Impact of Trading Gains on Economic
Growth in BRICs for 1995-2010:
Some Lessons from BRICs

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1. Introduction

Brazil, Russia, India and China (BRIC)[1] account for 37 percent of the planet's land and 40 percent of its population. Their efforts at catching up with the advanced economies has been described in detail by O'Neill (2001), and Wilson and Purushothaman (2003) using a conventional growth accounting [total factor productivity (TFP)].

As they predicted over the past decade, the weight of the BRICs (Brazil, Russia, India and China) in the world GDP at a current US$ basis markedly grew from 8 percent in 2000 to 18 percent in 2010 and China contributed half the advance.[2] In 2010, BRIC GDP in US$ on a PPP basis was 25 percent of the global total. The share of the BRIC countries in the G6 GDP at a current US$ basis increased from 13 percent in 2000 to 37 percent in 2010. The BRICs accounted for 15 percent of world exports. China's GDP exceeded Japan's by 8 percentage points at end-2010 measured in current dollars, and it hopes to overtake America soon.

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[1] BRIC excludes South Africa. See *BRICS Joint statistical Publication, 2011* available at the website of National Bureau of Statistics of China.

[2] The figures in this section are based on IMF, *The World Economic Outlook Databas*e, April 2011, IFS and the websites of the statistics authorities of the BRICs. For India during 2008-2010, the data of the press release of the Indian Central Statistics Office dated February 7, 2011 are employed.

In 2009 the global financial crisis caused a 2 percent drop in world GDP, but the BRICs expanded by 4.3 percent despite Russia's 7.8 percent contraction. China and India were the pacesetters. In 2010 the BRICs GDP surged by 8.8 percent.

In this paper, we analyze the determinants of BRIC economic growth by comparing the dynamics of real GDI (gross domestic income) with GDP for 1995-2010 including the period of the global financial crisis. Real GDI measures the purchasing power of a country's total income generated by its domestic production (SNA2008, section 15.188). Real GDI is defined as "command-basis GDP" by the US Bureau of Economic Analysis. In an open economy the real GDI is real GDP *plus* the trading gain (or loss) including currency appreciation and depreciation. Accordingly, the trading gain is defined as the difference between the real GDI and GDP. It arises from changes in the terms of trade, defined as the ratio of the export price P^e to the import price P^m, namely P^e / P^m. In general, if imports and exports are large relative to GDP and if the terms of trade markedly change due to a large increase in export prices relative to import prices or a decrease in import prices relative to export prices, the magnitude of potential trading gains or losses would be large, as was shown in Russia for 2008-2010.

The big finding of this econometric inquiry is that the Asian BRICs, China and India were hardly affected by oil price shocks and associated changes in terms of trade, even during the global depression 2008-2010. Ceteris paribus, they appear well positioned to withstand future external shocks, whereas Russia's prospects appear to hinge decisively on natural resource price driven "command GDP."

2. An Overview of Economic Growth in the BRICs

Figure 1 shows the GDP growth of the BRICs for 2000-2010.[3] As can be seen, China grew fastest, followed by India, Russia and Brazil. The average annual growth rates of China, India, Russia and Brazil for 2000-2010 were 10.5 percent, 7.8 percent, 4.8 percent and 3.6 percent respectively. Russia's growth paced India's before the global financial crisis. In 2009, however Russian GDP contracted, whereas India continued to grow rapidly. Thereafter, Russia's growth path followed Brazil's lead.

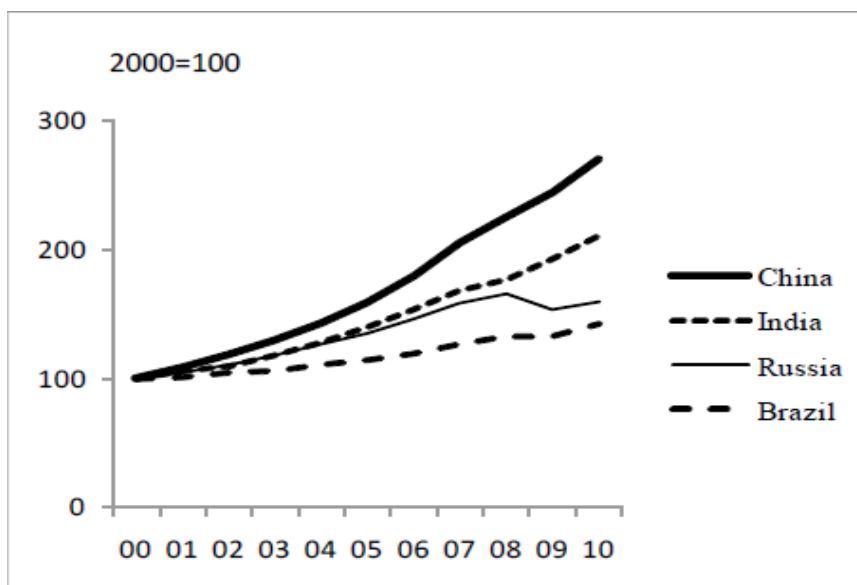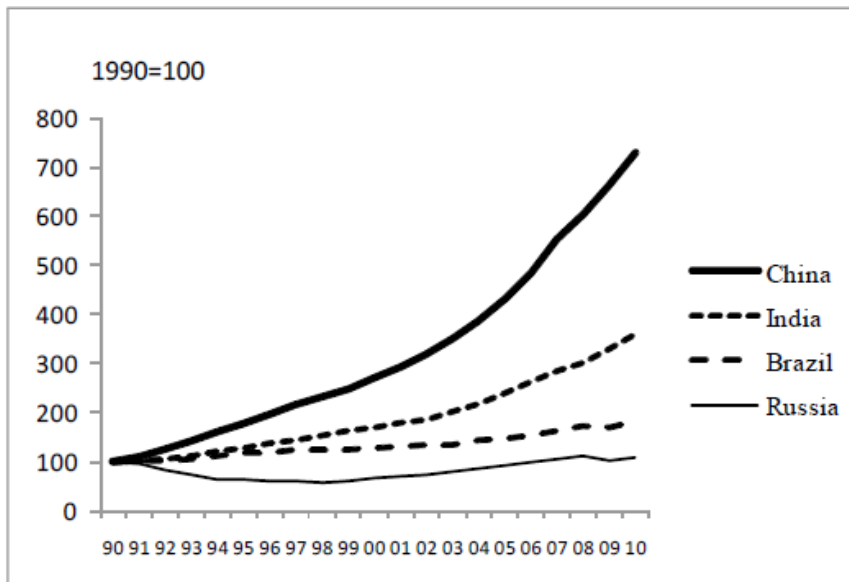Figure 1 GDP Growth in BRICs in the 2000s

Figure 2 shows BRIC growth for the extended period 1990-2010. China and India grew fastest over this interval with the average 10.4 percent and 6.6 percent respectively. Brazil showed steady growth at the average growth rate of 3.1 percent. In contrast,

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[3] Here, in addition to the data mentioned in the footnote 2, we employ the United Nations online database of the main aggregates (the 2011 version released in December, 2010) for 1990-2009, and the CEIC online database for 2005-2010. Russia's data are based on the updated GDP series provided on the website of its statistics office named Rosstat as of April 1, 2011.

Russia's GDP in 2010 was 1.07 times its level in 1990 due to the post-Soviet economic collapse in the early 1990s. Russia's average growth rate was only 0.34 percent for 1990-2000. This rate was less than Japan's low rate of 0.94 percent for the same period. Even though the composition of Russia's GDP became more consumer oriented, growth point to point is negligible.[4] Russia's per capita GDP at a current US\$ is about 10,000 US\$, well below the level of the advanced countries.

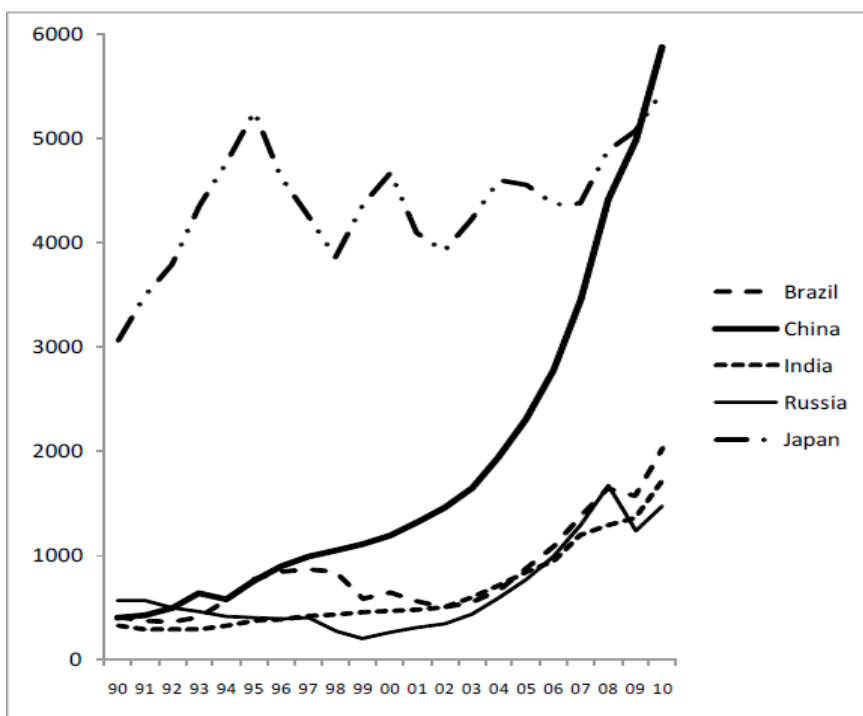Figure 2 GDP Growth in BRICs for 1990-2010

GDP at a current US\$ basis is important from the point of view of a country's collective and individual purchasing power for tradable goods and services. In particular

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[4] Let us index the GDP level (Russia's peak) in 1989 as 100. Using the official, updated data, Russia's GDP level accounts for 99.9 in 2009 and 103.9 in 2010. Using our estimate of the growth rate of *minus* 0.6 percent for 1990 (Kuboniwa and Ponomarenko, 2000 and Rosefielde and Kuboniwa, 2003) and the official data for 1991-2010, it accounts for 102.4 in 2009 and 106.5 in 2010. Anyway, in our estimation, during the global financial crisis Russia's GDP was slightly over its peak level.

it is important for a country such as Russia with free FOREX market and strong demand for imports..

Figure 3 shows BRIC GDP in billions of current US$. It shows that China overtook Japan in 2010. The US GDP was still 2.5 times larger than the Chinese GDP in 2010. However, China seems poised to close the gap. Its GDP in 2010 was 5 times that in 1990. The Soviet dream of overtaking America voiced by Nikita Khrushchev 50 years ago, might come true in China.

Figure 3 GDP at a Current US$ Basis in BRICs and Japan (billions)

Brazil's GDP decreased 1995-2002 and then steadily rose until 2008. It fell slightly again during the global financial crisis, but rapidly recovered in 2010. Brazil's GDP is the second highest in the BRIC hierarchy.

Russia's GDP plummeted after August 1998 financial crisis, finally reaching rock bottom in 1999. It recovered steadily until 2008, catching up with Brazil. Thereafter Russia's GDP in 2008 was 8.5 times that in 1999, due mostly to currency appreciation. China's GDP in 2008 was only 4 times that in 1999 on the same basis. This marked growth of Russia's current GDP contributed to a large improvement in the living standard of Russians for the same period. Russia's current and real GDP however, contracted sharply during the 2008 global financial crisis, even though ruble depreciation remained within a very limited range. Russia also showed a rapid recovery in 2010 but its GDP level was still lowest in the BRICs.

India's GDP also is catching up with Brazil. Its GDP growth slowed during the global financial crisis, but it did not decline. It's GDP is the second smallest of the BRICs.
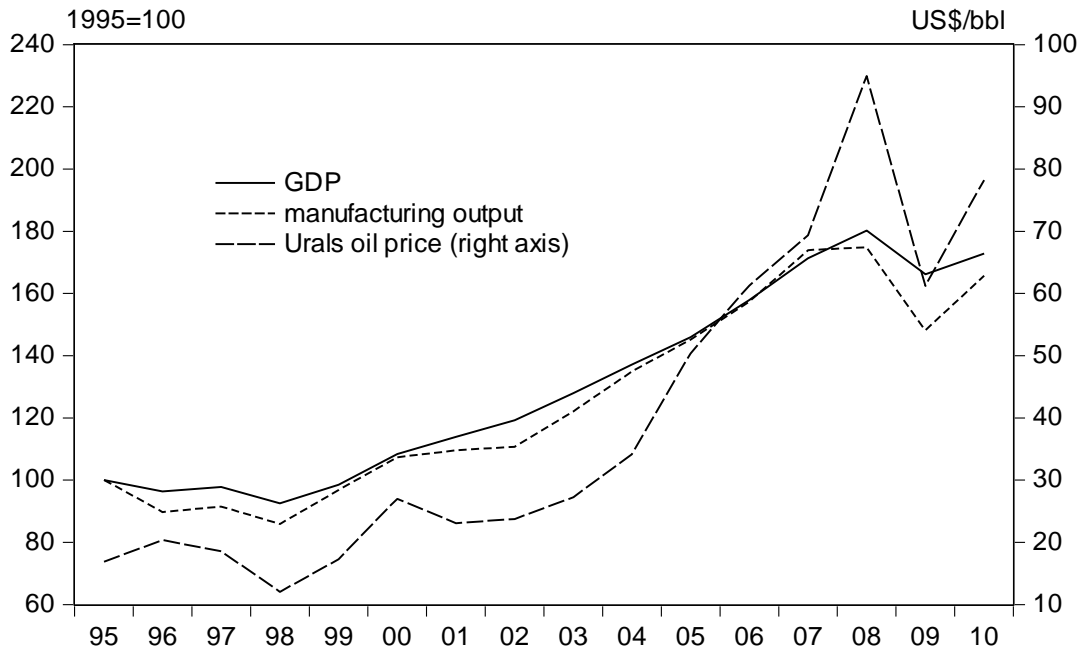
3. From Dutch to Russian Disease

Kuboniwa (2010) showed the followings. First, there is a strong positive relationship between the changes in real GDP and oil prices. Second, there is a strong positive impact of the changes in oil prices on Russian manufacturing, which differs markedly from the Dutch Disease (slower growth of manufacturing). Third, the increase in imports due to real appreciation of rubles, in turn, contributed to GDP growth in the trade sector, which is a major source of the overall Russian growth. These correlations make Russia sensitive to petroleum price fluctuations, and vulnerable to the "Russian disease" whenever global growth slackens.

Figure 4 shows Russian GDP, manufacturing output and international oil price (Urals) movements for 1995-2010, based on the official data (website of Rosstat and the

oil price data of Bloomberg). As can be seen, GDP and manufacturing output grew and contracted along with rises and falls in oil prices.

Figure 4 GDP, Manufacturing and Oil Prices in Russia

By using an OLS regression (log-log type with trend) we have the following result with all coefficients at the 1 percent significance level (adj. R^2= 0.977):

$$gdp = 0.217*oil\ price + 2.16 \text{ percent (trend)}, \tag{.1}$$

where an italic lower case *x* denotes the growth rate of the variable x *(dx/x)*. Since the elasticity of GDP with respect to oil prices is 0.22, a 10 percent increase in oil prices induces a 2.2 percent increase in GDP. Equation (.1) also suggests that the overall growth of GDP is supported by the exogenous trend of 2.2 percent (a technical progress, catch-up efforts and so on) which corresponds to TFP (total factor productivity) in growth accounting. In this paper we call this trend growth factor "quasi-TFP."

The average growth rates of GDP and international oil price (Urals) for 1995-2010 were 3.7 percent and 10.8 percent respectively. It follows from Eq. (.1) that the oil price contribution to growth (2.34 percentage points) explains 63 percent of the overall growth. The residual 37 percent consists of the quasi-TFP (58 percent) and statistical error (*minus* 21 percent). About one half of the growth can be explained by the oil price impact. The quasi-TFP explains another half of the Russian growth. It is the growth trend; oil price fluctuation is a cyclical factor.

It is noteworthy that Russia's growth 1995-2010, the global financial crisis and the present recovery are explained by a simple equation such as Eq. (.1). This wasn't the case 1960-1990 in the Soviet era.

We also have the following regression result (adj. $R^2= 0.948$)[5]:

$$\textit{manufacturing output} = 0.282*\textit{oil price} + 1.39 \text{ percent (trend).} \qquad (.2)$$

The elasticity of manufacturing output with respect to oil prices is 0.282 much higher than the GDP elasticity whereas the quasi-TFP for manufacturing is much less than that for overall growth.

Since the average growth rate of manufacturing output 1995-2010 was 3.4 percent, the oil price contribution to the manufacturing growth (3.03 percentage points) explains 89 percent of the overall growth. The residual 11 percent consists of the quasi-TFP (41 percent) and statistical error (*minus* 29 percent). The Russian manufacturing output

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[5] The coefficient of the oil price is significant at 1 percent level whereas that of the trend with the standard error of 0.8 percent is significant at 11 percent level (>10 percent). This problem can be avoided using monthly or quarterly data of manufacturing output for 1999M01-2010M12. When we omit the trend factor, we have the following regression at all coefficients with the 1 percent significance level (adj. R^2=0.941): *manufacturing output = 0.378*oil price*.

heavily depends on the oil price factor, without a trace of Dutch Disease in the Russian manufacturing.

4. The Impact of Trading Gains on Economic Growth in the BRICs

All of the BRICs are oil producers, but Russia has been the sole oil exporter since 1993 when China became an oil importer. A broader measure of the terms if trade effect is needed for Brazil, India and China. This can be accomplished by computing changes in the trading gains defined as the changes in real GDI to real GDP, that is, current net exports deflated by the import price *minus* real net exports. When E and M denote exports and imports in current prices respectively, and P^e and P^m denote export and import prices (deflators) respectively, the real trading gain T is defined as:

$$T = (E - M)/P^m - (E/P^e - M/P^m) = (1/P^m - 1/P^e)E = (P^e/P^m - 1)E/P^e .$$

T is only meaningful in real terms if $P^e = P^m = 1$ and $T = 0$.

The real GDI is defined as:

$$GDI = GDP + T.$$

The real growth of the trading gain cannot directly be defined. Instead, we measure the change in the trading gain as the change in F=GDI/GDP; f equals the difference between changes in GDI and GDP, that is to say, $f = gdi - gdp$.

I used the following data for the BRICs. For Russia the official data on the website (as of May 1, 2010 and April 1, 2011) were employed. Real growth rates of GDP, exports, imports and GDI for the period 1995-2000, the period 2000-2003 and the period 2004-2010 were based on 1995 constant prices, 2000 constant prices and chain-method (annually changing base previous year prices) respectively. For Brazil the official data in the CEIC and IFS-WEO databases for 2005-2010 were used. The United

Nations database for 1995-2009 was also used. Real of GDP, export, import and GDI growth rates were calculated by using the chain-method (changing the base year annually). For India, in addition to IFS, UN and CEIC databases, the official press release for 2008-2010 on the website the Indian statistics office were employed. Real growth rates are calculated as in Brazil.

China's official GDP statistics on the expenditure side may be soft because most of its GDP data are based on the production side. Supplementary data on exports and imports in current prices as well as constant prices are not available. Only data on net exports in current prices are published. We employ China's data on exports and imports in current prices in IFS for 1990-2009 and CEIC for 2010. These data in US$ are converted to those in RMB (Yuan) through the annual average exchange rates in IFS. Net exports calculated from these data in RMB are consistent with the official data on the official website except for 2010. These data for 2007-2010 are shown in Table 1. As is seen from this table, the data in current prices of IFS are quite different from those of UN for 2008-2009. This may be attributable to two errors in the United Nations database (main aggregates of national accounts) for China's foreign trade data in current prices during 2008-2009.[6] Although the UN data in current prices are not reliable, we employ them for real growth export and import rates of exports and imports 1995-2009 because they are consistent with the framework of the national accounts. For 2010 we employ percent changes of exports and imports estimated in the WEO database. Following the official methodology, our estimations of China for 1996-2000,

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[6] As can be seen in Table 1, there are some similarities between figures in foreign trade of IFS in US$ and UN in RMB. The United Nations might misconstrue the data in US$ as RMB. The United Nations also might convert these erroneous figures to US$ by using IFS exchange rates.

2001-2005 and 2006-2010 are made in 1990 constant prices, 2000 constant prices and

2005 constant prices respectively.

Table 1 Foreign Trade Data of China

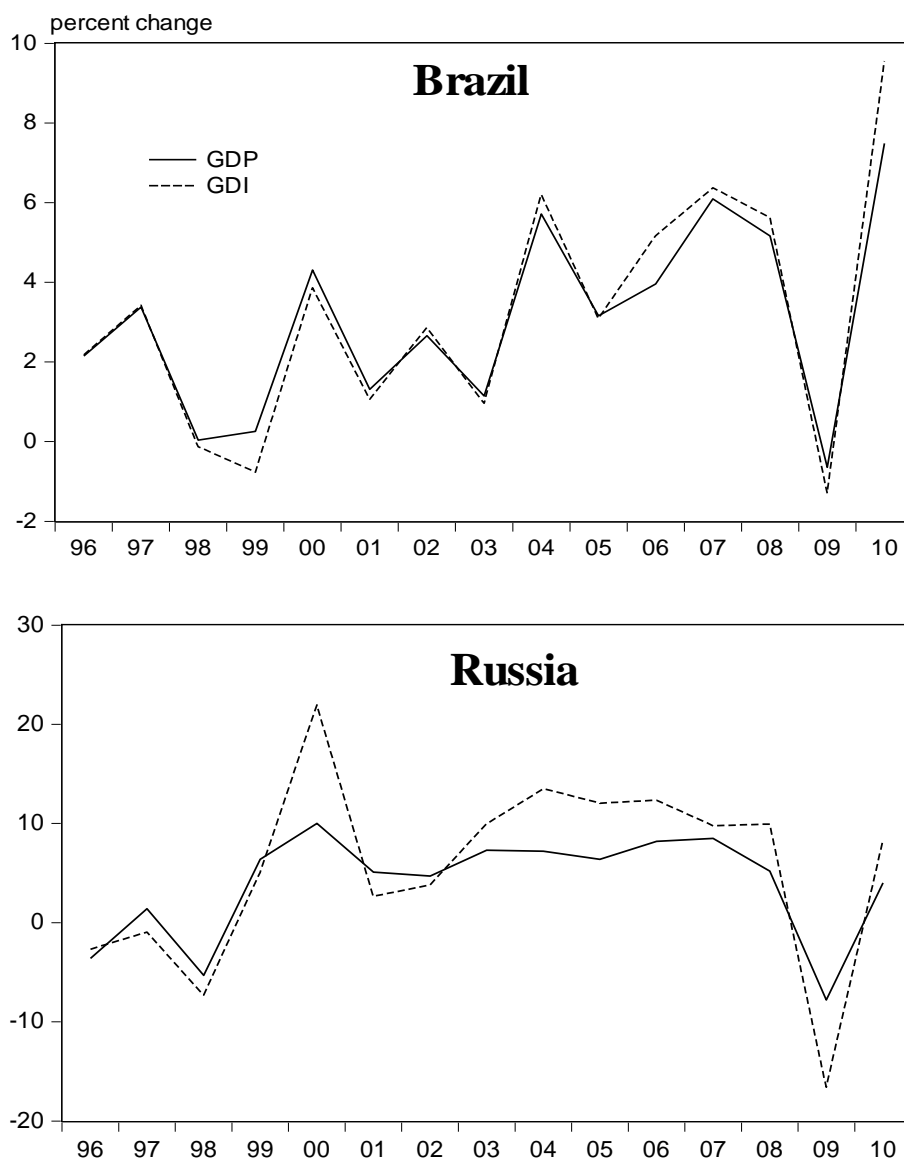|		2007	2008	2009	2010
In current prices					
		Data of IFS for 2007-9 and CEIC for 2010			
Exports	bln US$	1,342	1,582	1,333	1,753
Imports	bln US$	1,035	1,233	1,113	1,521
Net exports	bln US$	307	349	220	232
		Calculated from data of IFS and CEIC			
Exports	bln RMB	10,211	10,991	9,109	11,866
Imports	bln RMB	7,872	8,567	7,605	10,294
Net exports	bln RMB	2,339	2,424	1,504	1,571
		Data of the United Nations (as of April 1, 2011)			
Exports	bln US$	1,342	2,276	1,952	
Imports	bln US$	1,034	1,774	1,528	
Net exports	bln US$	307	502	424	
Exports	bln RMB	10,206	15,817	13,332	
Imports	bln RMB	7,868	12,328	10,435	
Net exports	bln RMB	2,338	3,489	2,897	
		Official data of NBSC			
Net exports	bln RMB	2,338	2,423	1,503	997
		Data of IFS			
Exchange rate	RMB/US$	7.608	6.949	6.831	6.770
Real percent change					
		Data of IMF(WEO) based on CEIC			
Exports	%	18.1	8.5	-10.3	34.6
Imports (cif)	%	8.0	3.8	3.7	17.7
		Data of the United Nations			
Exports	%	15.7	7.7	-10.3	
Imports	%	12.1	7.6	-2.1	

Sources: Websites of IFS, WEO, CEIC, UN and NBSC(National Bureau of Statistics of China).
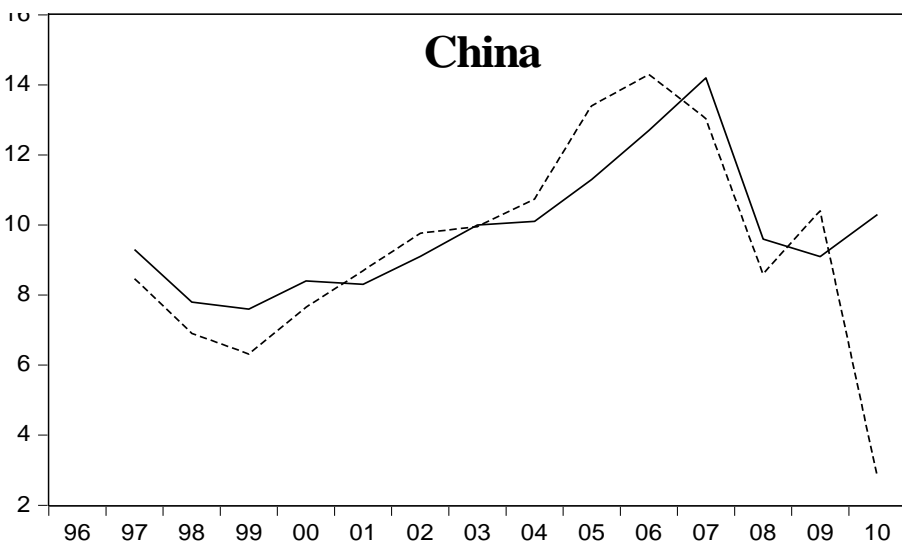Notes:
Exports and imports includes both goods and services.

Now we are in a position to present our estimations of real GDP, GDI and trading gains. Figure 5 summarizes real GDP and GDI (command-basis GDP) movements in the BRICs. As was stated, differences between percent changes in GDI and GDP show changes in the trading gains (*f*).

Figure 5 GDP and GDI (Command-Basis GDP) in the BRICs

In Russia, large trading gains were observed for 2000 when the oil prices showed a sharp increase. Russia also showed large trading losses in 2009 due to an adverse oil shock. The favorable growth for 2003-2007 was coupled with relatively large trading gains. The recovery in 2010 accompanied rising trading gains.

Brazil suffered from relatively small trading losses for 1997-2001 and positive trading gains thereafter. In particular, Brazil's trading gains rose 3.1 percent in 2008, despite oil price rises. The improvement of terms of trade was due to an increase in export prices against oil prices and a decrease in oil imports. It should be noted that Brazil showed a marked decrease in crude oil imports from 28.4 to 4.0 million tons for

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2000-2009, whereas it showed a remarkable increase in crude oil extraction from 63.2 to 100.4 million tons for the same period (BP, *Statistical Review of World Energy 2010*). The recession in 2009 was associated with trading losses. The recovery in 2010 was coupled with positive trading gains.

India also experienced relatively small trading losses 1999-2002. The impact of trading gains on the Indian growth appeared to be negligible for 2003-2010. In 2008 India's GDP growth rate fell despite positive trading gains.

Along with Brazil and India, China too experienced relatively small trading losses 1997-2000. China's high growth for 2001-2006 was coupled with trading gains. In particular, China experienced relatively large trading gains for 2005-2006 in spite of continuous increases in oil prices. However, it incurred trading losses 2007-2008. The change in trading gains of *minus* 1 percent in 2008 was relatively small. The fall in trading gains in 2008 however was about 3 percent, employing the WEO data on percent changes in exports and imports for the year. This result may be more plausible taking the 2008 oil shock into account. The sharp fall in trading gains of 7.5 percent in 2010 is rather surprising. If we project China's GDP growth based on the past relationship between GDP and GDI as will be shown below, China's GDP growth rate should be negative. However, the official preliminary growth rate was over 10 percent. So the situation in 2010 is unclear. Preliminary data on exports and imports in current and/or constant prices for 2010 might distort the gap between GDI and GDP. If the data are right, the Chinese government might have taken special measures to offset the great trading loss shock. Alternatively, the 2010 GDP growth rate may be overestimated. Anyway, we need further investigation for China's large trading losses in 2010. The

National Bureau of Statistics of China as well as the Statistics Division of the United States should improve China's GDP statistics on the expenditure side.

Using a log-log type regression with trend similar to Eq. (1) we have the following results of regressions:

For Brazil: adj. R^2=0.990

$$gdp = 1.789*f + 2.6 \text{ percent (trend)} \tag{.3}$$

All coefficients are significant at1 percent level.

For Russia: adj. R^2=0.981

$$gdp = 1.255*f + 2.6 \text{ percent (trend)} \tag{.4}$$

All coefficients are significant at 1 percent level.

For India: adj. R^2=0.990

$$gdp = 2.001*f + 7.0\text{percent (trend)} \tag{.5}$$

All coefficients except for f are significant at 1 percent level. The coefficient of f is significant at 10 percent level (the p-value is 0.0546).

For China:[7] adj. R^2=0.997

$$gdp = 1.679*f + 9.2 \text{ percent (trend)} \tag{.6}$$

All coefficients including the dummy variable are significant at 1 percent level.

Russia's elasticity of GDP with respect to trading gains is the smallest in the BRICs. This can be explained by large magnitude of changes in trading gains in Russia which were in the range between 12 percent in 2000 and -8.8 percent in 2009 (the gap of 21 percent). Those in Brazil were in the range between 3.1 percent and -0.8 (the gap of 3.9 percent). The values of changes in trading gains in India were in the range

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[7] A dummy variable for 2010 is introduced into the regression. The value of coefficient of the dummy variable is 0.140 (14 percent).

between 1.6 percent and -1.7 percent (the gap of 3.3 percent). Those in China for 1996-2009 were in the range between 2.1 percent and -1.3 percent (the gap of 3.4 percent).

Russia and Brazil show rather low values of exogenous trend factor whereas China and India show large values of exogenous trend factor. This reflects the large differences in GDP growth trends of two groups of Brasil-Russia and India-China. For Russia the quasi-TFP of 2.6 percent in Eq. (.3) is very close to the TFP of 2.5 percent derived from the production function (Kuboniwa, 2011). For China and India the coefficient of the trends are much greater than their TFP in the conventional growth accounting.

Table 2 provides an accounting of the sources of BRICs growth based on Eqs. (.3)-(.6) 1995-2010. Russia showed the largest total impact of trading gains on its GDP growth (1.6 percentage points), followed by Brazil (0.5 percentage points). The share of contribution of trading gains to average growth, which shows a country's dependency on trading gains or terms of trade, was 44 percent in Russia and 16.5 percent in Brazil. On the other hand, the total impact of trading gains on GDP growth in India and China was statistically meaningful but almost negligible although China's great trading gains contraction in 2010 remains puzzling.

Table 2 Average Growth of GDP and Trading Gains in the BRICs: 1995-2010

		Brazil	Russia	India	China
a	GDP (percent change)	3.1	3.7	7.1	9.8
b	Trading gain (percent change)	0.28	1.30	-0.02	0.05
c	Elasticity of GDP to trading gain	1.8	1.3	2.0	1.7
d	Impact of trading gain change (b*c)	0.5	1.63	-0.04	0.1
e	quasi TFP (Trend) (percent)	2.6	2.6	7.0	9.2
f	Residual (a-d-e) (percent)	-0.1	-0.5	0.1	0.5
g	Contribution of trading gain (d/a percent)	16.5	43.9	-0.6	0.9

Source; Author's calculations.
Notes:
China's calculations are made for 1995-2009.

5. Summary

As O'Neill predicted the BRICs countries showed relatively rapid growth in the 2000's despite the global financial shock. Surprisingly, Russia was unscathed by the Dutch disease. Some BRICs countries were strongly affected by trading gains. About one half of the Russian growth can be explained by this impact. About 20 percent of the Brazilian growth can also be explained in the same way. India and China showed large impacts *per unit* of changes in trading gains on their growth as is shown by the values of elasticity of GDP with respect to changes in trading gains. However, the *total* impacts in India and China were almost negligible. It seems that if these correlations persist, Asia's BRICs will be relatively immune to recurrent global financial crises.

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