de-industrialisation. In these three countries the shares of services increased. In 2008, the share of services in GDP stood at almost 65 per cent on average.

In South Africa and Russia the relatively large contribution of mining to GDP at the beginning of the period stands out. In South Africa it accounted for 13.3 per cent of GDP, in Russia this was 12.8 per cent. By 2008, the shares of mining in both countries had declined, in the case of South Africa by more than fifty per cent. China and India have experienced most structural change, with large declines in the shares of agriculture and large increases in respectively manufacturing and services.

Lin and Yu (2015) draw three broad lessons for structural change from these successful experiences of China. First, industrial policy can and should identify and facilitate the development of industries consistent with a country's latent comparative advantage. Two, pro-active industrial policy can play a crucial role in helping an

economy transform itself in line with its actual and latent comparative advantage. Structural transformation requires coordination of firms in different sectors and first mover firms engaging in risking technological innovations should be supported; and three, developing countries can try to empirically identify their future or latent comparative advantages by comparing themselves with other countries with similar characteristics by higher levels of per capita income.

Haraguchi and Rezonja (2015) analyses the strength of production linkages in an input-output context using data from the World Input Output Database. China has strong production linkages with both domestic and foreign suppliers. In Russia, foreign linkages have decreased over time, while its domestic linkages have increased. India is the only country among the BRICs whose domestic linkages have declined, while its international linkages increased. Brazil has increased its domestic linkages in the natural resource based industries and in the transport equipment industries. South Africa is highly dependent on foreign inputs. In the period studied, China has emerged as a dominant supplier to other BRICS's manufacturing industries. In terms of market orientation, the manufacturing industries of Brazil, India and South Africa are more oriented towards domestic markets than those of China and Russia.

Table 4 highlights the fact that the contribution of manufacturing to employment remains limited, even in the most industrialised of the BRICS, China (18.7 per cent of total employment in 2008). This of course is due to higher than average labour productivity in manufacturing. Between 1980 and 2008, the share of manufacturing in total employment shrank by around 3.5 percentage points in Russia and South Africa. In India and China, the employment share increased by around 2 percentage points. In Brazil there was hardly any change. It is worth noting that in China the share in employment increased in spite of rapid labour productivity growth. In India, it was stagnant productivity growth that made increases in the labour share possible.

Table 5: Changes in sectoral shares of Value Added (VA) and Employment (N). BRICS, 1980-2008(in percentage points)

	Brazil (1980-2008)		Russia (1995-2008)		India (1980-2008)		China (1987-2008)		South Africa (1980-2008)	
	VA	N	VA	N	VA	N	VA	N	VA	N
<i>Agriculture</i>	1.39	-20.63	-3.20	-6.18	-19.93	-14.43	-20.31	-18.43	-0.78	-12.04
<i>Mining</i>	1.16	-0.20	-3.98	-0.18	-0.22	0.03	0.59	-0.53	-7.19	-7.24
<i>Manufacturing</i>	-2.25	0.24	0.40	-3.58	1.79	1.78	14.78	2.38	-3.20	-3.40
<i>Utilities</i>	1.64	-0.34	-1.80	0.36	0.50	0.02	0.58	0.21	0.33	-0.26
<i>Construction</i>	-2.91	-1.76	1.40	-0.40	0.38	4.80	-0.59	2.20	-	2.45
<i>Services</i>	0.9 6	22.69	7.19	9.98	17.4 8	7.79	4.95	14.1 6	11.5 3	20.49

Source: Naudé et al. (2015a)

Thus, China and India's fast GDP per capita growth has been accompanied by structural changes away from agriculture, and into manufacturing and services, respectively. In Russia, rapid growth since 1997 has not seen a growing manufacturing share. This lack of industrial expansion is typical of gas/oil-rich countries. Haraguchi and Rezonja (2015) focus on changes in the sectoral composition of GDP in the five BRICS countries. Using econometric methods, they predict the value added and employment levels of manufacturing sectors, on the basis of data for a set of large countries, controlling for population density and resource endowments. They then compare the actual sectoral trends of the five countries. This shows whether or not a country is doing better or worse than predicted, and in which sectors such advantages are concentrated. Chinese performance in manufacturing was better than the predicted average, while India's performance was worse. For Brazil, Russia and South Africa their manufacturing strengths of these countries lie in the natural resource based industries, although in case of South Africa the country has experienced a shrinking manufacturing share – but mysteriously an even larger decline in the relative share of mining, over a period that includes one of the strongest commodity booms since the Second World War. As Kaplan (2015:259-260) concludes '*In the absence of significant policy support for growth and development and job creation, the prospects for significant employment gain in South African manufacturing are likely to be limited and the share of manufacturing, while by no means constituting wholesale deindustrialisation, is likely to diminish pari passu with growth in per capita income*'. As in Russia, the service sector has become the dominant sector in South Africa, and is also dominant in Brazil. In fact, the services sector was already by far the largest sector in Brazil in 1980.

We should ask, given the reasons for the 'special' nature of manufacturing discussion in section 2 what has been the contribution manufacturing growth to aggregate productivity growth in the BRICS. Did manufacturing growth also drive productivity changes? Table 6 reproduces the sectoral contributions to aggregate productivity growth – the sum of contributions of within sector productivity increases and contributions due to sectoral shifts of employment - for the period 1980-2008.⁶ The contributions are presented as percentage points. Between brackets the contributions are calculated as the percentage of total productivity growth over the whole period. (When productivity growth is very low, the percentages can be very high. In this respect, percentage points are more revealing).

⁶ In table 5 the sectoral contribution is calculated by first distinguishing between expanding and contracting sectors. For the expanding sectors the contribution to aggregate productivity growth consists of the contribution of intrasectoral productivity growth plus (or minus) the product of the increase in the sectoral employment share from the beginning to the end of the period and the difference between that sector's average labour productivity over the period and the average productivity of all shrinking sectors (This methodology is developed in Van Ark and Timmer 2003, see also Wang and Szirmai, 2008). For shrinking sectors, the contribution equals the intrasectoral productivity contribution.

Table 6: Sectoral contribution to total labour productivity growth. BRICS, 1980-2008 (in percentage points)

	Brazil	Russia	India	China	South Africa
	80-08	95-08	80-08	87-08	80-07
<i>Agriculture</i>	0.22%	0.05%	0.44%	0.73%	0.04%
	(351%)	(2%)	(11%)	(9%)	(13%)
<i>Mining</i>	0.08%	0.15%	0.09%	0.50%	0.32%
	(128%)	(5%)	(2%)	(6%)	(103%)
<i>Manufacturing</i>	-0.05%	0.80%	0.65%	3.20%	0.08%
	(-88%)	(25%)	(16%)	(39%)	(24%)
<i>Utilities</i>	0.13%	-0.05%	0.09%	0.24%	0.06%
	(216%)	(-1%)	(2%)	(3%)	(19%)
<i>Construction</i>	-0.05%	0.31%	0.21%	0.39%	-0.09%
	(-80%)	(10%)	(5%)	(5%)	(-27%)
<i>Trade, restaurants and hotels</i>	-0.15%	0.82%	0.66%	0.71%	-0.16%
	(-236%)	(25%)	(17%)	(9%)	(-50%)
<i>Transport and telecommunications</i>	-0.02%	0.29%	0.37%	0.69%	0.14%
	(-33%)	(9%)	(9%)	(8%)	(44%)
<i>Financing, Real Estate and Business</i>	0.01%	1.06%	0.77%	1.13%	0.10%
	(19%)	(33%)	(19%)	(14%)	(32%)
<i>Other services</i>	-0.11%	-0.23%	0.70%	0.68%	-0.18%
	(-177%)	(-7%)	(17%)	(8%)	(-57%)
Total	0.06%	3.20%	3.99%	8.27%	0.32%
	(100%)	(100%)	(100%)	(100%)	(100%)

a Between brackets percentage of total productivity growth

Source: Authors' estimations based on Timmer (ed) (2012), G. J. de Vries et al. (2011) and K. De Vries et al. (2013)

In four of the five countries manufacturing has a substantially positive contribution to aggregate productivity growth. The only exception is Brazil, where the manufacturing sector has a marginally negative contribution, and almost all of the (negligible) productivity growth is explained by what happened in Agriculture and Utilities. In China, manufacturing makes by far the greatest sectoral contribution to productivity growth, accounting for thirty nine per cent of total growth. In Russia, India and South Africa service sectors are the most important drivers of growth with an exceptionally large contribution of trade (25 per cent) and finance (33 per cent) in Russia. In India all service sectors contribute to growth. In South Africa the record is more mixed. Transport and finance contribute positively, while other sectors make negative contributions to a slow aggregate rate of productivity growth.

De Vries et al. (2015) find strong growth enhancing effects of structural change in China, India and Russia, but not in Brazil. In their statistical analysis level of aggregation makes a great deal of difference. If only a few large sectors are distinguished, reallocation is not very important. When more (35) sectors are

distinguished, reallocation contributes much more. Furthermore, they make a distinction between formal and informal sectors, and show that in the case of Brazil, increased formalisation appears to be growth enhancing, while in India the increase in informality is growth reducing.

Summarising the above trends, it is clear that the most rapid economic growth has occurred in the BRICS where most structural change has taken place and where manufacturing continues to play a substantial role such as China, and to a lesser extent India. The different patterns of structural change illustrate the extreme heterogeneity of the BRICS.

4. Drawing Lessons: Explaining Successes in the BRICS' Industrialisation

Before proceeding to draw lessons, a word of caution is in order. As argued by Hobday (2013) in the context of the debate on the East Asian 'miracle', one should be wary of trying to extract general lessons from the experiences of specific countries. As Hobday pointed out, the East Asian experience was characterised by a variety of issues: countries followed vastly different policies, the market and state played varying roles in the different countries, the focus was on different types of firms, and the different countries in East Asia experienced varying success with respect to FDI and multinational companies.

Rather than drawing some general lessons from East Asia, Hobday argued that one should formulate industrial policies that are aligned with the stage of a country's development, its resource endowments and characteristics, and that take the rapidly changing global environment into account. This argument also applies to any lesson-drawing attempt from the BRICS's experience as described in this paper.

This notwithstanding, it is clear that the most successful BRICS seem to be those in which industrial policy has helped to reveal latent comparative advantages, facilitated foreign investment and technology transfer, traced complementary domestic investment and innovation strategies, and where industrial policies were flexibly adapted and modified in light of changing external circumstances. This is reflected in (i) their respective patterns of structural change; (ii) the way in which trade and FDI has been harnessed to promote economic development; and (iii) the different ways in which opportunities for sustainable industrialisation have been pursued. We discuss these ingredients of success in the following sub-sections.

4.1 Patterns of Structural Change

'Development is fundamentally about structural change' (Rodrik, 2007:6). The BRICS have been successful to varying degrees in fostering economic growth and development through structural change in the past three decades. In China and India, structural change has resulted in a rise of the share of both manufacturing and services, with a greater emphasis on manufacturing in China and services in India. In

terms of the composition of exports, the shares of manufacturing increased hugely in both countries. In contrast, in Russia the manufacturing sector's share of value added hardly changed between 1995 and 2008. In the same period, South Africa experienced a decline in its manufacturing share of more than three percentage points, and a more than ten percentage point increase in the share of its service sector. Strangely, South Africa experienced a huge drop in the relative share of mining over a period that includes one of the strongest commodity booms since World War II.

The service sector is the leading sector in South Africa, Russia, Brazil, and India. In fact, the service sector has been the dominant sector in Brazil's economy since 1980. China is the only country where services do not account for over 50 per cent of GDP. Notwithstanding the varying shares of manufacturing, all BRICS had relatively high manufacturing growth since 1999 at least until the financial crisis, and given their higher backward linkages with their domestic economies than other sectors, manufacturing made a solid contribution to their growth in the last decade.

Within manufacturing, a gradual (and sometimes uneven) shift has taken place from more labour-intensive to capital-intensive (and higher skill-intensive) manufacturing. Thus, important industries such as food processing, textiles, leather and footwear, and wood and wood products (typically labour- and low-skill-intensive industries) have only shown moderate changes in output, while output grew fastest in more capital-intensive industries such as chemicals, machinery, electrical and optical equipment, transport equipment, and metals and metal products. Some country-specific features that stand out are the growth in value added in the petroleum and chemicals industries in Brazil, India, and South Africa, transport equipment in China and Brazil, rubber and plastics in Russia, and electrical and optical equipment in China and India.

As a group, the combined size of the BRICS economies is already larger than that of the USA or the EU. This is the result of relatively stable economic growth since the mid-1990s, although not all the BRICS have been growing equally fast. In spite of their increased weight in the world economy, the BRICS still have much to achieve in terms of catching up. Compared to successful catch-up economies (such as Republic of Korea) or the world technological leader (the USA), the BRICS countries still have a long way to go. In 2010, in terms of PPP dollars, the GDP per capita of Brazil, China, and South Africa was only around one-fifth of that of the USA, while India did not even reach 10 per cent of US GDP per capita.

4.2 Harnessing Trade and FDI

Trade—particularly exports—has played an important part in the structural transformation and growth performance of the BRICS countries, especially since the 1990s. While the BRICS only accounted for less than 4 per cent of world exports at the beginning of the 1980s, their combined share reached 13 per cent by 2010. China's phenomenal export-led growth (exports of manufactured goods) is well

known and is to a large extent responsible for the increase in the share of exports from the BRICS. India has increasingly been exporting IT services and exports of resource-based goods and commodities have risen in Russia and South Africa, with much less dynamic manufacturing exports. Brazil has been successful in exporting natural resources as well as certain categories of manufactured goods, often natural resource-based products.

Within manufacturing, China and India have managed to transform the nature of their manufacturing exports from an export structure concentrated in labour intensive and low-tech products (mainly food and textiles) towards a structure concentrated in capital intensive and high-tech products (metal products, machinery, and electrical equipment in China, and chemicals and other manufacturing goods in India). Brazil and South Africa have witnessed less radical changes, albeit in the same direction, with transport equipment, machinery, and electrical equipment gaining shares. In contrast, Russian manufacturing exports show a trend towards a concentration exclusively in refined petroleum products (driven by its oil and gas resources).

During the past thirty years, an important characteristic of the globalisation process has been the emergence of global production sharing, or as it is also known, the rise of global value chains (GVCs), which refers to the global outsourcing of the chain of production across countries. Incorporation into GVCs today is deemed crucial for industrialisation. The differential export success of the BRICS suggests that they also have very different patterns of incorporation into GVCs.

Over the last fifteen years, except for India, the other BRICS have strengthened production linkages with domestic and foreign manufacturers. There is a clear difference between China and the rest of the countries in terms of their participation in GVCs. China has become a major supplier in GVCs across almost all manufacturing industries, whereas other BRICS have come to be active in specific global production chains. For example, Brazil and Russia have emerged as important players in food and beverages, and coke and refined petroleum GVCs, respectively, although they are lagging behind China even in their respective industries.

One of the sectors in which GVCs are important, is the food and beverages sector. The BRICS countries have been successful in attracting FDI to their food and beverages industry, although again differences between the countries are evident. While China has been the preferred destination for food and beverages FDI among the BRICS, South Africa appears to attract the least FDI. The preference of MNEs for China may come at the detriment of other BRICS, especially Brazil, which was previously the preferred location for US food and beverage MNEs. According to outward FDI data for food and beverages from the USA, a recent geographic shift seems to have occurred. Data on the restructuring of major companies in this industry seem to corroborate this interpretation. The major food and beverages MNEs have not been engaged in many Greenfield investments in the BRICS. However, nearly all of such Greenfield investments (i.e. the construction of new industrial production

facilities) have taken place in China and Russia. In contrast, nearly all their divestitures (e.g. the closure of industrial plants, selling of affiliates, or selling off stock) have occurred in Brazil and South Africa.

The structural changes in the BRICS economies and the extent to which these have been driven by success in manufacturing exports are attributable to their differential success in upgrading technological capabilities. Technological progress has been most significant in China, followed by India, and to a lesser extent in Brazil, Russia, and South Africa—corresponding to their patterns of structural transformation and degree of success in manufacturing. The latter two remain economies that are essentially dominated by natural resource extraction and services, and characterised by difficulties in their political and social transition processes.

There are at least two explanations for the differential success in technological upgrading, namely differences in human capital accumulation (education and skills formation) and in attracting foreign technology through FDI. Brazil, Russia, China, and India are amongst the top five countries in the world in terms of the absolute number of university enrolments in 2007. Similarly, the BRICS received only 5 per cent of global FDI in 1980, while other middle income countries attracted 12 per cent. Thirty years later, the BRICS countries now attract 13 per cent of global FDI while all other middle-income countries together attract only 15 per cent. China and India stand out from the other BRICS in attracting FDI.

The bulk of FDI has gone to China, especially after 1990, and to India and Russia in the period after 2005. FDI has driven China's export-led growth as well as industrialisation, with most FDI to China going to the manufacturing sectors. In Brazil, Russia, and South Africa, there has been a reorientation of FDI over time from manufacturing towards mining. The share of FDI flowing into manufacturing in India has declined considerably. Most FDI to India flows into the service sector, in particular financing, real estate, and business services. In Brazil, Russia, India, and South Africa, FDI is increasingly focusing on the exploitation of natural resources or services, and is thus less conducive to manufacturing. The focus on foreign investment should not obscure the importance of domestic investment, as is clearly illustrated in the case of China and also in the case of the other BRICS. Between 2005 and 2010 the volume of domestic investment in China was 20 times as high as that of Greenfield FDI (Naudé, Szirmai and Lavopa, 2015). It was the complementarity of domestic investment efforts and FDI, which resulted in spectacular success in structural change and technological upgrading in China.

In addition to direct investment in human capital, factors such as increased domestic investment in infrastructure, attracting the return migration of skilled workers, transferring surplus labour from rural to urban areas, and promoting joint ventures (JVs) with foreign companies (Harrison and Rodriguez-Clare, 2010) have played a significant role in making technology transfers from MNEs more effective in China. This has accelerated the structural transformation of China (and to an extent also of

India), which in turn has made their economies even more attractive as destinations for foreign investment, and recently also as destinations for the rising trend of global R&D expenditures. In contrast, in South Africa, the science and technology sector is widely seen as being hampered by a lack of skilled workers and a significant brain drain, both of which reflect a poor economic policy environment, including endemic corruption, cronyism, nepotism, gangsterism, state capture, and violent crime.

4.3 Sustainability of Structural Change⁷

Energy consumption in manufacturing is one of the most significant contributors to greenhouse gases (GHG). Increasing energy efficiency and reducing pollution intensity are two important routes towards more sustainable patterns of industrialisation. The prospects for green industrialisation in the BRICS may also depend on the adoption and diffusion of renewable energy technologies as an alternative to fossil fuel technologies.

Significant differences currently exist among the BRICS in the level of diffusion of installed capacity to produce renewable energy. China and India lead diffusion efforts. Since 2005, China and India have installed capacity to produce wind energy very rapidly. In 2010, China overtook the USA in terms of installed wind energy capacity. In 2011, China ranked third in the world, behind the UK and Denmark, in offshore wind capacity. By 2006, India had the fourth largest wind power capacity installed with 6.27GW. In 2009, 2010, and 2011, the grid-connected wind power capacity in India increased to 10.9GW, 13GW, and 16GW, respectively (see Iizuka et al., 2015).

In the other BRICS countries, the development of installed capacity in wind energy has been slow. In terms of hydroelectric power generation, Brazil stands out amongst the BRICS as a world leader, producing over 80 per cent of its electricity through hydroelectric power. With regard to solar electricity generation, the BRICS are lagging far behind the advanced economies. Among the BRICS, China has the highest installed capacity to generate solar energy, but still has a low capacity overall when compared with the world's leading countries in solar energy production. In solar heating installed capacity, China is the world leader, followed by India and Brazil, whereas in Russia and South Africa, there is negligible diffusion in the use of solar heating. Despite the diffusion of renewable energy capacity, energy demand is rising so rapidly in the BRICS that they are becoming increasingly reliant on conventional fossil fuel energy sources.

Another side of the story is the diffusion of the capability to produce machinery for sustainable energy technologies. Here there are some remarkable success stories. With regard to manufacturing capabilities in wind turbines, China has become the world's largest producer, with India ranking fifth. Brazil and South Africa are also investing in production capacity at more modest levels. Russia's installed capacity to

⁷ This section draws on Iizuka et al. (2015).

manufacture these products is incipient, though Russia seems to show some potential in technological capabilities. Brazil has achieved considerable success in producing bio-fuels. For grid-connected solar PV systems, China, followed by India, has the highest installed capacity to generate solar energy among the BRICS. In 2008, China accounted for 35 per cent of the global production of PV cells. In other BRICS countries (Brazil, Russia, and South Africa), the diffusion of production capabilities is still at an incipient stage. In sum, the BRICS record in terms of sustainable energy is mixed. On the one hand, there are some remarkable successes in the generation of renewable energy and the production of machinery and equipment for sustainable energy production. China, India, and Brazil provide true examples of leapfrogging in this respect.

5. Impact on Poverty Reduction

The structural transformation described in this paper has had very different impacts on poverty reduction in the respective BRICS. Whether or not structural change contributes to poverty reduction depends on (i) whether there is net new employment creation; (ii) productivity and wage differentials between expanding and shrinking sectors; and (iii) within sectoral wage and productivity trends. Only in the case of China did manufacturing growth directly and significantly contribute to poverty reduction. A major reason for the significant reduction in poverty was that poor rural inhabitants migrating to urban areas found work in the manufacturing sectors—the largest single sector of employment for migrant workers in China. It should be noted, however, that the decline in China’s poverty is not only attributable to growth in manufacturing jobs, but also to policies that supported rural development and the position of smallholder farmers.

In Brazil, Russia, and India, structural change was also accompanied by declining poverty rates. A very substantial decrease in poverty was witnessed in India between 1969 and 2006 from 69 per cent in 1969 to around 20 per cent in 2006. The Povcal database (World Bank 2014) shows a decline of the poverty rate from 65.9 per cent in 1977 to 32.7 in 2009. The decline in poverty is driven by economic growth, industrialisation and redistributive policies. Aggarwal and Kumar (2015) conclude that service-led growth has not been especially conducive to poverty reduction.

Also, in recent years, Indian manufacturing has also been shedding jobs, and employment in the sector is dominated by low-skilled, low wage earning industries. Chapter 8 concludes that the decline in poverty in India has been slowing down since the 1990 reforms. But from a long-run perspective, substantial gains have been made in combating poverty. In Brazil, poverty declined by 23 per cent between 1990 and 2009, dropping from 48 per cent of the total population to 24.9 per cent (ECLAC, 2011). According to the PovCal database, the poverty rate dropped from 17.9 in 1992 to 6.1 in 2009 (World Bank, 2014). In the past ten years, social protection policies and cash transfer programmes to the poor have made a dent in poverty and have somewhat reduced the high level of income inequality.

In Russia, the poverty rate was more than halved between 2000 and 2011, dropping from 29 per cent of the population in 1990 to 12.8 per cent in 2011 as documented by Kuznetsov et al. (2015). This decline in poverty comes after a period of deep economic distress, plummeting GDP per capita, and declining standards of living after the collapse of communism and the dissolution of the Soviet Union in 1989. As Kuznetsov et al. (2015) explain manufacturing development had little to do with the decline in poverty. More influential were increases in pensions, wage increases in non-market services sectors, and the creation of jobs in the public sector. The labour market in Russia functioned as a partial buffer against poverty, as enterprises were slow to lay off labour when output declined and instead adjusted wages and working hours downward.

In South Africa poverty declined from 24.3 per cent in 1993 to 13.8 percent in 2008, with most of the decline in poverty taking place after 2000 (World Bank, 2014).

Naudé et al. (2015) conclude that the decline in poverty in Brazil, Russia, and South Africa cannot be directly attributed to industrialisation or the manufacturing sector, mainly due to the fact that employment in manufacturing either declined or grew only very slowly in these countries. For instance, employment in manufacturing in Brazil grew at an annual compound growth rate of only 1.5 per cent between 1990 and 2009. In Russia, low growth in manufacturing after 2000 was accompanied by job destruction in all major industrial sectors—between 2000 and 2007, manufacturing employment decreased by 2 million. In these two countries, as well as in South Africa, declines in poverty were mainly attributable to improved social welfare (higher pensions) and more jobs in services, such as in healthcare, education, finance, and government. A number of factors had dampening effects on poverty decline in South Africa, namely the exclusion of large parts of the labour force from the formal labour market, the decline in manufacturing employment and excessively capital-intensive production methods in the manufacturing sector (See Kaplan, 2015).

6. Concluding Remarks

Appropriate industrial policies can play an important role in helping an economy transform itself in line with its actual and latent comparative advantage. The most successful countries seem to be those in which industrial policy has helped realise latent comparative advantages, facilitated human capital formation, foreign investment and technology transfer, and where industrial policies were flexibly adapted and modified in light of changing external circumstances.

This paper has shown that all BRICS have shared an evolution from import substituting industrialisation towards a more outward looking stance. All BRICS have experienced varying degrees of liberalisation since the 1980s. In recent years, they have formulated policies to promote and strengthen the manufacturing sector but with varying degrees of success. In Russia, South Africa, and Brazil, manufacturing is

shrinking in spite of explicit policy efforts to the contrary. As a result, these countries today have large reservoirs of unemployed people, amongst the highest levels of inequality in the world, and often experience episodes of social unrest, violent crime, and political uncertainty. Despite the continued attention these countries have paid to industrial policy, the outcomes have, as in the case of their political and social transitions, not lived up to expectations. It is clear that the success of industrial policy is not automatic, and it also depends on policy design, policy capabilities, social cohesion, luck, and external circumstances.

As a result we are now seeing a re-thinking process with regard to openness and liberalisation, and a cautious re-entry of the state in more selectively and actively promoting industry is evident, albeit not to the same extent as during the ISI-era. These are, however, only broad trends; within these general trends, the instruments and motivation for industrial policy varied quite substantially.

Since 2008, the rapid growth rates characteristic of the BRICS prior to 2008 have slowed down.⁸ The differences in structural change documented extensively in this paper have had important consequences for the resilience of the different economies, which show increasing divergence in economic performance. Two of the countries most dependent on primary exports, Russia and Brazil have experienced negative growth rates, Brazil since 2013, Russia since 2014. South Africa continues to be rather stagnant, with GDP per capita growing at between 2 and 3 per cent since 2011. India has been least affected. Its growth rate in 2014 was 4.6 per cent, compared to an average growth rate of 5.7 per cent between 2000 and 2008.

In 2014-2015, the per capita growth rate of China was still a very respectable 6 per cent, but compared to an average growth rate of 11.3 per cent between 2008 and 2008 this represents a very marked slowdown. The Chinese slowdown has had a major impact on the growth prospects of the global economy, testifying to the increased role of the BRICS in the global economic order. The Chinese slowdown reflects the breakdown of the model of exclusive reliance on exports as the engine of growth, the erosion of competitiveness due to increasing wages and the transition to an economy which has to innovate, at least in part, at the frontiers of knowledge, rather than relying on absorbing global technology from the advanced economies at low cost. China is struggling with the challenges of the middle-income trap.

Important areas for future research and current challenges remain. Foremost in this is the need for BRICS to drive their further structural economic transformation through stimulating innovativeness. In best promoting structural economic transformation for poverty reduction, a country's stage of development, and the particulars of the sectors involved, need to be considered. As countries develop, entrepreneurship and the role of private sector seem to become more important. Firms have to be innovative enough to adapt in an economic environment that demands more diverse and heterogeneous

⁸ From The Conference Board, Total Economy Database, 2015.

consumer goods, sophisticated services, and globalised production systems (Sachs 1996). As noted by Tang and Hussler (2011:25) ‘as the latecomer approaches the technological frontier, its strategies have to shift from imitation to innovation’. This is an important challenge now facing the BRICS.

Finally, one of the clear messages in this paper is that the BRICS are a very heterogeneous set of countries. It makes no analytic sense to study them as a separate kind of economy with special characteristics. One could well expand the BRICS to include other dynamic emerging economies such as Turkey, Malaysia, or Indonesia. The real relevance of the BRICS is that they represent an ongoing change in the post-1945 international order, which has so far been dominated by large Western economies and Japan. Since the call for a New International Economic Order at the UNCTAD conference of 1974, developing countries and emerging economies have been arguing for an enhanced role and increased voting power of the developing world in international financial organisations such as the World Bank, the IMF, or the WTO. The increasing weight of the BRICS in the world economy provides them with the economic clout to act as advocates on behalf of emerging economies. The breakdown of the Cancun trade talks in 2003 was one of the first signs of this increasing clout, the creation of an ‘alternative world development bank’ in July 2014 the most recent. In this sense, the BRICS might develop into another development pole as an alternative to the one that has been led by large OECD countries since 1945, resulting in a polarisation of the world order. These two trends—the greater voice of emerging economies in the world economy and world affairs, and/or increased global polarisation—deserve more scholarly attention.

Acknowledgements

This paper is based on the first and final chapters of our edited volume ‘**Structural Change and Industrial Development in the BRICS**’ published by Oxford University Press (2015). We have a substantial debt to the various authors who contributed chapters to this book and whom we cited here, to our colleagues at UNIDO and UNU-MERIT for their comments, suggestions and logistical and practical support during the editing of the book, as well as to the commissioning editor and his staff at Oxford University Press for their professional support. All errors and omissions remain solely our own responsibility.

References

- Ács, Z. and Naudé, W. (2011). ‘Entrepreneurship, Stages of Development, and Industrialization’, *UNU-WIDER Working Paper no. 2011-53*, Helsinki
- Aggarwal, A. and Kumar, N. (2015). ‘Structural Change, Industrialization, and Poverty Reduction: The Case of India’ (In Naudé, W., Szirmai, A. and Haraguchi, N. eds. *Structural Change and Industrial Development in the BRICS*. Oxford: Oxford University Press. Chapter 8, pp. 199-223).

De Vries, G., Erumban, A., Timmer, M., Voskoboynikov, I., and H. Wu (2011). ‘Deconstructing the BRICs: Structural transformation and aggregate productivity growth’, *Journal of Comparative Economics*, Volume 40, Issue 2, May 2012, Pages 211-227.

ECLAC (Economic Commission for Latin America and the Caribbean) (2011). *Social Panorama of Latin America 2010*

Harrison, A. and A. Rodriguez-Clare (2010). ‘Trade, Foreign Investment, and Industrial Policy for Developing Countries’, (In D. Rodrik (ed.), *Handbook of Development Economics*, Amsterdam: North Holland, vol. 5, pp. 4039–214).

Hobday, M. (2013). ‘Learning from Asia’s Success: Beyond Simplistic “Lesson-Making”’ (In A. Szirmai, W. Naudé and A. Alcorta eds. *Pathways to Industrialization in the Twenty-First Century. New Challenges and Emerging Paradigms*, Oxford: Oxford University Press, 131–54).

Iizuka, M., Dantas, E., and Freitas, I.M.B. (2015). ‘The Diffusion of Renewable Energy Technologies in the BRICS’ (In Naudé, W., Szirmai, A. and Haraguchi, N. eds. *Structural Change and Industrial Development in the BRICS*. Oxford: Oxford University Press. Chapter 15, pp. 408-428).

Kaplan, D. (2015). ‘The Structure and Performance of Manufacturing in South Africa’ (In Naudé, W., Szirmai, A. and Haraguchi, N. eds. *Structural Change and Industrial Development in the BRICS*. Oxford: Oxford University Press. Chapter 9, pp. 244-266).

Kuznetsov, B., Gimpelson, V. and Yakovlev, A. (2015). ‘Industrialization in the Russian Federation’ (In Naudé, W., Szirmai, A. and Haraguchi, N. eds. *Structural Change and Industrial Development in the BRICS*. Oxford: Oxford University Press. Chapter 6, pp. 138-161).

Lin, J.Y. and Yu, M. (2015). ‘Industrial Upgrading and Poverty Reduction in China’ (In Naudé, W., Szirmai, A. and Haraguchi, N. eds. *Structural Change and Industrial Development in the BRICS*. Oxford: Oxford University Press. Chapter 4, pp. 93-118).

Naudé, W., Szirmai, A. and Lavopa, A. (2015). ‘Industrialization and Technological Change in the BRICS: The Role of Foreign and Domestic Investment’ (In Naudé, W., Szirmai, A. and Haraguchi, N. eds. *Structural Change and Industrial Development in the BRICS*. Oxford: Oxford University Press. Chapter 12, pp. 324-351).

Naudé, W., Szirmai, A. and Haraguchi, N. eds (2015). *Structural Change and Industrial Development in the BRICS*. Oxford: Oxford University Press.

Rodrik, D. (2007). ‘Normalizing Industrial Policy’, Paper prepared for the Commission of Growth and Development, J.F. Kennedy School of Governance.

Sachs, J.D. (1996). 'Notes on the Life Cycle of State-Led Industrialization', *Japan and the World Economy*, 8: 153-174.

Szirmai, A. (2012). 'Industrialization as an Engine of Growth in Developing Countries, 1950-2005', *Structural Change and Economic Dynamics*, 23 (4): 406-20.

Szirmai, A. (2013). 'Explaining Success and Failure in Economic Development' (In: D.S. Prasada Rao and Bart van Ark eds. *World Economic Performance. Past, Present and Future*, Edward Elgar, 2013, chapter 9).

Tang, M. and C. Hussler (2011). 'Betting on indigenous innovation or relying on FDI: The Chinese strategy for catching-up', *Technology in Society*, 33(1-2): 23-35.

Wilson, D. and Purushothaman, R. (2003). 'Dreaming with the BRICs: The Path to 2050', *Goldman Sachs Research Paper no. 99*

World Bank (2004), *PovcalNet*,
<<http://iresearch.worldbank.org/PovcalNet/index.htm?3>>, downloaded 2014

The UNU-MERIT Working Paper Series

- 2016-01 *Mexican manufacturing and its integration into global value chains* by Juan Carlos Castillo and Adam Szirmai
- 2016-02 *New variables for vocational secondary schooling: Patterns around the world from 1950-2010* by Alison Cathles
- 2016-03 *Institutional factors and people's preferences in social protection* by Franziska Gassmann, Pierre Mohnen & Vincenzo Vinci
- 2016-04 *A semi-endogenous growth model for developing countries with public factors, imported capital goods, and limited export demand* by Jan Simon Hallonsten and Thomas Zieseemer
- 2016-05 *Critical raw material strategies in different world regions* by Eva Barteková and René Kemp
- 2016-06 *On the value of foreign PhDs in the developing world: Training versus selection effects* by Helena Barnard, Robin Cowan and Moritz Müller
- 2016-07 *Rejected Afghan asylum seekers in the Netherlands: Migration experiences, current situations and future aspirations*
- 2016-08 *Determinants of innovation in Croatian SMEs: Comparison of service and manufacturing firms* by Ljiljana Bozic and Pierre Mohnen
- 2016-09 *Aid, institutions and economic growth: Heterogeneous parameters and heterogeneous donors* by Hassen Abda Wakoy
- 2016-10 *On the optimum timing of the global carbon-transition under conditions of extreme weather-related damages: further green paradoxical results* by Adriaan van Zon
- 2016-11 *Inclusive labour market: A role for a job guarantee scheme* by Saskia Klosse and Joan Muysken
- 2016-12 *Management standard certification and firm productivity: micro-evidence from Africa* by Micheline Goedhuys and Pierre Mohnen
- 2016-13 *The role of technological trajectories in catching-up-based development: An application to energy efficiency technologies* by Sheng Zhong and Bart Verspagen
- 2016-14 *The dynamics of vehicle energy efficiency: Evidence from the Massachusetts Vehicle Census* by Sheng Zhong
- 2016-15 *Structural decompositions of energy consumption, energy intensity, emissions and emission intensity - A sectoral perspective: empirical evidence from WIOD over 1995 to 2009* by Sheng Zhong
- 2016-16 *Structural transformation in Brazil, Russia, India, China and South Africa (BRICS)* by Wim Naudé, Adam Szirmai and Nobuya Haraguchi