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Implications of the Growth of China and India for the Other Asian Giant: Russia

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Abstract

Continuing rapid growth of China and India can be expected to raise incomes in Russia, but also to put adjustment pressure on Russian firms. The impacts of the rapid growth of China and India on the Russian economy are explored by examining a baseline projection using a global general equilibrium model, and then assessing the implications of higher-than-expected growth in China and India. The authors find that a major source of benefits to Russia is likely to be terms-of-trade improvements associated with higher energy prices—a quite different channel of effect from that for many developing countries that benefit primarily through expanded opportunities to trade directly with these emerging giants. Taking into account the likely improvements in the quality and variety of exports from China and India, the gains to Russia increase substantially. The expansion of the energy sector and the contraction of manufacturing and services are a sign of a Dutch disease effect that will increase the importance of policies to encourage adaptation to the changing world environment.

This paper—a product of the Trade and Integration Team, Development Research Group; and the Economic Policy and Debt Department, Poverty Reduction and Economic Management Network,—is part of a larger effort to analyze the implications of the growth of China and India for developing countries. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at wmartin1@worldbank.org or eianchovichina@worldbank.org or mivanic@worldbank.org

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Implications of the Growth of China and India for the Other Asian Giant: Russia

Introduction

Wilson and Purushothaman (2003) and many other recent studies have pointed to the rapid changes associated with the growth of today's major developing economies, including Brazil, Russia, India and China (the BRICs). Trade linkages, both direct and indirect, are transforming world trade, and particularly the trade of countries such as Russia, which has most of its territory in Asia and is actively involved in regional trade forums such as APEC (Asia-Pacific Economic Cooperation). Projected future growth of China and India also appears likely to have major impacts through increased demand for the natural resources that are of special importance to Russia.

Changes in trade are arguably the strongest and most direct channel through which the growth of China and India has affected other developing countries. China alone accounted for 7.2 percent of world exports in 2006—substantially more than her share of world GDP at market prices (estimated at 6.0 percent in 2007) and more than three times Russia's share of world exports in 2006. China's openness is high for a large economy, and it reflects partly the fact that as much as a third of the value of exports comes from imported inputs (Winters and Yusuf 2007). With annual growth at 15.1 percent over the period 1995 to 2004, China has been the second largest contributor after the US to world merchandise trade providing almost 9 percent of the increase in world exports, and 8 percent of the increase in world imports. While the turbulence associated with the current financial crisis seems likely to cause substantial fluctuations, the underlying trend rates of growth in the trade of China and India seem likely to remain strong.

In earlier work, we have examined the implications of the growth of China and India for other developing countries, and particularly the East Asian newly industrialized countries. This work (see Dimaranan, Ianchovichina and Martin 2007, 2009) highlighted the benefits to other

developing countries from increases in their direct trade and the potentially adverse impacts of greater competition in third markets. Our work on Europe highlighted the benefits from direct trade, and some interesting interactions of changes on energy prices and domestic taxation policies for energy (Martin, Ianchovichina and Dimaranan 2008). In this paper, and in related work on the Middle East (Ianchovichina, Ivanic and Martin 2008), we pay more attention to impacts through changes in the prices of resources resulting from the growth of China and India.

The purpose of this paper is to analyze the trade implications of the growth of China and India for Russia. We begin by considering the nature of the key trade linkages between Russia, China and India, and review the available literature on the nature and magnitude of these effects. Then, we consider a baseline to 2020 showing the nature of the changes in a world economy heavily influenced by the higher growth rates of large developing countries. Finally, we present simulation results showing the implications of higher growth in China and India for Russia and offer concluding remarks.

What the Literature Tells Us

If we hold policy settings constant in the world, the trade impacts of growth in China and India on Russia can usefully be divided into four channels: (i) opportunities for Russia to export to China and India; (ii) opportunities for Russia to import from China and India; (iii) third-market export competition from China and India; and (iv) indirect trade impacts.

The first two of these interactions unambiguously involve gains to countries trading with China and India, although the first is typically seen politically, as well as economically, as a gain, while the second is frequently seen politically as a loss. The third interaction invariably involves a loss to countries competing with China and India in third markets, and it is frequently the subject of a great deal of attention and angst. The fourth of these interactions is fundamentally ambiguous in sign. If increased imports by China and India raise the prices of goods that are also imported (exported) by Russia, then the effect can be adverse (favorable). As an example, Russia could expect to gain from increases in the demand for oil in China and India, even if that oil is supplied by the Middle East or Africa. Each of these channels of effect is discussed further below.

Opportunities to export to China and India

The opportunities to export to China and India are expanding extremely rapidly. China in particular has become an important destination for exports of other countries' primary products. In metals and coal, China ranks first, with shares of 15 to 33 percent of world consumption; in energy China ranks second or third after the USA (Streifel 2006). India and China are important consumers of agricultural commodities with India leading the world in consumption of sugar and tea, while China in consumption of wheat, rice, palm oil, cotton and rubber. Even more striking is the rate at which China has increased imports of primary products in recent years. According to Streifel (2006), soybean consumption has been growing by around 15 percent a year, and soy and palm oil consumption by 20 percent and 25 percent, respectively.

Since 1995 China has accounted for nearly 40 percent of global growth in imports of fuels and minerals. Most of this increase represents a net increase in demand as millions of Chinese consumers, and more recently Indian consumers, have grown richer, and increased their consumption of resource-intensive goods. As pointed out by Shalizi (2007), changes in the energy intensity of growing economies can have a large impact on the demand for energy.

Opportunities to import from China and India

The growth of China and India has created enormous opportunities for their trading partners to benefit economically from cheaper and higher-quality imports. While this is frequently seen purely as a political cost, it is a potentially very important source of economic gains. Amiti and Freund (2007) find that the prices of China's exports to the USA fell by 1.6 percent per year between 1997 and 2005. The growth of China's exports has been accompanied by technological upgrading. Devlin, Estevadeordal, and Rodríguez-Clare (2006) show how high-technology goods have partly displaced low-technology ones within the set of China's manufactured exports. This upgrading reflects both imports of more sophisticated products and local improvements in product quality (Branstetter and Lardy 2006).

The expansion of China and India's trade differs from the expansion of developing countries' exports considered in much of the traditional development literature that focused on the deterioration in the terms of trade associated with expanding exports of primary commodities. China and India's trade growth involves, for instance, two-way trade in

manufactures and services, which make the recipient countries the beneficiaries of improvements in efficiency in their trading partners (Martin 1993). It also involves fragmentation and global production sharing, where part of the production process is undertaken in one economy, and subsequent stages are undertaken in another (Ando and Kimura 2003; Gaulier, Lemoine and Unal-Kesenci 2004). This makes participants in this process beneficiaries from, rather than victims of, improvements in the competitiveness of their partners. And new trade theory now recognizes that export expansion does not involve just increases in exports of the same products. Rapidly growing economies expand the range of products they export, improve product quality, and export to additional markets as their exports grow (Evenett and Venables 2002; Hummels and Klenow 2005).

In addition, the trade patterns of growing countries tend to be quite dynamic. A large part of the growth of exports from a growing economy tends to be from new products (Hummels and Klenow, 2005). Further, the quality of the goods exported tends to increase substantially as economies grow, increasing the benefit to both the exporting country and its trading partners as shown by Dimaranan, Ianchovichina and Martin (2007). Both of these developments generate direct benefits to the trading partners of the emerging economies. The benefit in the case of improved quality is very clear. Higher quality goods allow importers to meet their needs with a smaller quantity of the good, and/or to consume more in response to a lower effective price of the good. The benefit from the increase in the number of goods supplied by the emerging market generates a benefit to countries that value an increase in the variety of goods available to them—a phenomenon frequently captured using formulations such as Dixit-Stiglitz preferences (see, for example, Hummels and Klenow, 2005).

Improvements in the quality of exported goods produced by an emerging market supplier increase the demand for these goods at any given price level, and hence tend to lead to increases in the actual unit prices received for imports from these suppliers. The result is an improvement in the terms of trade, and in the real incomes, of both the emerging exporter and the importer. How strong this increase is will depend upon the extent of the improvement in quality, on the increase in the number of varieties of products exported, and on the extent to which importers value increases in the variety of goods imported. If policy settings allow imported inputs to be used in partner countries, improvements in the variety and quality of imported inputs can be a

particularly important source of dynamism in the manufacturing sector (Amiti and Konings 2007).

Third-market competition

To the extent that the trade interactions between China and India, and other countries involve third-market competition, the countries facing increased competition stand to lose. As found by Freund and Ozden (2008) and by Hanson and Robertson (2008), some industries in some countries can and will lose from increased competition from the two countries. A key question is which countries and which industries will face the most serious competition? And where will the largest opportunities be found?

Lederman, Olarreaga and Perry (2008) report that aggregate gains have been accompanied by pain as some industries, firms, and sub-regions have been negatively affected by the rapid growth of the two Asian economies. Some of their background studies found this to be the case, for example, in industrial and electrical machinery, electronics, furniture, textiles, and transport equipment, mainly in Mexico and to some extent in Central American countries. Most of the deterioration in the position of Latin American exports in third markets relative to China and India's has to do more with domestic supply-side conditions than with lower demand for products from Latin America due to increases in China and India's market shares.

However, as noted in Dimaranan, Ianchovichina and Martin (2008), the trade impacts of fast growing economies today are very different from those that have typically been analyzed when considering the impacts of growth in primary-producing developing countries. In the traditional literature on the "fallacy of composition," a rapidly-growing developing country was typically a supplier of a raw agricultural or mineral commodity produced by other developing countries. Although this literature was subsequently extended to take into account the rapid growth in exports of manufactures from developing countries, it continued to focus only on third-market export competition from developing countries, in which only negative impacts from the growth of other developing countries' exports are feasible. If, for instance, Vietnam or Indonesia should grow by expanding exports of coffee or cocoa (or socks), then the traditional exporters of these goods could expect to lose from increased competition in third markets. The only research question is how large these effects might be.

The answer to this question in the case of Russia depends a great deal on the extent to which China and India's patterns of exports overlap with each other and with Russia's. As shown in Dimaranan, Ianchovichina and Martin (2007), the export patterns of China and India have been quite different, with India relying much more heavily than China on exports of services. Even within merchandise trade, their export patterns have been radically different at the six-digit level of the Harmonized System, with only one product—refined petroleum—appearing on the two countries' top-25 list of products, which accounted for 58.4 percent of India's merchandise exports and 38.4 percent of China's in 2004.[1] Neither has an export composition anything like that of Russia. This difference in export patterns reduces the risk of a collision in which the prices of exports by China, India, Russia and other developing countries are all simultaneously depressed.

Complicating factor in the analysis is the fact that, while both China and India are more labor-abundant than developed economies, relative factor endowments and income levels vary substantially across regions within China and India. Many of China's coastal areas are in a different income-level category than the much more labor-abundant inland provinces. This heterogeneity can influence the range of goods produced and exported by China, and therefore it helps explain the disproportionate similarity of China's export bundle with those of the developed countries (Schott, 2007). India's large number of skilled workers also implies that there may be a lot more competition between India and developed economies than suggested by its relative endowment shares.

Although China and India's merchandise exports are dominated by manufactures (World Bank 2003), the composition of these manufactures and the approach to their production differ considerably. While their shares of manufactured intermediate inputs in non-fuel imports in 2004 were very similar, their shares of imports of parts and components differed sharply as might be expected given China's much greater role in global production sharing. In 2004, imports of parts

[1] A notable feature of China's list is the prominence of computer and electronic equipment products under Chapters 84 and 85. These two chapters, which also include non-electronic equipment, alone accounted for almost 42 percent of China's exports in 2004, up from 16 percent in 1994. In India, three HS products under Chapter 71 (diamonds and jewelry) and refined petroleum under Chapter 27 likewise accounted for 28 percent of total exports.

and components accounted for 31 percent of China's merchandise imports, as against only 12 percent in India.

On the export side, the two countries also differ substantially in the importance of final goods in their exports (Dimaranan, Ianchovichina and Martin 2007). China has relied primarily on exports of final manufactured products, frequently as part of an East Asian production sharing network. In 2004, 61 percent of China's non-fuel exports were classified as final goods, compared to 40 percent of India's. Within manufactures, China has relied heavily on exports of finished goods, while India has focused much more on exports of intermediate inputs. India's exports are mostly comprised of capital- and skill-intensive goods, while China has emphasized exports of labor-intensive goods—although these are increasingly sophisticated (Rodrik 2006).

India's share of commercial services in total goods and services exports has been much higher than China's, not just since the rapid expansion of exports of computing services around 2000, but for the entire period since 1992 during which comparable estimates are available. The share of services in India's exports, at around 20 percent, began over twice as high as China's. This share declined in India until the late 1990s, when it again started to rise sharply. Since 2000, services have accounted for over a quarter of India's exports, while have declined to under 10 percent of total Chinese exports although China's exports of services have been growing rapidly in absolute terms. However, both countries still have relatively small world shares (1.8 percent and 2.8 percent of world services exports, respectively) and services trade alone is unlikely to transform India's economic performance (Winters and Yusuf 2007).

Finally, China's export growth has been accompanied by tremendous growth in product variety. While China was present in 9 percent of all manufacturing product categories in 1972, it was present in 70 percent of categories by 2001 (Schott 2007). This growth at the extensive margin is an important factor, which we take into account when evaluating the implications of rapid growth in China and India on the rest of the world.

An important concern for Russia and other countries will be the extent to which the giants, especially China, move up market into their "product space." India and China have demonstrated their ability to upgrade their performance in specific sectors. This issue is explored by Dimaranan, Ianchovichina and Martin (2007) by examining the potential implications of

different types of growth in China and India. They find that adjustment pressures in particular sectors are likely to be much greater if growth is driven by biased technical change in high-growth sectors in China and India than if it is driven by broad-based and relatively neutral technical change.

Indirect trade impacts

The rapid growth of imports and exports by China and India is likely to change the prices of many goods of interest to Russia, even if these goods are not traded directly. The sign of these effects is ambiguous, because it depends on the relationship between the mix of these products and those exported and imported by Russia. Particular areas where price changes seem likely are in agricultural commodities and natural resources, and particularly energy products (see Dimaranan, Ianchovichina and Martin, 2007). The relationship between the growth of output in emerging countries and the prices of these goods is likely to be different from that of manufactures and services.

For manufactures and services, we would expect a decline in prices relative to factor prices (in actual, rather than effective, prices). Productivity growth, or more efficient use of factors, in the emerging economies is raising their output, and hence putting downward pressure on the prices of manufactures and services. Energy and mineral products are different in that their supply is constrained by a fixed factor, energy resources. As incomes rise, the demand for energy grows strongly, and this tends to push up the price of energy products relative to factor prices. In our experiment, this effect is muted, but not completely offset, by the increase in the productivity of energy production itself assumed in the analysis.

For agricultural goods, there are several competing influences on prices. The first is the technological-change effect described above for manufactures and services, which tends to lower prices. A second is the presence of a fixed factor, land, in agricultural production, which tends to raise prices because world income demand for these goods has risen, just as in the case of energy products. A third factor is the well-known Engel effect—that demand for agricultural products, and particularly basic foods, tends to rise more slowly than income. A fourth factor that can be important in influencing agricultural prices is the Rybczynski effect—if growth is associated

with increases in the capital-labor ratio, it will tend to reduce agricultural output and raise agricultural prices.

Dimaranan, Ianchovichina and Martin (2007) find that higher growth in the giants implies increases in output of farm and forestry products in other countries and in output of energy, mineral and other resource-based products in countries endowed with natural resources. As China and India achieve major gains in their market shares in manufacturing, most other countries experience declines in manufacturing output relative to base, especially in clothing and electronics, which are sensitive to increased competition from the labor-intensive giants. Therefore, even if the two countries' success is generally good news for other economies, there are adjustment costs that will be borne by different stakeholders within those countries.

Methodology and Simulation Design

We use a modified version of the standard GTAP model (Hertel 1997) to analyze the consequences of higher growth in China and India on Russia. The model includes the explicit treatment of international trade and transport margins, a "global" bank designed to mediate between world savings and investment, and a relatively sophisticated consumer demand system designed to capture differential price and income responsiveness across countries. Product differentiation between imported and domestic goods and among imports from different regions allow for two-way trade in each product category, depending on the ease of substitution between products from different regions.[2] Factor inputs of land, capital, skilled and unskilled labor, and in some sectors a natural resource factor, are also included in the model, which emphasizes the constraints imposed on economies by their overall resource endowments, and takes into account the role of intersectoral factor mobility and overall resource constraints in determining sectoral output supply.

We modified the constant returns to scale version of the GTAP model to incorporate China's duty exemptions—which have been a key reason for the rapid integration of China into

[2] Imported and domestic intermediates are imperfect substitutes following the Armington structure.

global production networks—and to allow for much deeper integration by India into global production sharing than has been the case in the past.[3] Duty exemptions were incorporated in the GTAP model and data base following the methodology developed by Ianchovichina (2004). This duty exemption model allows for two separate activities in each industry – production of exports and production for the domestic market. Production of exports is represented as an activity for which imported intermediate inputs are available duty-free. Production for the domestic market uses the same technology as the production for exports, but requires payment of duties on intermediate inputs. Ianchovichina (2004) shows that failure to account for duty exemptions will introduce bias in trade liberalization outcomes in countries using such export processing systems.

The 57 sectors of the GTAP 7 (pre-release 4) database were aggregated into 26 sectors based on their importance in China, India and Russia. Because the 106 regions in this database would provide too much unnecessary detail and slow down our calculations, we aggregated most regions into 11 regional aggregate groups and 14 separate countries of interest—including Russia, China, India and a number of countries in the Asian region.

To examine the implications of more rapid growth in China and India on Russia, we needed first to take account of some of the major reforms that are transforming India's trade structure, in particular liberalization of non-agricultural tariffs, the introduction of free-trade zones where imported intermediate inputs used in the production of exports are exempt from import tariffs, and improvements in infrastructure needed to support trade. Then, to provide a benchmark against which the effects of higher growth rates of output might be assessed, we undertake a baseline projection to 2020 (See Table 1). This baseline allows us to take account of the much higher expected rates of growth in many developing countries, including China and India, than in the mature industrial economies, and a consequent greater impact of future changes in outcomes in developing countries.

We examine the implications of higher-than-projected growth in India and China in order to assess the direct implications of growth in China and India on Russia. We assumed that growth rates in China and India were 2 percentage points per year higher than under the baseline.

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[3] This was done assuming large-scale liberalization of the non-agricultural sector in India and the introduction of an effective system of duty exemptions for inputs used in the production of exports in India.

For comparability with Dimaranan, Ianchovichina and Martin (2007), we considered accelerated growth over a fifteen year baseline which resulted in output levels 34.6 percent higher in each region than under the baseline scenario. Consistent with Kaldor's (1957) stylized facts of economic growth, we also increased the stock of human and physical capital in line with the overall output increase in these two growing economies.

Recent empirical evidence (see, in particular Hummels and Klenow , 2005) suggests that economic growth of the type considered increases both the quality and the variety of the goods exported by the growing economy. Building on Hummels and Klenow (2005), the quality of goods exported is represented using a variable, λ, which determines the number of effective units of a good obtained from each actual, physical unit of that good. It has a counterpart in the popular iceberg specification for international transport costs, but is much more general in allowing the additional units of effective output to arise from a wider range of sources than changes in transport costs. Where purchasers have utility or demand functions that value gains in variety, the effective prices of goods decline as the variety of goods supplied increases.

The macroeconomic closure of the simulation model assumes a constant level of employment, perfect mobility of skilled and unskilled labor between sectors but none between regions. Because we look at long-run trends, we have doubled the elasticity of substitution between imported goods from different sources and between composite imported and domestic goods from the values used in the given GTAP database. In all simulations the trade balances as shares of GDP were fixed for China and India to avoid potentially important changes in welfare resulting from changes in financial inflows from abroad when growth rates in these countries change substantially.

Results

Impact of global growth 2005-2020

According to the widely-used projections for the growth in GDP, labor force, capital and population presented in Table 1, the most rapidly growing regions are expected to be the countries of South East Asia—China, Malaysia, India, Vietnam and Indonesia—all growing

above 5 percent per year in the period between 2005 and 2020. These projections involve a lower growth rate for Russia over the entire period of 3.1 percent per year.

Tables 2 and 3 show some key effects of global growth in the 2005-2020 baseline period for the world and for Russia, respectively. The first two sets of columns in the two tables show industries' base output shares and growth rates in the world and Russia. The numbers suggest that for most products the expansion in Russia is more modest than that in the world markets except for energy, vehicles, communication and other services. When we take into account the shares of output, we may also calculate the contribution of each sector's growth to the total growth. Most of world growth, about 33 percent, is attributed to growth in services other than trade, transportation and communication services, followed by trade and transportation services (16 percent), and communication services (13 percent). In Russia, services other than trade, transportation and communication services are even more important, contributing 41 percent to aggregate growth, followed by trade and transportation sector (14 percent) and energy (12 percent). The fact that energy contributes much larger share to aggregate growth in Russia than in the world economy (just 2 percent) underscores the importance of developments affecting this sector for Russia's growth outlook.

The differences between Russia and the global economy become even more striking when we compare their patterns of exports. While half of world export growth can be attributed to four sectors including machinery (15 percent) and electronics (15 percent), vehicles (10 percent) and chemicals (11 percent), most of Russia's export growth (70 percent) is accounted for by energy exports (52 percent) and metals (17 percent). This result highlights the much lower degree of export diversification in Russia compared to the rest of the world.

We also look at the last columns of Tables 2 and 3 showing the changes in export prices for the world as a whole and for Russia. The patterns for the two are very similar. Energy prices experience the greatest increase as the supply of energy products is constrained by a fixed factor, energy resources, although energy output can be augmented by applying additional capital and labor. As incomes rise, the demand for energy grows strongly, and this tends to push up the price of energy products relative to factor prices. In our experiment, this effect is muted, but not completely offset, by the increase in the productivity of energy production itself assumed in the analysis.

For manufactures and services, we would expect a decline in prices relative to the composite price of factors[4] (in actual, rather than effective, prices). World output has increased for any given level of factor use, and the price of the augmented factors used in production of manufactures has risen relative to the price of commodities.

For agricultural products the results are mixed, with prices of some products in world markets—namely wheat, vegetables and fruits, plant-based fibers and other crops—rising slightly, while prices of other agricultural product decline to varying degrees. These results quantify the importance of different factors influencing prices in the long run for Russia and the world economy. These include technical change, the presence of an important fixed factor (land), and the Engel and Rybczynski effects discussed in the previous section.

Impacts of additional growth of China and India

While the results from the baseline scenario are interesting, they do not allow us to tell how much of the changes observed in the baseline are due to the extraordinary performance of the Chinese and Indian economies. To gain some insight into this, we consider the impact of additional growth of 2 percentage points per year in China and India. The higher growth performance might be thought of as resulting from higher-than-projected performance beyond the baseline outcome and, hence, allowing us to assess the implications of higher growth. Alternatively, given the near-linearity of the model for this type of experiments, it might—with a change of sign—give an indication of how much the outcomes in the baseline would have fallen short of the observed levels had growth rates in China and India been 2 percent per year below their baseline levels. The impact of additional growth supplemented with an improvement in the quality and variety of exports—under two assumptions about the elasticity of substitution between varieties[5]—is also examined.

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[4] This is the numeraire in the model.

[5] We examine two different values (2.5 and 7.5) for the substitution parameter σ in the Hummels-Klenow relationship between different product varieties.

Welfare impacts

Table 4(a) summarizes these results for three key economic variables: growth, welfare, and the terms of trade. The first two columns of the table show that most countries, including Russia, benefit from additional growth of China and India, and all countries and regions considered gain if growth is accompanied by improved quality and variety of the growing countries' exports. The welfare changes are largest for China and India, which benefit directly from their own growth. The gains for other countries are relatively small in the absence of quality and variety improvements in exports from China and India (Dimaranan, Ianchovichina and Martin 2009). High-income countries gain, except for the EU and Japan, which lose despite terms-of-trade gains in the growth-only scenario because of the second-best interactions between existing distortions and the price changes resulting from the growth of China and India (Martin, Ianchovichina and Dimaranan 2008).

The reason for the frequently substantial terms-of-trade gains can be inferred from Table 4(b) that lists the impact of our scenarios on each region's exports and imports. Many countries benefit from improved terms of trade for their products as China increases its imports from the rest of the world by 28 percent and India by 33 percent in the growth scenario. This expanded demand raises world prices of a number of commodities, while the sharp increases in exports from China and India push down their export prices, and lower the cost of other countries' imports.

In the absence of improvements in the quality and variety of exports from China and India, some middle and low income countries such as Thailand, the Philippines, and other countries in South Asia, are projected to lose as competition from China and India in third markets adversely affects their terms of trade. Improvements in quality and variety of exports from China and India have large, favorable impacts on welfare in economies such as Japan, Korea, and Hong Kong/Taiwan that trade very extensively with China and India, and less in countries like the Philippines that have weaker direct trade links, and are more exposed to competition in third markets.

The welfare gains to Russia from growth in China and India are estimated at $US 8.4 billion per year. These gains are not associated with increases in export volumes, but arise

primarily from terms-of-trade gains of $US 8.7 billion. Further analysis shows that most of these gains, about $US 7.3 billion, come from the rising world price of energy—Russia's main export commodity (Table 8). While the welfare benefits of improvements in product quality and variety from China and India are substantial, the size of this gain is small relative to those for economies such as Malaysia, and Korea, which have much more direct trade in manufactures than does Russia. Given its terms-of-trade gains from expansion of China and India, Russia is able to increase its consumption at any given volume of exports, which in turn raises domestic prices and reduces its ability to export.

Industry impacts

Losses in terms of export volumes for Russia suggest that the effect from increased opportunities to export to emerging Asia is dominated by the effects from increases in third-market export competition and the increase in domestic demand resulting from the terms-of-trade improvement.

Russia is likely to play a smaller role in exporting manufactured goods with the exception of some natural-resource-based manufactures (e.g. paper and wood products, minerals; see Table 5). The boost to China and India's manufacturing industries has positive spillover effects via increased demand for intermediate inputs including energy and farm products. Within manufacturing, the hardest hit sectors are electronics, metals and machinery and equipment which contract by 13 percent, 9 percent, and 9 percent, respectively. Electronics and machinery are sectors that see the largest declines in prices as they face intensive international competition.

Tables 5, 6 and 7 explore the impacts of high growth in China and India on Russia's industries under different scenarios. In value terms (see Table 7) the greatest negative impact is borne by the metals sector which contracts by $US 7.1 billion, at 2004 prices. This contraction is mainly due to the reduction in output volume of 9.3 percent (Table 5), with a small reduction in price (0.5 percent) (Table 6). Since this reduction in price is smaller than the worldwide reduction, buyers of Russian metals—e.g. the European Union, rest of the Former Soviet Union, the USA, and other countries in the rest of the world— have an incentive to switch to other suppliers, resulting in a sizable drop in the volume of exports and output of Russia's metals sector.

The energy sector gains the most from the extra growth in China and India. The resulting increases in the value of output and exports are estimated at $US 19.3 billion and US$ 11 billion, respectively (Table 7). Most of the gain can be ascribed to the 6.1 percent rise in the price of energy (Table 6) rather than the quantity increase for output (1.7 percent) and exports (4.6 percent). The processed food sector also shows a significant gain in production of US$ 1.4 billion (Table 7). This happens despite the reduction in output price by 0.4 percent because of a three percent increase in output. Fruit and vegetables production grows by $US 1.2 billion due to a production increase of 2.8 percent and a price increase of 1.4 percent.

The reduction of exports from Russia contrasts strongly with the sharp expansion in exports from economies such as Japan and Hong Kong/Taiwan. In these cases, the expansion in direct trade with China outweighs the trade-reducing impacts of higher income and the resulting Dutch-disease impact of higher prices of nontraded goods.

Role of China

Throughout Tables 5, 6 and 8, we report separately the impact of China's growth alone. We do this by decomposing the results of our scenario for each exogenous variable, allowing us to see how important China and India are for the welfare outcome and sectoral production in Russia. The tables make it clear that in the case of Russia, most of these growth impacts come from China's growth. The impact of China alone accounts for more than US$ 5.0 billion (about 70 percent) of the total gain to Russia of $US 8.4 billion. Despite the overall significance of China over India in impacting the Russian economy, there are a number of—mostly agricultural—sectors where the impact of India's growth is greater than that of China's.

Conclusions

The key issue for our analysis is the extent to and channels through which higher-than-expected rates of growth in China and India affect Russia. In our survey of the literature, we noted that there are four broad channels through which the growth of China and India might be expected to impact on Russia: (i) opportunities for Russia to export to China and India; (ii) opportunities for

Russia to import from China and India; (iii) third-market export competition, and (iv) indirect trade impacts.

In this study, we began with a representation of the world in 2005. We then projected forward to 2020, to take into account the rapidly-increasing importance of China and India in the world economy. We also took into account liberalization and reductions in trading costs that increased India's interaction with the world economy. For our analysis, we used a special version of the Global Trade Analysis Project (GTAP) model designed to allow for extensive export-oriented manufacturing where Chinese and Indian exporters have access to imported intermediate inputs duty-free. In addition to examining the consequences of high export growth from China and India, we considered two scenarios under which the quality and variety of exports from these two giants improve as they grow.

Russia benefits substantially from high growth in China and India. Real incomes in Russia rise by $US 8.4 billion at 2004 prices when growth alone is considered. When we took into account increases in product variety and improvements in quality of exports from India and China these gains increased substantially. Because of uncertainty about the closeness of substitution between varieties, we considered two possible levels of preference for variety in the expansion of exports from China and India. The gains to Russia were $US 14.7 billion in the strong preference-for-variety scenario and $US 10.3 billion in the central scenario using the elasticity estimates preferred by Hummels and Klenow (2005).

We found that this increase in growth rates of China and India increases their exports to and imports from Russia. The overwhelming majority of the welfare gains—between $US 8.7 billion and $US 12.6 billion—accrued through improvements in Russia's terms of trade. These terms-of-trade gains were primarily associated with increases in world prices of energy products. The increment to growth that we considered raised Russia's energy export prices between 1.7 and 6.1 percent, while export prices for manufactured goods and services declined up to 5.8 percent. The prices of most agricultural prices changed somewhere between -2.8 to 1.8 percent, with downward pressure on these prices coming from increased productivity growth in China and India, and from the low income elasticities of demand for these products, and upward pressure coming from labor being pulled by Rybcznski effects out of agriculture in China and India into more capital and skill-intensive activities.

Overall, exports from Russia decreased slightly in volume terms (-0.3 percent) in the pure-growth scenario, but increased when quality changes in exports from China and India were taken into account. Exports of energy, some agricultural products and a few manufactured products increased, while exports of apparel, electronics, machinery and equipment, metals, automobiles and some services declined. These effects were the result of increased competition in third markets and increased domestic demand resulting from the income effects of the terms-of-trade improvements associated with the growth of China and India.

The results of this study suggest that the implications of higher growth in China and India on Russia are likely to be quite complex. The improvements in the country's terms-of-trade provide worthwhile income gains. These gains are larger when likely improvements in the quality and variety of exports from China and India are factored in. Against that, increased competition in third markets reduces the opportunities of some Russian sectors to expand exports of manufactures, and places some manufactures and services under increased competitive pressure in domestic markets. Finally, the expansion of the energy sector and the contraction of many manufacturing and service sectors is a sign of a Dutch-disease effect. Russia will face increasing pressures to adjust her industries to the changing world environment, and domestic and trade policies to improve competitiveness and to promote adjustment to these changes are likely to be particularly important.

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Table 1 Annual Output, Factor Inputs, and Population Growth Projections, 2005-2020, %

	GDP	Unskilled labor	Skilled labor	Physical capital	Population
Australia & New Zealand	3.4	1.6	0.6	3.8	0.7
China	6.6	0.8	3.9	8.5	0.6
Japan	1.6	0.2	-0.7	2.5	-0.2
Korea	4.7	2.0	5.8	4.9	0.3
Hong Kong & Taiwan	4.3	0.6	2.9	4.9	0.3
Indonesia	5.2	2.7	6.5	4.7	1.1
Malaysia	5.6	-1.4	3.9	5.8	1.4
Philippine	3.5	1.8	4.5	3.4	1.5
Singapore	4.9	0.6	1.1	5.3	0.8
Thailand	4.6	0.1	3.2	3.9	0.5
Vietnam	5.4	1.4	1.9	6.0	1.1
Rest of Southeast Asia	3.1	1.3	4.2	3.7	1.0
India	5.5	1.6	4.0	6.1	1.1
Rest of South Asia	5.0	2.1	3.6	5.1	1.7
Canada	2.6	1.6	0.9	3.2	0.4
USA	3.2	1.5	0.8	3.9	0.7
Mexico	3.8	2.7	4.6	3.3	1.4
Argentina & Brazil	3.6	0.9	3.6	3.1	1.0
Rest of Latin America	3.3	1.6	3.9	3.4	1.4
EU + EFTA	2.3	0.4	0.1	2.6	0.0
Russia	3.1	-0.1	0.4	3.4	-0.6
Former Soviet Union	3.4	0.6	1.1	4.4	0.3
MENA	4.0	1.8	3.0	4.1	1.6
Sub-Saharan Africa	3.5	2.6	3.3	3.1	1.9
Rest of World	4.1	0.8	2.5	3.0	0.8

Source: World Bank and Center for Global Trade Analysis (GTAP).

Table 2 Changes in Key Economic Indicators of the World Economy as a Result of Global Growth, 2005-2020

	Share of output	Output	Share of total growth	Share of exports	Exports	Share of total growth	World price
Rice	0.3	58.7	0.3	0.1	54.8	0.1	-1.1
Wheat	0.2	60.4	0.2	0.2	75.8	0.2	1.5
Grains	0.2	52.7	0.2	0.2	54.9	0.2	-0.4
Vegetables & fruits	0.7	38.3	0.4	0.8	38.8	0.5	2.2
Oils and fats	0.4	81.8	0.5	0.8	77.4	1.0	-11.3
Sugar	0.2	50.5	0.2	0.1	68.6	0.1	-11.4
Plant-based fibers	0.1	84.9	0.1	0.1	108	0.2	4.8
Other Crops	0.3	41.8	0.2	0.4	45.3	0.3	0.6
Livestock & meat	1.6	50.1	1.3	1	85.3	1.3	-10.3
Dairy	0.8	38.9	0.5	0.5	59.1	0.5	-12.9
Other processed food	3.1	44	2.2	3.1	40.9	2.0	-13.4
Energy	1.8	61.5	1.8	4.4	81.8	5.6	27.4
Textiles	1.1	63.9	1.2	2.8	55.2	2.4	-14.1
Apparel	0.8	62.4	0.8	2.1	48.7	1.6	-15.5
Leather	0.3	55.3	0.3	1	43.7	0.7	-13.9
Wood products	3.2	56	3.0	4.1	53.8	3.5	-15.1
Minerals	1.6	69.1	1.8	2.3	71.8	2.6	-14.4
Chemicals	4.8	52.5	4.2	12.3	55.8	10.7	-13.9
Metals	4.1	63.3	4.3	7.2	64.1	7.2	-15
Vehicles	3.9	52.8	3.4	11.5	55.8	10.0	-15
Machinery & equipment	4.4	62.8	4.6	14.1	67.8	15.0	-15.3
Electronics	3.1	88.7	4.5	11	84.7	14.6	-17.8
Other manufactures	1	85.8	1.4	1.8	72.1	2.0	-18.3
Trade & Transport	16	61.6	16.2	6.7	66.7	7.0	-15.3
Communication services	13.3	60.2	13.2	7.1	60.6	6.7	-18
Other services	32.7	61.5	33.1	4.1	63.4	4.1	-16.2
Total	100	58.8	100	100	64.4	100	-13.3

Source: Authors' simulation with modified GTAP model (Ianchovichina, 2004).

Table 3. Changes in Key Economic Indicators of Russia as a Result of Global Growth, 2005-2020

	Share of output	Output Growth %	Share of total growth	Share of exports	Export growth	Share of total growth	Export price change
Rice	0	52.7	0.0	0	208	0.0	-10.2
Wheat	0.7	46	0.6	0.4	96.5	0.8	-0.2
Grains	0.4	42.9	0.3	0.1	55.3	0.1	-0.2
Vegetables & fruits	2	37	1.3	0.1	346.5	0.8	-1.1
Oils and fats	0.3	33.5	0.2	0.3	22.3	0.1	-9.7
Sugar	0.6	50.8	0.5	0	100.2	0.0	-13.4
Plant-based fibers	0	55.3	0.0	0	145	0.0	1.3
Other Crops	0.2	41.5	0.1	0	110.8	0.0	-0.9
Livestock & meat	3.2	45.6	2.6	0.2	75	0.3	-8.9
Dairy	1.7	46.8	1.4	0.1	45.3	0.1	-10.1
Other processed food	3.9	52.5	3.6	2.9	82	5.2	-13.1
Energy	11	64.2	12.4	32	75	52.1	26.4
Textiles	0.5	44	0.4	0.6	22.7	0.3	-12.8
Apparel	0.3	41	0.2	0.3	3.7	0.0	-13.4
Leather	0.4	51.1	0.4	0.2	32.4	0.1	-13.2
Wood products	2.2	40.5	1.6	6.2	30.5	4.1	-12.6
Minerals	2.9	59.2	3.0	2.7	70	4.1	-14.3
Chemicals	3.2	20	1.1	10.9	2.2	0.5	-10
Metals	5.6	38	3.7	24.1	32.1	16.8	-13.6
Vehicles	4.1	53.7	3.9	3.1	35.9	2.4	-13.3
Machinery & equipment	1.2	33.6	0.7	3.4	21.6	1.6	-13.1
Electronics	0.1	13.2	0.0	0.3	-9.7	-0.1	-13.9
Other manufactures	1.3	44.6	1.0	1	0.2	0.0	-14.9
Trade & Transport	14.1	54.4	13.5	4.5	37.4	3.7	-11.7
Communication services	5.3	67.3	6.3	3.2	86.6	6.0	-19.6
Other services	34.6	67.7	41.2	3.2	11.7	0.8	-12.3
Total	100	57.3	100	100	47.4	100	0.8

Source: Authors' simulations with modified GTAP model (Ianchovichina, 2004).

Table 4(a) Impact of China and India's extra growth

	Welfare						Terms of trade		
	Growth		G&Q* (σ=2.5)		G&Q (σ=7.5)		Growth	G&Q (σ=2.5)	G&Q (σ=7.5)
	USD mil	Percent	USD mil	Percent	USD mil	Percent	USD mil	USD mil	USD mil
Australia & New Zealand	5,280	0.5	19,009	1.8	8,587	0.8	5,136	16,545	7,833
China	1,042,537	28.9	1,364,962	37.9	1,120,554	31.1	-57,325	273,588	21,516
Japan	-380	0.0	36,591	0.7	7,491	0.1	2,488	24,305	6,667
Korea	4,060	0.4	34,571	3.0	10,774	0.9	-573	19,563	3,722
Hong Kong & Taiwan	2,642	0.4	33,562	4.6	9,429	1.3	2,753	32,573	9,198
Indonesia	1,247	0.3	5,388	1.2	2,132	0.5	1,091	3,590	1,586
Malaysia	2,639	1.2	14,148	6.5	5,088	2.3	1,896	7,747	3,033
Philippine	-512	-0.4	1,754	1.4	-197	-0.2	-482	1,140	-265
Singapore	-344	-0.2	9,970	5.6	1,683	0.9	395	9,695	2,197
Thailand	356	0.1	8,334	1.6	1,935	0.4	-52	5,590	951
Vietnam	616	0.8	2,887	3.7	1,032	1.3	619	3,189	1,146
Rest of Southeast Asia	456	1.9	884	3.7	580	2.5	446	858	565
India	382,380	30.5	470,535	37.5	403,628	32.2	-14,505	83,857	6,774
Rest of South Asia	-855	-0.3	3,000	1.0	-114	0.0	-634	3,981	321
Canada	3,451	0.3	10,927	0.9	5,126	0.4	3,662	8,177	4,636
USA	15,665	0.1	139,604	0.9	45,020	0.3	4,769	83,542	21,125
Mexico	2,449	0.2	19,041	1.9	6,154	0.6	217	2,799	634
Argentina & Brazil	1,915	0.2	10,220	0.9	3,697	0.3	2,007	7,074	3,023
Rest of Latin America	3,768	0.5	11,359	1.5	5,531	0.7	3,502	8,513	4,648
EU + EFTA	-4,246	0.0	99,519	0.6	15,699	0.1	6,071	84,808	20,464
Russia	8,401	1.0	14,661	1.8	10,338	1.3	8,716	12,567	10,059
Former Soviet Union	677	0.3	6,132	2.5	1,891	0.8	222	3,581	925
MENA	24,920	1.4	43,326	2.4	30,369	1.7	24,530	43,775	30,134
Sub-Saharan Africa	6,308	0.8	18,766	2.4	9,389	1.2	5,162	16,767	7,919
Rest of World	-1,501	-0.2	3,678	0.4	-758	-0.1	-756	7,951	901

Source: Authors' simulations with the modified GTAP model (Ianchovichina, 2004).*G&Q denotes growth accompanied by improvements in export quality.

Table 4(b) Impact of China and India's extra growth on trade

	Exports			Imports		
	Growth Percent	G&Q* (σ=2.5) Percent	G&Q (σ=7.5) Percent	Growth Percent	G&Q (σ=2.5) Percent	G&Q (σ=7.5) Percent
Australia & New Zealand	1.1	6.7	2.5	4.1	8.5	5.4
China	33.4	139.8	60.1	28.4	183.9	65.0
Japan	3.1	13.3	5.4	7.6	21.1	10.7
Korea	3.3	13.2	5.5	3.8	12.5	5.9
Hong Kong & Taiwan	1.2	7.9	2.9	2.2	5.4	3.0
Indonesia	-0.1	2.4	0.2	0.4	-2.0	-0.4
Malaysia	-0.9	0.1	-0.7	-0.2	-2.4	-0.8
Philippine	0.3	4.2	0.7	-0.4	-1.4	-1.3
Singapore	1.5	10.1	2.7	2.0	7.0	2.4
Thailand	0.9	6.2	2.0	0.8	1.9	0.9
Vietnam	-0.6	-1.4	-1.0	0.0	-5.1	-1.5
Rest of Southeast Asia	-1.2	-1.5	-1.4	2.6	-1.8	1.5
India	40.2	148.0	67.3	34.0	178.7	67.6
Rest of South Asia	0.9	4.8	1.8	-0.3	-3.6	-1.2
Canada	-0.7	-1.7	-1.0	0.4	-2.1	-0.1
USA	1.1	9.0	2.8	2.1	4.1	2.6
Mexico	1.3	8.7	3.1	0.2	-1.8	-0.3
Argentina & Brazil	0.8	4.0	1.4	2.6	4.1	2.9
Rest of Latin America	-0.2	2.3	0.3	1.5	1.4	1.5
EU + EFTA	0.2	0.5	0.2	0.7	-0.5	0.4
Russia	-0.3	3.0	0.4	2.8	3.0	2.9
Former Soviet Union	0.6	0.8	0.7	-0.2	-1.6	-0.5
MENA	-1.9	0.0	-1.6	2.2	0.1	1.8
Sub-Saharan Africa	-0.1	3.1	0.6	2.3	2.6	2.5
Rest of World	1.0	1.8	1.1	0.2	-2.2	-0.4

Source: Authors' simulations with modified GTAP model (Ianchovichina, 2004). *G&Q denotes growth accompanied by improvements in export quality.

Table 5 Impact of China and India's extra growth on Russia (change in quantities in percent)

	Output						Exports						Imports					
	Growth		G&Q* (σ=2.5)		G&Q (σ=7.5)		Growth		G&Q (σ=2.5)		G&Q (σ=7.5)		Growth		G&Q (σ=2.5)		G&Q (σ=7.5)	
	Total	China	Total	China	Total	China	Total	China	Total	China	Total	China	Total	China	Total	China	Total	China
Rice	1.9	1.5	1.4	1.0	1.7	1.4	13.7	6.8	36.7	30.0	16.2	10.2	-2.1	-2.1	-0.5	-0.1	-1.6	-1.6
Wheat	1.5	1.1	2.1	1.1	1.7	1.1	8.9	6.2	13.5	5.4	10.1	6.3	3.3	3.2	6.3	6.6	4.0	4.0
Grains	0.5	0.3	0.3	0.2	0.4	0.3	2.5	1.4	4.0	1.0	2.8	1.4	1.3	1.4	2.3	3.0	1.6	1.8
Vegetables & fruits	2.8	2.6	6.1	5.7	3.6	3.3	112.6	109.8	267.7	259.3	148.2	143.9	3.7	3.7	8.0	8.7	4.7	4.9
Oils and fats	0.0	-0.4	-1.4	-2.0	-0.3	-0.7	-1.2	-2.4	-5.2	-8.4	-2.2	-3.9	2.4	2.2	5.3	5.2	3.1	2.9
Sugar	1.3	1.0	2.4	2.0	1.6	1.3	2.0	1.5	2.5	0.9	2.0	1.3	1.3	1.2	3.1	3.5	1.7	1.8
Plant-based fibers	2.5	1.4	1.3	-0.2	2.3	1.2	15.8	9.7	18.7	10.1	17.0	10.0	-1.0	-0.7	-5.7	-5.0	-2.3	-1.8
Other Crops	0.6	0.1	0.5	-0.8	0.6	-0.1	21.8	18.1	41.3	29.0	26.5	21.0	1.1	1.4	1.7	3.2	1.3	1.8
Livestock & meat	0.8	0.6	0.9	0.6	0.9	0.6	23.0	21.0	63.4	55.8	32.8	29.6	2.5	2.1	5.9	5.6	3.4	3.0
Dairy	0.2	0.1	-0.1	-0.1	0.1	0.1	-4.4	-3.5	-6.5	-6.1	-5.3	-4.3	5.5	4.5	10.6	9.2	6.9	5.7
Other processed food	3.0	3.0	7.9	8.1	4.2	4.2	19.7	20.1	56.2	58.4	28.4	28.9	2.3	1.9	4.7	4.6	3.0	2.6
Energy	1.7	1.2	1.3	0.8	1.7	1.2	4.6	3.2	3.7	2.1	4.7	3.2	7.0	4.9	5.4	3.2	7.0	4.8
Textiles	-1.5	-1.5	-14.1	-14.0	-4.7	-4.6	-2.7	-3.1	-32.1	-32.3	-10.6	-10.8	0.8	0.5	-6.2	-6.6	-0.8	-1.1
Apparel	-2.9	-2.9	-17.0	-16.9	-7.1	-7.0	-6.9	-6.9	-38.1	-36.6	-16.1	-15.3	2.2	1.8	-11.7	-12.4	-1.7	-2.0
Leather	0.3	0.2	-22.3	-22.5	-4.6	-4.5	-0.1	0.6	-36.3	-34.1	-11.0	-9.4	1.7	1.2	19.8	19.3	5.7	5.0
Wood products	0.8	1.1	21.3	20.3	5.2	5.2	4.5	4.8	62.8	59.2	17.2	16.4	2.5	2.0	8.5	7.6	4.0	3.3
Minerals	-1.5	-1.0	-2.6	-1.7	-1.8	-1.2	2.7	2.8	7.7	10.4	3.9	4.7	0.2	0.2	1.0	0.7	0.4	0.3
Chemicals	-7.0	-5.0	-10.0	-4.7	-7.9	-5.1	-9.7	-6.6	-3.5	4.9	-8.7	-4.4	3.4	2.5	5.5	4.6	4.1	3.1
Metals	-9.3	-7.2	-16.1	-14.0	-11.2	-9.1	-12.7	-10.0	-19.1	-17.9	-14.7	-12.3	2.2	1.0	5.0	1.6	2.9	1.1
Vehicles	-1.0	-0.8	-1.7	-1.2	-1.1	-0.8	-4.5	-3.5	1.5	2.7	-3.2	-2.1	2.6	2.1	6.4	5.2	3.5	2.7
Machinery & equipment	-8.8	-7.5	-24.9	-24.9	-12.3	-11.4	-13.4	-12.2	-33.4	-39.0	-17.8	-18.3	1.0	0.8	-2.1	-2.5	0.4	0.2
Electronics	-12.7	-11.9	-52.5	-51.8	-23.5	-22.6	-16.3	-16.0	-48.4	-50.4	-26.2	-27.0	1.0	0.8	-9.2	-9.5	-1.2	-1.4
Other manufactures	-4.7	-4.1	-14.8	-13.7	-7.2	-6.4	-22.8	-17.9	-54.1	-44.3	-33.0	-25.9	15.0	14.0	33.8	32.0	19.6	18.3
Trade & Transport	-0.4	-0.3	0.4	0.5	-0.2	-0.1	1.3	1.2	16.2	14.8	4.5	4.1	3.6	2.8	4.3	3.6	4.0	3.1
Communication services	-0.5	-0.3	-0.2	-0.3	-0.4	-0.3	-3.4	-2.4	-1.9	-3.1	-3.4	-2.8	1.0	0.6	0.5	0.8	0.8	0.7
Other services	0.2	0.1	0.4	0.3	0.2	0.2	-8.7	-6.4	-5.3	-4.5	-8.8	-6.6	6.0	4.5	8.1	6.3	6.8	5.2

Source: Authors' simulations with modified GTAP model (Ianchovichina, 2004). *G&Q denotes growth accompanied by improvements in export quality.

Table 6 Impact of China and India's extra growth on Russia (change in prices in percent)

	Output and exports						Imports					
	Growth		G&Q* (σ=2.5)		G&Q (σ=7.5)		Growth		G&Q (σ=2.5)		G&Q (σ=7.5)	
	Total	China	Total	China	Total	China	Total	China	Total	China	Total	China
Rice	-0.2	0.0	-2.3	-1.4	-0.7	-0.4	0.4	0.5	2.3	2.9	0.7	1.0
Wheat	1.2	1.1	0.6	0.9	1.0	1.1	1.0	0.9	0.4	0.6	0.8	0.8
Grains	0.9	1.0	0.3	0.8	0.8	0.9	0.7	0.7	0.1	0.3	0.5	0.6
Vegetables & fruits	1.4	1.4	1.8	2.2	1.5	1.6	0.5	0.5	-0.1	0.1	0.3	0.4
Oils and fats	-0.3	-0.1	-2.3	-1.5	-0.8	-0.5	-0.7	-0.5	-2.7	-2.0	-1.3	-0.9
Sugar	-0.6	-0.4	-2.8	-2.0	-1.2	-0.8	-0.6	-0.4	-3.0	-2.5	-1.2	-0.9
Plant-based fibers	1.5	1.3	0.9	1.0	1.3	1.2	2.6	2.0	2.6	2.2	2.7	2.1
Other Crops	0.9	0.8	0.3	0.5	0.7	0.7	0.6	0.4	-0.1	-0.5	0.4	0.2
Livestock & meat	-0.1	0.0	-1.9	-1.1	-0.6	-0.3	-0.4	-0.2	-2.8	-2.0	-1.0	-0.7
Dairy	-0.2	0.0	-2.1	-1.3	-0.7	-0.3	-0.9	-0.6	-3.5	-2.6	-1.5	-1.1
Other processed food	-0.4	-0.2	-2.5	-1.6	-1.0	-0.6	-0.9	-0.6	-3.1	-2.4	-1.5	-1.1
Energy	6.1	4.2	1.7	0.5	5.5	3.7	5.3	3.7	1.3	0.4	4.7	3.2
Textiles	-0.9	-0.6	-4.7	-3.7	-1.8	-1.4	-1.3	-1.0	0.8	1.9	-0.9	-0.5
Apparel	-1.1	-0.8	-5.0	-4.0	-2.0	-1.5	-2.4	-2.0	6.9	8.4	0.2	0.8
Leather	-1.1	-0.8	-4.2	-3.2	-1.9	-1.3	-1.2	-0.8	1.9	3.1	-0.6	-0.1
Wood products	-0.9	-0.6	-3.2	-2.2	-1.5	-1.0	-1.4	-1.0	-4.2	-3.1	-2.1	-1.6
Minerals	-0.9	-0.6	-3.7	-2.7	-1.6	-1.1	-1.2	-0.9	-2.2	-1.1	-1.4	-0.9
Chemicals	0.4	0.2	-3.0	-2.3	-0.4	-0.3	-1.0	-0.8	-1.9	-1.6	-1.3	-1.0
Metals	-0.5	-0.3	-3.5	-2.5	-1.2	-0.8	-1.6	-1.1	-1.5	-1.4	-1.7	-1.2
Vehicles	-1.1	-0.8	-4.3	-3.2	-1.9	-1.4	-1.6	-1.2	-4.6	-3.3	-2.4	-1.7
Machinery & equipment	-1.0	-0.7	-4.4	-3.3	-1.8	-1.3	-2.0	-1.5	-2.5	-1.3	-2.2	-1.6
Electronics	-1.3	-1.0	-5.8	-4.7	-2.4	-1.9	-2.8	-2.3	-0.7	0.6	-2.4	-1.7
Other manufactures	-0.9	-0.6	-3.7	-2.6	-1.6	-1.1	-3.2	-2.8	3.6	5.1	-1.5	-0.8
Trade & Transport	-0.4	-0.2	-3.1	-2.3	-1.0	-0.7	-1.3	-1.0	-2.9	-2.0	-1.6	-1.2
Communication services	-1.3	-0.9	-4.1	-2.9	-2.0	-1.4	-1.9	-1.3	-3.6	-3.0	-2.3	-1.7
Other services	-0.2	-0.1	-3.1	-2.3	-0.9	-0.6	-1.6	-1.2	-3.9	-2.8	-2.2	-1.6

Source: Authors' simulations with modified GTAP model (Ianchovichina, 2004). *G&Q denotes growth accompanied by improvements in export quality.

Table 7 Impact of China and India's extra growth on Russia (change in values in millions of USD 2004)

	Output			Exports			Imports		
	Growth	G&Q*	G&Q (σ=7.5)	Growth	G&Q (σ =2.5)	G&Q (σ=7.5)	Growth	G&Q (σ=2.5)	G&Q (σ=7.5)
Rice	11.9	-6.3	7.0	1.7	4.4	2.0	-2.3	2.3	-1.1
Wheat	286.4	295.3	288.2	123.1	171.8	135.1	14.0	21.5	15.7
Grains	91.4	44.4	78.4	8.9	11.2	9.3	4.8	5.4	5.0
Vegetables & fruits	1,220.2	2,294.8	1,461.8	692.2	1,641.9	908.6	153.4	287.4	184.0
Oils and fats	-12.7	-124.8	-40.0	-6.7	-32.8	-13.7	17.6	26.4	19.3
Sugar	54.0	-41.9	30.4	1.4	-0.4	0.8	8.4	0.0	6.3
Plant-based fibers	21.7	11.4	20.1	8.5	9.6	9.1	6.2	-13.2	1.2
Other Crops	41.5	24.0	36.6	17.0	31.1	20.4	28.3	27.2	28.1
Livestock & meat	309.1	-445.3	134.1	93.9	248.3	131.8	99.6	148.5	113.9
Dairy	4.3	-507.6	-119.8	-12.0	-22.3	-15.6	84.5	126.0	97.4
Other processed food	1,441.5	2,877.3	1,778.0	1,208.8	3,289.8	1,706.3	106.1	112.9	113.6
Energy	19,287.0	7,405.3	17,822.2	11,049.8	5,455.8	10,462.1	486.8	258.1	460.3
Textiles	-161.9	-1,200.4	-427.5	-33.3	-323.6	-112.5	-23.3	-264.6	-85.1
Apparel	-133.3	-705.9	-300.9	-29.6	-153.4	-66.1	-18.8	-444.0	-113.7
Leather	-49.1	-1,568.5	-391.3	-4.5	-145.3	-47.0	10.4	556.1	127.1
Wood products	-13.5	5,108.0	1,077.2	337.0	5,344.1	1,434.4	83.4	315.1	139.1
Minerals	-996.7	-2,650.5	-1,425.9	89.6	188.6	113.8	-45.1	-52.8	-45.8
Chemicals	-2,479.6	-4,698.9	-3,057.5	-1,270.1	-867.4	-1,218.2	454.0	676.6	522.2
Metals	-7,050.1	-13,719.0	-8,844.5	-5,195.3	-8,652.7	-6,202.6	56.4	373.1	125.1
Vehicles	-1,245.2	-3,451.5	-1,771.6	-290.2	-146.1	-262.4	143.7	242.0	159.6
Machinery &	-1,465.9	-4,283.5	-2,114.5	-734.8	-1,878.0	-995.6	-289.5	-1,340.5	-528.1
Electronics	-195.9	-777.8	-357.3	-61.1	-180.2	-98.3	-191.1	-1,028.4	-372.4
Other manufactures	-975.0	-3,145.7	-1,535.0	-279.6	-663.0	-405.5	312.5	1,065.2	493.3
Trade & Transport	-1,514.5	-5,661.9	-2,561.6	60.8	855.9	236.3	365.9	214.2	359.5
Communication	-1,354.7	-3,208.1	-1,868.0	-339.0	-423.6	-386.7	-120.2	-375.7	-186.5
Other services	-96.7	-14,886.4	-3,467.2	-421.4	-391.3	-454.0	825.0	753.1	868.1
Total	5,024.2	-43,023.5	-5,548.6	5,015.1	3,372.4	4,891.8	2,570.7	1,691.9	2,506.1

Source: Authors' simulations with the modified GTAP model (Ianchovichina, 2004). *G&Q denotes growth accompanied by improvements in export quality.

Table 8 Decomposition of Russia's welfare gains following the scenario with China and India growing by additional 2 pct points per annum

	Gains from changes in							
	World price		Export price		Import price		Welfare change	
	Total	China	Total	China	Total	China	Total	China
Rice	-2.1	-1.2	-0.2	-0.1	0.5	-0.4	-1.8	-1.7
Wheat	33.1	28.9	-17.6	-15.2	4.9	4.4	20.5	18.0
Grains	0.7	0.6	-3.3	-2.6	3.2	2.8	0.6	0.8
Vegetables & fruits	-66.4	-54.3	-5.3	-2.0	28.6	22.7	-43.1	-33.6
Oils and fats	-5.6	-4.6	-0.6	0.0	5.2	4.0	-0.9	-0.5
Sugar	-5.8	-5.1	-0.1	0.0	-0.2	0.0	-6.1	-5.1
Plant-based fibers	-16.6	-12.6	-1.0	-0.7	2.8	1.8	-14.8	-11.5
Other Crops	-33.4	-24.9	-0.2	0.0	4.2	3.2	-29.4	-21.7
Livestock & meat	-41.7	-38.3	0.2	0.3	11.6	9.4	-30.0	-28.6
Dairy	-5.0	-5.2	1.6	1.3	1.5	0.9	-1.9	-3.0
Other processed food	-2.6	-2.8	21.4	18.8	9.9	8.0	28.7	24.1
Energy	7,327.9	5,158.2	-228.1	-135.1	10.7	6.5	7,110.4	5,029.6
Textiles	1.1	0.8	1.6	1.9	8.2	5.5	10.9	8.2
Apparel	55.0	49.3	2.5	2.5	54.9	51.6	112.4	103.3
Leather	4.1	0.1	0.5	0.3	-0.7	0.2	3.9	0.5
Wood products	-5.6	-3.4	50.9	41.9	2.4	1.0	47.7	39.5
Minerals	-1.8	0.6	19.3	7.9	-3.9	3.5	13.6	12.0
Chemicals	-7.2	-5.9	169.7	126.9	6.6	3.8	169.1	124.7
Metals	-166.9	-83.8	464.1	310.1	-10.1	-7.6	287.0	218.7
Vehicles	70.6	47.9	25.6	21.1	-2.7	-4.2	93.5	64.8
Machinery & equipment	280.4	204.8	56.4	44.2	-46.7	-29.5	290.0	219.5
Electronics	178.6	159.1	4.4	4.2	9.8	5.7	192.8	169.0
Other manufactures	45.9	36.3	25.8	21.4	-1.9	6.5	69.8	64.2
Trade & Transport	23.2	12.9	117.3	91.4	-0.2	-0.2	140.3	104.1
Communication services	61.4	32.3	49.9	29.5	-11.9	-2.1	99.4	59.6
Other services	83.2	52.0	61.3	45.0	8.4	8.4	152.9	105.5
Total TOT	7,804.5	5,541.6	816.1	612.9	95.1	106.0	8,715.7	6,260.5
Other welfare gains							-314.4	-234.9
Total welfare gain							8,401.3	6,025.6

Source: Authors' simulations with modified GTAP model (Ianchovichina, 2004).