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Economic Development in Emerging Asian Markets: Implications for Europe

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Summary

The impacts of faster growth in China and India for Europe are analysed taking into account terms-of-trade effects, second-best welfare impacts and improvements in product quality and variety. More rapid growth in these giants could improve Europe's terms of trade, but second-best effects on energy markets could lower welfare unless these taxes are Pigovian. Whether growth arises from productivity or capital accumulation has important implications, with capital-driven growth involving higher energy and agricultural prices. When quality and variety growth are taken into account, the benefits to Europe are substantially greater. If agricultural protection in emerging Asia increases with growth, the impacts on Europe appear to be adverse but small.

Keywords: economic growth, China, India, Europe, product quality, product variety

JEL classification: F11, F43, Q17

1. Introduction

The rapid growth of emerging Asia has the potential to transform the global economy of the 21st century, just as the faster growth of Europe transformed the world economy of the 19th century. In this paper, we focus on the high growth in the two giant economies of China and India and seek to assess some of its key impacts on Europe. We focus on trade linkages, which include some of the most important channels of effect and pay particular attention to linkages affecting markets for agricultural products.

A wide-ranging evaluation of the implications of the recent, rapid growth in China and India—taking into account key issues such as financial integration, energy and emissions, and governance—is provided by Winters and Yusuf (2007). Other recent studies focus on implications for individual regions, including the study by Lederman *et al.* (2006) on the Latin America and Caribbean region, Broadman (2007) on Africa, Abdel-Khalek and Korayem

(2007) on the Middle East. This paper contributes to the literature by focusing in more detail on the impact of high economic growth in China and India on Europe.

The paper considers two key sets of linkages. The first is through trade when policies are assumed to remain constant, which are investigated using a global computable general equilibrium model documented in Ianchovichina (2004). The second is through potential changes in agricultural trade policies as economies grow.

To foreshadow some key results, we find that the terms-of-trade effects of stronger growth in China and India are positive in all cases considered. In contrast, allocative efficiency impacts associated with higher world energy prices may outweigh these gains and create adverse welfare impacts—although this result depends on whether high energy taxes in Europe are interpreted as distortions or as Pigovian taxes set to internalise externalities associated with energy consumption. The effects on Europe also depend heavily on the source of the growth, with capital-driven growth increasing agricultural and energy prices much more than productivity-driven growth. In addition, we find that changes in the variety and quality of exports emphasised in the path-breaking study by Hummels and Klenow (2005) can greatly increase the welfare benefits to the giants and to Europe.

The following section of the paper provides a conceptual framework for this paper. Then, in Section 3, we consider the results of some simulations on the extent and nature of these linkages, assuming that trade policy settings remain unchanged. Section 4 examines the relationship between economic growth and agricultural trade policies. Section 5 concludes.

2. Framework and literature review

If we hold policy settings constant, the trade impacts of rapid growth in China and India on Europe can usefully be divided into four channels:

(i) increases in opportunities for Europe to export to China and India;
(ii) increases in opportunities for Europe to import from China and India;
(iii) increases in third-market export competition from China and India, and
(iv) increases in imports by China and India from non-European markets.

The first two of these interactions unambiguously involve gains to Europe, although the first is typically seen politically, as well as economically, as a gain, while the second is frequently seen politically as a loss and requires careful policy management if it is not to be transformed into an economic loss through protectionist responses. The third interaction almost inevitably involves losses. The welfare effects through the fourth channel can be determined only empirically. If increased imports by China and India raise world prices of goods that are also imported by Europe, then the effect can be adverse (as results from increases in demand for energy). If, in contrast, their import growth were in goods exported by Europe, then Europe might expect to gain even if the imports are not directly sourced from Europe.

As noted in Dimaranan *et al.* (2008), the trade impacts of emerging economies today are very different from those that have typically been analysed 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 (Athukorala, 1993; Sarkar and Singer, 1993), it continued to focus only on third-market export competition between developing countries, in which only negative impacts from the growth of other developing countries' exports are possible. If, for instance, Viet Nam or Indonesia were to grow by expanding exports of rice 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 growth of developing countries in recent decades has been driven by expansion in a wider range of exports of manufactures and/or services. As shown in Dimaranan *et al.* (2007), the export patterns of the largest of these emerging countries—China and India—have been very different, with India relying much more heavily than China on exports of services. Even within merchandise trade, their export patterns have been radically different, with only one product (at the six-digit level of the Harmonised System) appearing on the top-25 list of both countries.

Perhaps more important is the radically different pattern of trade in today's world of global production sharing. Nowadays, developing countries in Asia frequently import intermediate goods from other developing countries for use in the production of their own exports. Furthermore, manufactured goods are frequently quite finely differentiated, allowing countries that are both net exporters of, say, machinery to have extensive two-way trade in machinery. In both situations, increased efficiency and competitiveness in one emerging economy are very likely of benefit both to other developing countries and to their industrial-country trading partners (Martin, 1993).

In addition, the trade patterns of growing countries tend to be quite dynamic. If factors are being accumulated at differential rates, the composition of output can change quite quickly through Rybczynski effects (Martin and Warr, 1993). The specific products being exported can also change quite rapidly—it appears that a large part of the growth of exports from a growing economy tends to be from products that are new to the exporter (Hummels and Klenow, 2005). Using empirical estimates of the extent of these gains from Hummels and Klenow (2005), Dimaranan *et al.* (2008) show that the benefits to growing economies and their trading partners from improvements in product quality and variety could be very substantial if the love-of-variety is strong. The benefits in the case of improved quality arise from importers being able to meet their needs with smaller quantities of imports, and/or to consume more in response to lower effective import prices. The benefit from increases in the number of goods supplied is

frequently captured using formulations such as Dixit–Stiglitz preferences in which increases in the number of goods available raise utility and lower the effective price of composite goods (see, for example, Hummels and Klenow, 2005).

Improvements in the quality of goods produced by an emerging supplier increase the demand for their exports at any given price level and hence lead to increases in the actual prices received for their exports. The result is improvement in the terms-of-trade, and in the real income, of the emerging exporter. 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 being exported and on the extent to which importers value increases in the variety of goods imported.

Changes in trade patterns at constant policy settings may be only one part of the story, however. Economic growth and development appear to have quite a strong impact on some key trade policies. For non-agricultural products, economic growth appears to contribute to liberalisation, and applied tariff levels are now relatively low in both giants. However, as pointed out by Anderson and Hayami (1986), and in Anderson (2008), economic growth may lead to higher agricultural protection as countries develop. The effects of any of these policy changes on Europe will depend on their impacts on Europe's terms-of-trade and interactions with its existing trade distortions and can be analysed using techniques similar to those used in the analysis of growth at constant policies.

In the following section of the paper, we consider the likely channels of effect from growth in China and India to Europe and examine some evidence on the likely magnitude of these impacts at constant policy settings. Finally, we consider potential policy changes in the emerging economies, and their potential implications for Europe.

3. Implications of growth in emerging Asia for Europe

3.1. Growth scenarios

Many have expressed concern that simultaneous rapid growth by the labour-abundant giant economies will lead to a train-wreck scenario under which prices of a limited range of labour-intensive exports are driven to very low levels. This view assumes that China and India export a similar range of labour-abundant goods and services. However, as noted earlier, the export patterns of China and India are extremely different.

While the merchandise exports of both China and India are dominated by manufactures, the approaches to production of these exports have diverged sharply over time. China has increasingly relied on global production-sharing approaches, with the share of imported parts and components rising from 15 to 31 per cent between 1992 and 2004. In contrast, the share of parts and components in total non-fuel imports declined from 15 to 12 per cent in India. Another key difference between the two giants is in the importance of

services, with service exports accounting for 25 per cent of India's total exports of goods and services, and less than 10 per cent of China's in 2004.

It seems likely that India is increasingly moving towards the pattern of global production-sharing that has come to characterise China. Assuming that India does succeed in undertaking the liberalisation and investments in infrastructure needed to do this, a key question is whether this will bring these two giant, labour-abundant countries onto parallel paths. To examine this, we allowed for deep tariff cuts in India, and the establishment of duty exemption arrangements in India using the model developed by Ianchovichina (2004), which incorporates, for each good, one production activity producing for the domestic market (and paying distorted domestic prices) and a second sector producing for export and paying only some fraction of the import duties on intermediate inputs paid by the domestically oriented subsector. As a consequence of these two liberalisations, India's exports grew substantially. However, we found the exports of these two giant labour-intensive commodities became barely more alike. In fact, we found that the correlation between their exports of manufactures declined slightly. This suggests that India and China are likely to remain exporters of very different sets of products, and hence less likely to be subject to mutually adverse impacts from export expansion.

As in Dimaranan *et al.* (2007), we analyse the implications of growth in China and India[1] by projecting the world economy to 2020. Our baseline from 2005 to 2020 is designed to replicate the widely used GTAP baseline series. Economy-wide rates of technical change were used to ensure consistency between the exogenous variable forecasts and the GTAP baseline forecasts for GDP. This benchmark simulation incorporates a wide range of forces including projections of productivity growth and factor accumulation in all countries, and hence tells us little about the implications of high growth in China and India. To isolate the impacts of this higher growth, we then consider the partial impact of changes in the growth rates of China and India. As in Dimaranan *et al.* (2007), the specific increases in growth rates analysed were 2.1 per cent per year in China and 1.9 per cent per year in India, based on assessments of potentially feasible increases in growth rates. These shocks resulted in welfare levels 39.9 per cent higher in China and 33.7 per cent higher in India than under the baseline scenario.

In our analysis of more rapid growth, we first consider a case where exports grow in volume, without improvements in product quality and variety. Then, following Hummels and Klenow (2005), we consider growth with increases in the quality of exports from the growing economies, and in the variety of the goods they export to each market. Product quality is represented using a variable, λ, representing the number of effective units of a good obtained from each actual, physical unit of that good.[2] It has a counterpart in the popular

1 McDonald *et al.* (2008) also employ a global computable general equilibrium model to analyse the impact of expanding trade in emerging Asia.

2 The model results in an effective price, P^*, given by $P^* = \left[N(P/\lambda)^{(1-\sigma)}\right]^{(1/1-\sigma))}$, where P is the actual

iceberg specification for international transport costs. An increase in the quality of goods increases the effective quantity available to users and lowers the effective price of the good.

We also include increases in the number of varieties of goods exported, using the Hummels–Klenow (2005) estimate of the share of export growth derived from increases in the range of products exported (the so-called extensive margin growth). In a demand system characterised by love-of-variety, an increase in the number of goods available increases the effective quantity of the good and reduces its effective price. In this case, though, the mapping between the number of goods and the effective quantities and prices depends on the elasticity of substitution. If this is high, and hence products are close substitutes, the reduction in the effective price will be small. If it is small, then the reduction in the effective price of the good will be larger.

With an elasticity of substitution σ equal to 7.5 – the mid-range value considered in Hummels and Klenow (2005) – we found effective price declines resulting from the cumulative increases in China's and India's real GDP growth in the high-growth scenario relative to the baseline of 9.2 and 8.2 per cent, respectively. We implemented this as product-quality-augmenting technical change on imports by other countries from China and India at the rates 9.2 and 8.2 per cent, respectively. There is considerable uncertainty about the strength of purchasers' love-of-variety, which manifests itself in the current context as uncertainty about the size of the elasticity of substitution between varieties.[3] To gain some insights into the sensitivity of these results to changes in this parameter, we present results not only for the mid-point parameter in Hummels and Klenow (2005) but also for a low-end estimate drawn from the literature (2.5).

The effects on key variables of faster growth in China and India, and faster growth with and without increased variety and quality of exports, are presented in Table 1. These impacts are presented for real incomes (welfare), for export volumes and for the income effects of terms-of-trade changes. For each variable, the effect depends upon whether the income increases in China and India result only in intensive margin growth of the same exports ('Growth'), or whether export growth is accompanied by expansion in the range of products exported and improvements in their quality ('Growth, Variety and Quality'). Increases in real income presented are percentage changes in equivalent variation where equivalent variation is measured in

price of individual commodity exports, N is the number of varieties, λ is product quality and σ is the elasticity of substitution between varieties. The variable λ is assumed to be unity initially.

3 Hummels and Klenow (2005) consider estimates that vary between 5 and 10 on the basis of estimates in Hummels (1999), but they also discuss the much lower value of 2.6 used in Acemoglu and Ventura (2002), which is close to more recent estimates in Kee *et al.* (2008). An elasticity of substitution lower than the one used in this paper (7.5) will enhance the welfare benefits of increased variety—other things equal—because it implies that variety is more highly valued by purchasers.

Table 1. Impacts of improved growth and quality exports in China and India (relative to base run, 2020)

Regions	Changes in welfare, %			Changes in exports, %			Terms-of-trade effects, 2001 US $ (million)		
	Growth	Growth, variety and quality		Growth	Growth, variety and quality		Growth	Growth, variety and quality	
		$\sigma = 2.5$	$\sigma = 7.5$		$\sigma = 2.5$	$\sigma = 7.5$		$\sigma = 2.5$	$\sigma = 7.5$
Australia and New Zealand	0.45	2.96	0.91	−0.06	4.27	0.72	2,652	16,387	5,240
China	39.9	60.27	43.6	29.41	171.29	55.34	−48,229	398,937	38,159
Japan	0.16	1.76	0.42	2.44	17.23	4.80	9,186	68,299	18,946
Korea	0.11	6.10	1.00	3.45	17.49	5.83	−957	37,626	4,646
Hong Kong/Taiwan	0.53	8.09	1.78	1.94	11.81	3.78	4,260	59,445	13,307
Indonesia	0.27	2.57	0.61	0.18	0.20	−0.10	723	8,137	1,907
Malaysia	0.87	8.82	2.03	0.27	−0.60	0.02	1,570	15,859	3,698
Philippines	−0.57	0.58	−0.89	−0.26	−7.66	−3.19	−559	1,425	−583
Singapore	−1.68	10.46	−0.34	4.92	22.14	6.50	−159	17,676	2,019
Thailand	−0.31	4.48	0.24	1.63	7.44	2.33	−857	8,967	312
Vietnam	−0.07	3.78	0.29	−1.10	−5.84	−2.33	63	2,985	468
Rest of South-East Asia	0.41	1.22	0.58	−2.85	9.38	−2.11	382	1,065	541
India	33.7	51.57	36.7	28.89	125.90	47.05	−12,379	117,027	10,661
Rest of South Asia	−0.35	1.99	−0.06	1.60	10.48	2.98	−1,110	4,008	−517
Canada	0.32	1.89	0.59	−0.91	−3.49	−1.43	2,634	13,943	4,736
US	0.00	1.05	0.15	0.67	15.75	2.87	479	137,790	20,671
Mexico	0.06	0.52	0.11	−1.33	−6.13	−2.37	175	2,594	489
Argentina/Brazil	0.13	1.21	0.28	−0.06	5.09	0.45	1,072	10,682	2,570

(*Continued on next page*)

Table 1. (*continued*)

Regions	Changes in welfare, %			Changes in exports, %			Terms-of-trade effects, 2001 US $ (million)		
	Growth	Growth, variety and quality		Growth	Growth, variety and quality		Growth	Growth, variety and quality	
		$\sigma = 2.5$	$\sigma = 7.5$		$\sigma = 2.5$	$\sigma = 7.5$		$\sigma = 2.5$	$\sigma = 7.5$
Rest of Latin America	0.36	1.65	0.56	−0.48	2.31	−0.26	2,652	12,266	4,251
European Union 25 and EFTA	**−0.04**	**1.60**	**0.18**	**−0.14**	**−0.15**	**−0.18**	**3,013**	**140,780**	**22,183**
Former Soviet Union	1.37	2.84	1.77	1.34	7.22	2.34	9,750	15,714	12,039
Middle East and North Africa	1.31	2.14	1.60	−1.50	0.55	−1.50	22,592	35,030	27,568
Sub-Saharan Africa	0.96	3.61	1.50	−0.24	6.19	0.80	4,004	16,149	6,439
Rest of the World	−0.34	1.23	−0.24	1.46	8.34	2.37	−596	2,910	−282
LICs (excluding India)	*0.46*	2.89	*0.87*	*−0.07*	5.91	*0.77*	*3,339*	24,208	*6,931*
MICs (excluding China)	*0.61*	2.00	*0.87*	*−0.18*	1.53	*−0.16*	*36,522*	113,583	*51,971*
HICs	*0.03*	*1.72*	*0.28*	*0.79*	*7.23*	*1.73*	*21,109*	*491,946*	91,749
World	3.8	7.1	4.3	4.4	29.2	8.5	363	1,145,701	199,472

Note: LICs denotes World Bank low-income countries; MICs, middle-income countries; HICs, high-income countries. The groups in italics are supersets of the countries and regions above.
Source: Dimaranan *et al.* (2007b).

2001 dollars. Export expansion is presented using percentage changes in the volume of exports. The terms-of-trade effects are presented in 2001 dollar terms.[4]

The pure productivity gain scenario for China and India translates into welfare gains of almost 40 per cent for China and 34 per cent for India relative to the baseline (see column 1 of Table 1). The volume of exports increases by 29 per cent from both India and China – an increase slightly smaller than the corresponding increases in output. This export expansion is accompanied by declining export prices and terms-of-trade losses of about US $48 billion for China and $12 billion for India. Such terms-of-trade losses are expected outcomes in models using the Armington assumption of national product differentiation.

Although our focus is on Europe, Table 1 presents the results for a range of economies, and for the world, in order to put these responses into context. The welfare changes for other countries are generally relatively small in the absence of quality and variety increases for exports from China and India. Gains for most of China's and India's trading partners in the Asia-Pacific region are modest. High-income regions gain, except for the European Union and EFTA, where the interaction of existing distortions and structural change lead to an allocative efficiency loss that dominates the terms-of-trade gain. Many countries benefit from improved terms-of-trade for their products as China increases its imports from the rest of the world by 23 per cent and India by a similar amount. Some middle- and low-income countries such as Thailand, the Philippines and some other countries in South Asia are projected to lose, as competition with China and India in third markets negatively affects their terms-of-trade.

3.2. Welfare impacts for Europe without product variety and quality increases

We examine the negative welfare impact for Europe in the first scenario, without improvements in quality and variety, further because its effects underlie all the other simulations. As is evident from the results for the terms-of-trade in column 7, it does not come about because of adverse impacts on the terms-of-trade. In fact, it arises from unfavourable second-best welfare effects[5] that require further examination.

On the basis of Martin (1997: 87), a second-order approximation to the welfare impact of a change in world prices in the presence of both trade

4 In our revised model framework where we incorporate product-quality-augmenting technical change, it is possible for the terms-of-trade to improve for both importer and exporter since the price of relevance to the importer is the effective price, which may fall when quality and variety increase, and the price relevant to the producer is the actual price, which rises when quality and variety increase.

5 Second-best welfare effects must be considered when changes involve moving from one distorted equilibrium to another, rather than to or from an undistorted situation. These effects are typically evaluated by considering changes in trade volumes over the remaining distortions (Martin, 1997).

and domestic distortions can be written as:

$$\begin{aligned}\Delta W = &- [z_p - (p - p^*)z_{pp} - (p^c - p)e_{pp}](p_1^* - p_0^*) \\ &- 1/2(p_1^* - p_0^*)z_{pp}(p_1^* - p_0^*),\end{aligned} \tag{1}$$

where ΔW is the change in welfare, with an increase being a welfare gain; p and p^* are vectors of domestic and world prices; z_p is a vector of net trade; z_{pp} is a vector of own- and cross-price effects and $(p_1^* - p_0^*)$ is a vector of changes in the world prices of traded goods between periods 0 and 1; p^c represents consumer prices of goods subject to consumption taxes and e_{pp} is a matrix of slopes of the demand functions.

The term in square brackets on the right-hand side of equation (1) is the level of trade that would occur in the absence of distortions. The $(p - p^*)z_{pp}$ term is the second-best welfare impact of changes in import volumes in the presence of continuing trade distortions. It arises because the change in the terms-of-trade induces a change in the volume of imports moving over the trade barrier. If imports of a protected import i increase, welfare increases because each additional unit of imports is worth more at domestic price p_i than at its international price p_i^*. Conversely, if imports of a protected good decline, the second-best welfare impact is negative. If a policy change alters the consumer price of a taxed good, the resulting welfare change is captured by the term $(p^c - p)e_{pp}$. The final, quadratic term in equation (1) is the standard Harberger-triangle measure of welfare gains.

In this particular case, by far the largest second-best welfare effect arises from interactions with taxes on energy use. Since energy, and particularly petroleum, is heavily taxed in Europe, the values placed on these products exceed their market price. An external shock that increases energy prices can therefore create second-best welfare losses by reducing consumption levels even further. With world energy prices rising by 3.5 per cent under the higher growth simulation in China and India, consumption of energy falls, resulting in a welfare loss. The allocative efficiency loss related to this is so large that it overwhelms the second-best effects from other sectors (Table 2), leading to the outcome reported in Table 1. An important qualifier must be placed on this result. If taxes on energy in Europe are, in fact, Pigovian taxes that internalise externalities associated with energy use, then these adverse allocative efficiency effects should be ignored, converting the loss in European welfare reported in Table 1 into a welfare increase.

To help understand the welfare impact in the first simulation values given in Table 1, we present the long-run impacts of higher growth achieved through neutral factor-augmenting technical change in India and China on world prices, and on allocative efficiency by sector in the first two columns of Table 2. The notable feature of the first column of Table 2 is the decline in prices of all commodities except energy relative to the model *numeraire*—the average world price of factors. To understand this result, it is useful to

Table 2. Implications of higher growth in China and India for commodity prices and for allocative efficiency in Europe (changes relative to baseline)

	TFP growth only		TFP and factor accumulation	
	World prices, %	European allocative efficiency, US $ in million	World prices, %	European allocative efficiency, US $ in million
Rice	−4.6	90	0.4	−45
Wheat	−2.6	6	2.6	−23
Grains	−2.3	−24	3.1	−59
Vegetables and fruits	−2.8	4	2.3	−91
Oils and fats	−2.2	−30	−0.2	−78
Sugar	−2.8	−17	−0.6	−102
Plant-based fibres	−2.4	−43	3.6	−310
Others crops	−2.5	−13	1.9	−62
Livestock and meat	−2.7	−342	−0.2	−1,338
Dairy	−2.8	−231	−0.8	−1,037
Other processed foods	−3.0	−3	−0.9	−70
Energy	3.6	−10,504	11.5	−17,722
Textiles	−3.7	403	−1.3	77
Wearing apparel	−5.2	767	−3.7	702
Leather	−3.7	21	−1.6	1
Wood products	−3.2	17	−1.8	18
Minerals	−2.9	45	−1.2	35
Chemicals	−2.4	19	−0.2	−18
Metals	−3.0	99	−1.6	28
Vehicles	−3.3	128	−2.4	126
Machinery and equipment	−3.6	398	−3.0	412
Electronics	−3.6	502	−3.1	841
Other manufactures	−4.7	−147	−4.2	−206
Trade and transport	−2.6	−206	−0.9	−745
Communications	−3.3	607	−2.6	327
Other services	−3.0	1,134	−1.8	1,001
Average world prices	−2.4		−0.2	
Key welfare components for Europe (US $ in million)				
Allocative efficiency		−7,319		−18,338
Terms of trade		3,734		2,309
Total welfare		−5,670		−20,321

Source: Authors' simulation results.

consider three separate groups of goods and services: (i) manufactures and services; (ii) energy and (iii) agricultural products.

For manufactures and services, we would expect a decline in price relative to the composite price of factors (in actual, rather than effective, prices).

Output has increased for any given level of factor use, and the price of the augmented factors used in production has risen relative to output prices. Energy products are different from manufactures and services in that their supply is constrained by a fixed factor, natural 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 simulation, 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 in the long run. The first is the technological change effect described earlier 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 lead to higher prices when demand grows, just as is the case with energy products. A third 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–labour ratio and agriculture is labour-intensive, the increases in the capital–labour ratio will tend to reduce agricultural output.

The decline in world prices of agricultural products in our first simulation is a consequence of the assumed neutrality of technical change in this simulation. Outputs of all goods increase uniformly, but the demand for food grows less than proportionately because of the generally low income elasticities of demand for these goods. We then consider the impact of the same rate of output growth achieved through a lower rate of factor-augmenting technical change, with capital and human capital growing in line with output.[6] When the stocks of physical and human capital rise in line with output (see the third and fourth columns of Table 2), the prices of most agricultural goods rise modestly. The increases in capital stocks relative to labour draw resources out of labour-intensive agriculture in these countries through Rybczynski effects, contributing to the increase in world prices of agricultural products [see Martin and Warr (1993) and Gehlhar *et al.* (1994) for a discussion of these channels]. The shifts in the industrial structure in China and India are quite strong – as predicted by the Rybczynski theorem – and result in an increase in energy demand because of the greater energy intensity of the expanding sectors.[7] This, in turn, pushes up global prices for energy quite sharply, as is evident in the third column of Table 2.

The allocative efficiency results in the second and fourth columns of Table 2 show that the overwhelmingly important source of lost allocative efficiency is in the energy sector. The rise in the price of energy causes

6 Growth of capital and labour in line with output is one of Kaldor's (1957) 'stylised facts' of economic growth.

7 We considered whether this result might have been due to high labour intensity of the non-resource inputs in the energy sectors of China and India. However, examination of the factor input structure of these sectors confirmed that they are capital-intensive in their non-resource inputs.

consumption of energy – already sharply reduced by taxation in Europe – to decline further. In each case, the allocative efficiency losses in the energy sector essentially explain the overall loss in allocative efficiency and in total welfare. However, as noted earlier, whether these are true welfare losses depends upon whether these taxes are viewed as distorting, or as internalising the externalities associated with energy consumption.

3.3. Impacts of growth, variety and quality

Under our central assumption of an elasticity of substitution of 7.5, adding improvements in the variety and quality of exports from China and India to the high-growth scenario increases the welfare gains to the world economy from 3.8 to 4.3 per cent (Table 1). In this case, the volumes of exports from China and India grow by 55 and 47 per cent, respectively, with positive terms-of-trade effects in all regions other than the Philippines. Most countries benefit since they can import higher volumes from these two countries at lower effective prices and also experience greater demand for their exports from China and India. The biggest beneficiaries are, of course, China and India, whose estimated welfare gains increase by 44 and 37 per cent, respectively. The volume of trade between China and India increases more than does the trade of either country with the rest of the world, deepening the trade links between these two Asian giants.

Table 1 also shows the importance of the extent to which products are differentiated for the benefits of increased product variety. If the elasticity of substitution between varieties takes a low value, such as 2.5, then the increase in China's welfare resulting from growth rises from 39.9 per cent in the base case to 60.7 per cent. If differentiated products are much closer substitutes, as is assumed with an elasticity of substitution of 7.5, then the increase in welfare is only from 39.9 to 43.6 per cent. Increases in the number of varieties are more strongly beneficial in the former case because individual varieties are seen as more highly differentiated (Chaney, 2007). This stands in sharp contrast to the results when different elasticities of substitution are considered in an Armington context. In this standard case, the size of the elasticity of substitution is negatively related to that of the price decline, and hence to the deterioration in the terms of trade required for any given expansion in exports.

Changes in the elasticity of substitution between varieties have quite different impacts on different countries and regions, depending upon whether their benefits from increased exports to China and India and their benefits from increased supplies of imports from China and India outweigh any costs from increased competition in third markets. Overall, the gains are much greater with a stronger preference for variety, and the gains to regions that trade substantially with China are typically considerably higher under this scenario. With stronger preference for variety, the export gains to Singapore, for instance, rise by a factor greater than 3, from 6.5 to

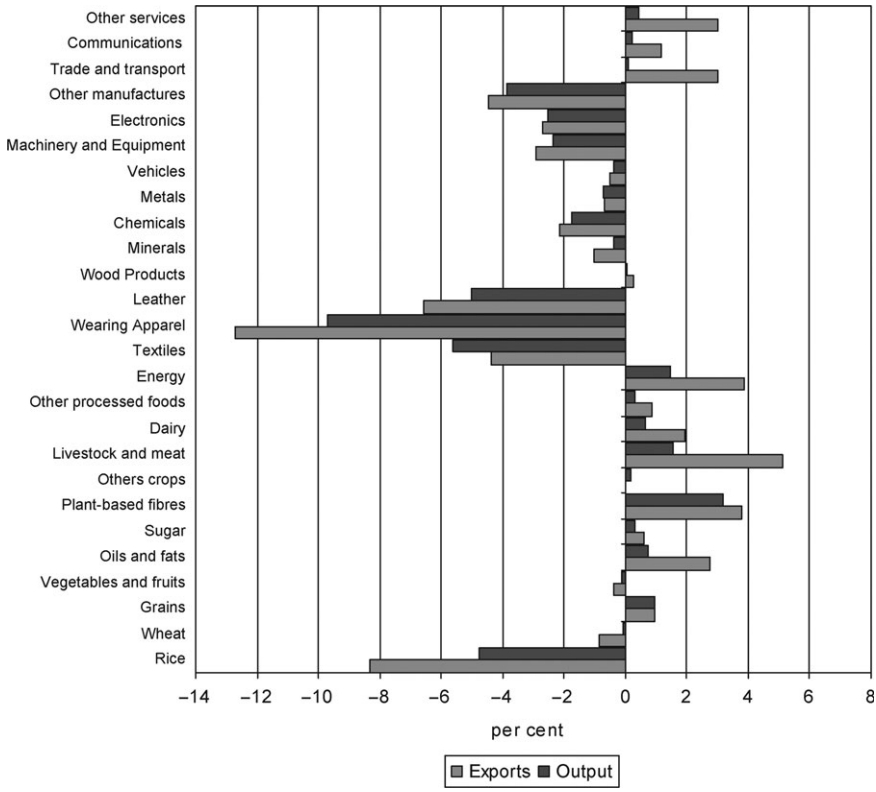

Figure 1. Output and export changes in Europe (in volumes), growth scenario.
Source: Authors' simulation results.

22 per cent (Table 1). There are a few cases such as Mexico, however, where the larger reduction in the effective price of imports from China and India results in larger trade losses, with Mexico's exports falling by 6 per cent, instead of by 2.4 per cent as with an elasticity of substitution of 7.5. These trade losses may not necessarily translate into welfare losses (Table 1). In the case of Mexico, for example, the overall welfare gains to Mexico increase even though exports decline.

For Europe, incorporating love-of-variety and quality improvement in imports from China and India turns the welfare effect from negative to positive. The gain of 1.6 per cent of GDP when we use an elasticity of substitution of 2.5 is much larger than the estimated loss of 0.04 per cent in the standard model (Table 1). A key component of this gain is the terms-of-trade benefit from the decline in the effective price of imports from China and India. However, the size of this gain is extremely sensitive to the strength of the love-of-variety effect. Our central elasticity of substitution of 7.5 results in a welfare gain of only 0.18 per cent of GDP (Table 1).

Table 3. Europe's exports by destination (percentage changes in volumes relative to baseline)

	China	Japan	Korea	Indonesia	Malaysia	Philippines	Thailand	Vietnam	India	Canada	US	Mexico	FSU	MENA	SSA
Rice	−17	−5	−31	−22	−12	−8	−21	−29	−46	−12	−16	−3	−10	−14	−25
	50	−4	−37	−21	−7	−6	−19	−34	11	−11	−15	−1	−9	−14	−27
Wheat	25	0	−10	−10	−11	−14	−4	−36	−68	−1	2	2	−5	−1	−1
	55	5	−10	−8	−6	−13	0	−39	−28	1	9	7	−8	−3	0
Grains	12	1	−3	−5	−7	−4	−4	−13	−21	3	2	1	−1	1	0
	20	4	−6	−7	−13	−5	−5	−23	−8	9	6	3	−2	1	−1
Vegetables and	2	−2	−8	−7	−6	−6	−2	−10	−14	0	0	1	−2	−1	−1
fruits	22	−3	−11	−8	−6	−8	1	−13	6	3	2	2	−2	−2	0
Oils and fats	63	2	−1	0	−1	−4	5	0	1	6	9	9	0	4	2
	73	0	−15	2	3	−12	7	1	21	6	12	10	1	5	5
Sugar	31	3	2	−2	4	−1	1	−2	−23	2	1	−1	3	5	3
	51	7	7	1	12	−2	4	2	25	3	0	−4	6	7	6
Plant-based	8	−4	−5	−11	−2	−11	−7	−4	15	−6	−1	−2	−5	1	−4
fibres	14	8	3	−17	−2	−20	−13	−5	16	−9	−6	−4	−8	−1	−10
Other crops	39	−1	−2	−4	−1	−1	1	−8	−36	2	2	1	−2	0	2
	48	−2	−2	−8	1	−2	2	−17	−6	6	4	1	−3	−1	2
Livestock	22	3	1	0	4	−2	−2	−3	15	2	3	0	1	3	3
and meat	66	6	9	5	14	0	−2	3	58	6	9	−2	3	5	8
Dairy	28	5	2	3	4	4	1	4	13	1	2	1	2	3	2
	63	9	8	9	11	10	5	11	103	3	2	2	6	5	4
Other processed	18	0	−2	−2	0	−2	−3	−1	8	0	0	0	0	2	2
foods	44	1	−2	−2	1	−1	−2	1	39	0	0	−2	2	3	3
Energy	40	19	6	3	2	8	10	−7	34	2	3	3	4	9	5
	62	16	4	3	3	6	9	−16	37	2	3	2	4	8	−1

(*Continued on next page*)

Table 3. (*continued*)

	China	Japan	Korea	Indonesia	Malaysia	Philippines	Thailand	Vietnam	India	Canada	US	Mexico	FSU	MENA	SSA
Textiles	20	−11	−9	−4	−4	−7	−5	−5	15	−10	−13	1	1	−5	−6
	81	−23	−13	−7	−8	−14	−11	−9	58	−24	−32	0	2	−13	−15
Apparel	21	−15	−17	−10	−14	−8	−5	−4	16	−20	−21	−2	−14	9	−6
	105	−28	−29	−17	−24	−15	−6	−7	62	−37	−40	−6	−25	22	−11
Leather	15	−6	−8	−13	−8	−9	−8	−5	19	−11	−11	−3	−5	−5	−6
	81	−15	−11	−26	−11	−18	−13	−8	76	−23	−23	−9	−8	−11	−13
Wood products	18	0	1	4	0	−1	1	1	21	0	−2	−1	1	1	1
	74	1	6	16	3	0	6	4	80	−2	−6	−5	3	1	4
Minerals	19	−5	−3	−4	−2	−3	−1	−4	25	−3	−5	−4	−3	−1	−1
	67	−7	−4	−8	−4	−4	−1	−5	48	−6	−9	−7	−3	−3	0
Chemicals	21	−3	−3	−6	−2	−5	−4	−7	19	−6	−5	−6	−1	−2	−4
	73	−6	−3	−11	−3	−11	−7	−15	35	−9	−10	−10	−1	−7	−8
Metals	23	−2	−2	−4	−2	−3	−3	−7	21	−4	−5	−4	1	−6	−8
	91	−3	−3	−10	−5	−8	−7	−15	67	−9	−11	−8	1	−14	−16

Vehicles	26	−4	−8	−10	−3	−10	−2	−22	21	1	0	0	−3	−2	−7
	61	−11	−17	−20	−7	−19	−5	−41	38	−2	−3	−2	0	−5	−14
Machinery	25	−9	−5	−11	−6	−4	−8	−10	13	−3	−6	−1	−3	−7	−10
	73	−18	−11	−22	−12	−10	−16	−18	26	−10	−15	−7	−4	−16	−21
Electronics	29	−5	−7	−9	−9	−4	−6	−3	10	−7	−8	−5	−3	−6	−8
	71	−25	−30	−32	−31	−18	−27	−16	−3	−26	−29	−23	−14	−22	−26
Other	10	−15	−15	−14	−12	−16	−16	−7	27	−19	−20	−15	−9	−10	−8
manufactures	80	−27	−25	−25	−22	−28	−25	−12	46	−34	−36	−29	−15	−19	−15
Trade and	26	0	0	−2	0	−3	0	−3	22	−2	−2	−4	0	0	1
transport	66	1	3	−2	1	−4	2	−4	56	−1	−2	−6	2	0	2
Communications	25	3	1	−1	0	−2	−1	−1	23	0	1	0	1	2	2
	67	4	3	1	2	−3	0	0	57	1	1	−2	2	3	4
Other services	26	4	3	2	5	0	2	0	23	2	2	2	7	6	5
	71	6	7	3	6	−1	3	1	68	1	1	0	9	6	7

Note: For each product, numbers in the first row are results for the case of improved growth in China and India; numbers in the second row are for the case of improved growth and quality exports in China and India when $\sigma = 7.5$. FSU, Former Soviet Union; MENA, Middle East and North Africa; SSA, Sub-Saharan Africa.
Source: Authors' simulation results.

Table 4. Europe's imports by origin (percentage changes in volumes relative to baseline)

	China	Japan	Korea	Indonesia	Malaysia	Philippines	Thailand	Vietnam	India	Canada	US	Mexico	FSU	MENA	SSA
Rice	100	−10	18	10	0	4	7	4	115	−4	−4	−4	−2	−6	3
	118	−14	17	6	−10	4	−2	−1	111	−7	−7	−4	−8	−8	−2
Wheat	84	0	11	6	14	12	13	35	661	−5	−1	−2	6	−1	−2
	291	0	14	7	16	15	14	52	756	−12	−4	−1	10	5	−1
Grains	32	1	4	5	3	6	5	10	105	−2	−1	1	2	0	1
	56	3	7	8	3	9	7	15	110	−4	−3	4	5	3	3
Vegetables and	90	−1	7	5	0	5	1	4	95	1	−1	0	4	−1	0
fruits	124	1	8	7	−8	6	−2	−1	116	−4	−4	1	5	1	−1
Oils and fats	29	−4	4	4	0	9	1	2	79	−3	−13	−2	1	−4	−2
	81	−5	10	0	−1	13	−2	1	119	−3	−16	−1	−3	−6	−6
Sugar	60	−6	−4	6	−2	5	−1	4	108	3	−1	2	−1	−5	−2
	93	−7	−9	4	−9	10	−5	1	108	5	1	8	−3	−5	−5
Plant-based	74	0	6	18	0	24	3	5	52	−2	0	2	3	−8	1
fibres	178	3	6	26	−5	43	2	7	138	1	0	7	4	−5	2
Others crops	51	0	9	6	1	4	−3	5	233	−4	−3	0	4	0	−2
	114	1	9	7	−4	8	−7	2	306	−12	−6	2	6	2	−2
Livestock and	80	−5	2	6	−5	10	3	10	109	−2	−1	5	3	−2	−2
meat	141	−7	−3	2	−16	14	−1	3	154	−6	−1	14	−1	−2	−6
Dairy	87	−7	0	6	−3	2	0	2	70	−1	−2	1	−1	−4	−3
	155	−10	−7	4	−9	−1	−5	−3	60	−1	−1	6	−6	−5	−7
Other processed	44	−4	−1	1	−1	3	−1	3	40	0	−1	1	0	−3	−2
foods	55	−5	−4	0	−2	4	−3	2	37	1	1	4	−2	−4	−4
Energy	21	6	−10	−2	−15	4	−5	−7	7	3	10	0	1	−7	1
	289	6	−13	−1	−16	6	−9	−9	273	4	10	0	0	−7	1
Textiles	19	−23	−21	−20	−20	−16	−17	−17	16	−16	−17	−16	−19	−22	−19
	38	−45	−46	−43	−43	−37	−42	−40	13	−35	−37	−34	−45	−44	−43

Apparel	12	−28	−24	−24	−23	−22	−22	−24	9	−20	−20	−22	−23	−26	−24
	14	−49	−48	−46	−41	−39	−43	−44	−3	−37	−35	−37	−46	−45	−45
Leather	47	−14	−10	−6	−5	−5	−5	−5	43	−5	−6	−4	−5	−9	−11
	104	−23	−22	−15	−8	−6	−14	−10	60	−8	−7	−2	−16	−14	−20
Wood products	50	−8	−5	−1	−2	−1	−1	−3	42	−2	−2	1	−4	−7	−4
	71	−12	−13	−6	−4	1	−4	−4	41	−1	−1	8	−9	−8	−9
Minerals	33	−5	−3	−4	−4	0	−2	1	17	−3	2	3	0	−4	−3
	45	−9	−10	−7	−5	1	−5	−1	28	−3	2	8	−5	−6	−7
Chemicals	44	−9	−10	−2	−1	8	0	−2	18	−5	3	6	−6	−15	−1
	83	−14	−18	−6	−5	8	−7	−3	63	−6	2	9	−13	−18	−7
Metals	36	−9	−2	−8	−3	0	−1	−5	31	−1	0	2	−9	−11	−7
	66	−15	−12	−13	−5	1	−4	−8	56	−2	−1	6	−17	−12	−13
Vehicles	35	−10	−5	2	−3	2	1	3	36	−2	−4	−1	−4	−6	−4
	59	−16	−15	0	−5	5	−2	7	39	−3	−4	2	−11	−9	−9
Machinery	41	−14	−9	0	−6	−3	−3	−8	31	−5	−8	−4	−11	−11	−11
	68	−24	−25	−4	−12	−4	−8	−13	57	−9	−13	−4	−24	−18	−21
Electronics	32	−15	−7	−7	−7	−6	−2	−10	32	−6	−8	−5	−16	−13	−10
	89	−34	−27	−26	−20	−19	−11	−26	54	−19	−23	−16	−38	−28	−33
Other	28	−23	−19	−17	−17	−11	−12	−18	20	−16	−16	−15	−18	−22	−19
manufactures	40	−37	−37	−32	−27	−20	−25	−30	17	−26	−26	−21	−35	−33	−34
Trade and	28	−3	−2	−3	−4	1	−2	−3	24	0	1	4	−3	−4	−5
transport	29	−4	−7	−4	−4	4	−3	−2	19	1	3	10	−6	−4	−7
Communications	29	−6	−3	2	−1	3	2	1	28	−1	−3	0	−4	−4	−4
	25	−8	−10	0	−1	6	1	0	12	0	−1	6	−6	−4	−7
Other services	26	−6	−3	−2	−6	1	−2	3	25	0	−1	−1	−10	−7	−5
	25	−8	−10	−4	−6	4	−4	1	14	0	0	4	−13	−7	−8

Note: For each product, numbers in the first row are results for the case of improved growth in China and India; numbers in the second row are for the case of improved growth and quality exports in China and India when $\sigma = 7.5$. FSU, Former Soviet Union; MENA, Middle East and North Africa; SSA, Sub-Saharan Africa.
Source: Authors' simulation results.

Interestingly, European aggregate exports decline and aggregate imports rise very slightly under all scenarios considered. Europe's exports to China and India grow across most product categories (Table 3), as well as exports of some farm products and services to third markets. However, European exports of manufactures face greater competition in third markets, and the reduction in the import prices from China reduces the need to generate export revenues to pay for these exports. As shown in Figure 1, Europe's exports and output of manufactures decline, while exports of farm, resources-based products and services expand in response to higher growth in emerging Asia.

The declines are much more pronounced when China and India improve the quality and sophistication of their exports and start competing increasingly in products in which Europe has had a traditional comparative advantage (Table 3). Under this scenario, Europe should be prepared for much more serious changes in its industrial structure and related adjustment costs.

Europe will benefit from increased opportunities to import from China and India. Europe's imports from China and India rise substantially, implying that there will be a shift of trade away from other emerging economies to China and India (Table 4). The shift is especially strong for electronics, machinery and equipment and other manufactures, and is amplified as the giants improve the quality and variety of their exports. This implies that as China and India grow, Europe will increasingly direct its trade to these two countries.

4. Changes in trade policies

While the analysis in previous parts of the paper treated trade policies as exogenous, there appear to be strong relationships between trade policies and the level of economic development. Policies for non-agricultural trade generally become more liberal as income levels rise, while agricultural trade policies tend to become more restrictive. The agricultural policy linkages are potentially crucial, since China and India are enormously important in agricultural production and China has recently become much larger in agricultural trade than the traditional major agricultural trading powers of the European Union and the US (Huang *et al.*, 2007).

These developments in trade policies can be expected to impact on Europe in a number of ways. One of the key ways is through induced changes in the terms-of-trade. If agricultural protection in China and India were to increase, Europe's terms-of-trade would deteriorate for the products it exports to them. On the other hand, Europe might benefit from lower world prices for goods it imports. Another potential cost could be through induced policy responses in Europe. If European agricultural policies reverted to their traditional goal of maintaining prices for agricultural goods relative to non-agricultural prices, then higher protection would be needed to offset declines in world prices of agricultural products.

The process of liberalisation of non-agricultural trade in China has been studied in detail by Ianchovichina and Martin (2004) and others. While some scope remains for further liberalisation of non-agricultural trade policies

in China, much of this liberalisation seems likely to take place through negotiations (perhaps under the Doha Development Agenda), rather than through autonomous reform in response to income changes. As noted earlier in this paper, non-agricultural tariffs in India have been substantially reduced (Pursell and Sattar, 2004), and further reductions also seem more likely to come about through negotiations rather than autonomous responses to income changes (although binding overhang in India is likely to reduce the extent of reductions in applied tariffs under the Doha agenda).

In agriculture, there appears to be a much more direct link between income growth and tariff rates. As explained by Anderson and Hayami (1986) and Lindert (1991), and subsequently documented by Anderson (2008), the political economy of trade policy tends to change in similar ways as countries develop. In countries as poor as China was in 1981, urban consumers care a great deal about the price of food and are relatively well organised. Farmers, in contrast, are numerous but poorly organised. They also tend to be subsistence-oriented, selling only a relatively small share of their output in the market. The primary exports tend to be agricultural products, which are easily taxed through direct border taxes or, as was historically the case in China, through state trading enterprises. The result tends to be a policy of taxing agriculture.

As economies develop and incomes grow, many of these elements change: food takes a smaller share of the expenditure of urban people, urbanisation increases while the urban community becomes more diverse in its interests and more difficult to organise and farmers sell a larger share of their output in the market, which makes output prices more important to their real incomes. Furthermore, they tend to use more purchased intermediate inputs, which increases the leverage of an output price change on their net income. Finally, the share of the population engaged in farming tends to decline, making farmers easier to organise. Consistent with the theory of collective action (Olson, 1971), commodities where production is concentrated in particular regions or where processing networks lower the cost of communication and organisation are more likely to receive high rates of protection.

Anderson (2008) finds strong evidence that many of the developments suggested in Anderson and Hayami (1986) and in Lindert (1991) have, in fact, materialised, with negative protection of agriculture declining as incomes grow in many countries and some countries moving from agricultural taxation to protection. However, the relationship between incomes and agricultural protection rates is not automatic and appears to vary somewhat by region. Figure 2 plots the level of agricultural protection against the log of the level of income for a wide range of countries. The tendency for protection rates to increase with rising incomes is strongest in East Asia, particularly North-East Asia, perhaps partly because the sample contains countries that have achieved relatively high levels of income, and partly because these economies have relatively limited agricultural endowments, and hence concerns about self-sufficiency in key food products. Another feature of Figure 2(a) is the apparently negative relationship between income levels and protection in South Asia.

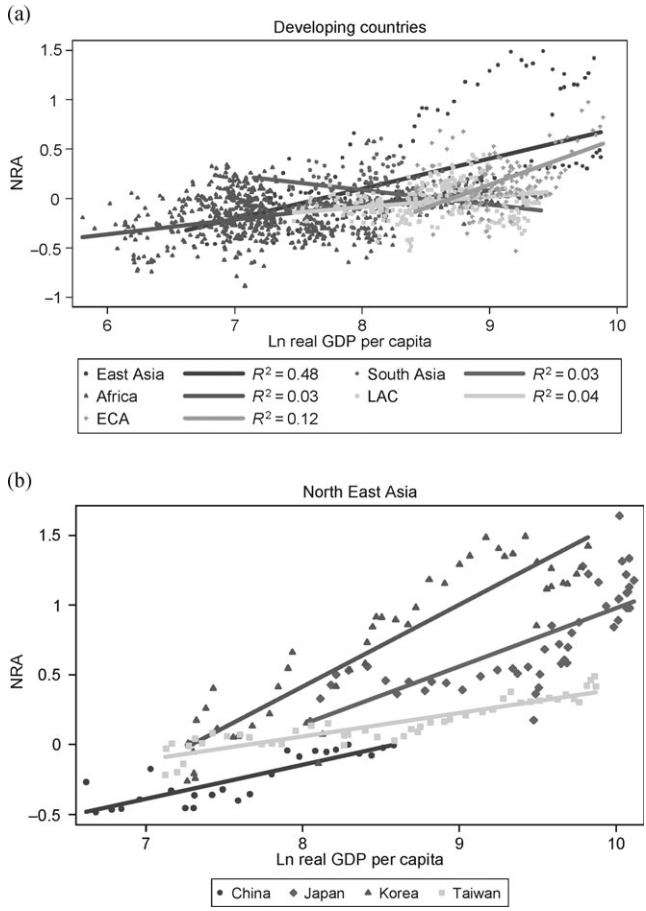

Figure 2. Nominal rate of assistance to agriculture (NRA) and real GDP per capita: (a) all developing countries; (b) East Asian economies. *Source*: Anderson (2008).

What is clear from Figure 2(b) is that, despite China's very different political history, its pattern of protection is consistent with that of the other North-East Asian economies, including a phase of negative protection and a rising trend.[8] While the evidence of this pattern in China is only available for 25 years, it is certainly suggestive of a potential common pattern.

To the extent that there are common factors driving the evolution of agricultural protection in the four economies depicted in Figure 2(b), a key difference is the point at which WTO disciplines began to affect agricultural protection levels. In Japan, protection had grown seemingly without limit during its period of high growth, and only towards the end of the sample period is there a suggestion of a slowdown in the rate of growth. In Korea,

8 Results in Anderson and Hayami (1986) point to a phase of negative protection in Japan at a much earlier stage than the one presented in Figure 2.

protection rates appear to start flattening out in the later years, possibly under the influence of the relatively mild WTO disciplines to which Korea was subject as a WTO member with developing country status. In China and Taiwan (China), the WTO disciplines negotiated at accession contributed – as discussed earlier and in Ianchovichina and Martin (2004) – to reducing protection to some degree. But more importantly, in view of Figure 2, they have introduced disciplines on future increases in protection in China – increases that could have been very costly for China and for the world if China had followed the pattern of other East Asian high-growth economies.

Given our focus on the growth of China and India, a comparison between trends in agricultural protection in these two countries is particularly important. The changes in their agricultural protection are presented in the two panels of Figure 3. Both countries are similar in having much higher protection for import-competing agriculture, rather than for export-oriented agriculture. In China, there appears to be a strong upward trend in average agricultural protection, together with a substantial reduction in the difference between import-competing and export-oriented agriculture. In India, there has been a similar reduction in the difference between import-competing and export-oriented agriculture. However, the strong upward trend evident in China is much less evident in India. This pattern appears to recur in most of the South Asia economies. However, agricultural protection in India increased more rapidly than in China over the period 1995–2005. This is consistent with the fact that the disciplines imposed on agricultural protection by WTO commitments in South Asia are extremely weak given very substantial binding overhang. Since the disciplines on agricultural protection in these countries are likely to remain weak even with a successful conclusion to the Doha Development Round negotiations (Jean *et al.*, 2008), future agricultural protection in India may follow a rising trend. On the other hand, historically, the underlying dynamic of agricultural protection rising as incomes grow has been much less strong in South Asia than in East Asia (Figure 2a).

While the future evolution of agricultural trade policies in China and India cannot be forecast with any precision, we can assess the potential impacts on other countries of hypothetical changes in agricultural trade policies in these giants. To do this, we consider the impact of an increase of 20 percentage points above 2001 levels in agricultural import protection in China and India.[9]

Table 5 shows that such an increase in protection would primarily damage the economies of China and India. The other economies adversely affected would be countries such as Australia and the US that export to China and India. For Europe, the overall welfare impacts turn out to be quite small. While the smaller result for Europe relative to the agricultural exporters may seem unsurprising, it is not necessarily a trivial finding. Lower world prices resulting from higher protection in these important markets might have been

9 To be more precise, we consider an increase of 0.2 in the power of the import tariff on all agricultural products, $(1+t_i)$.

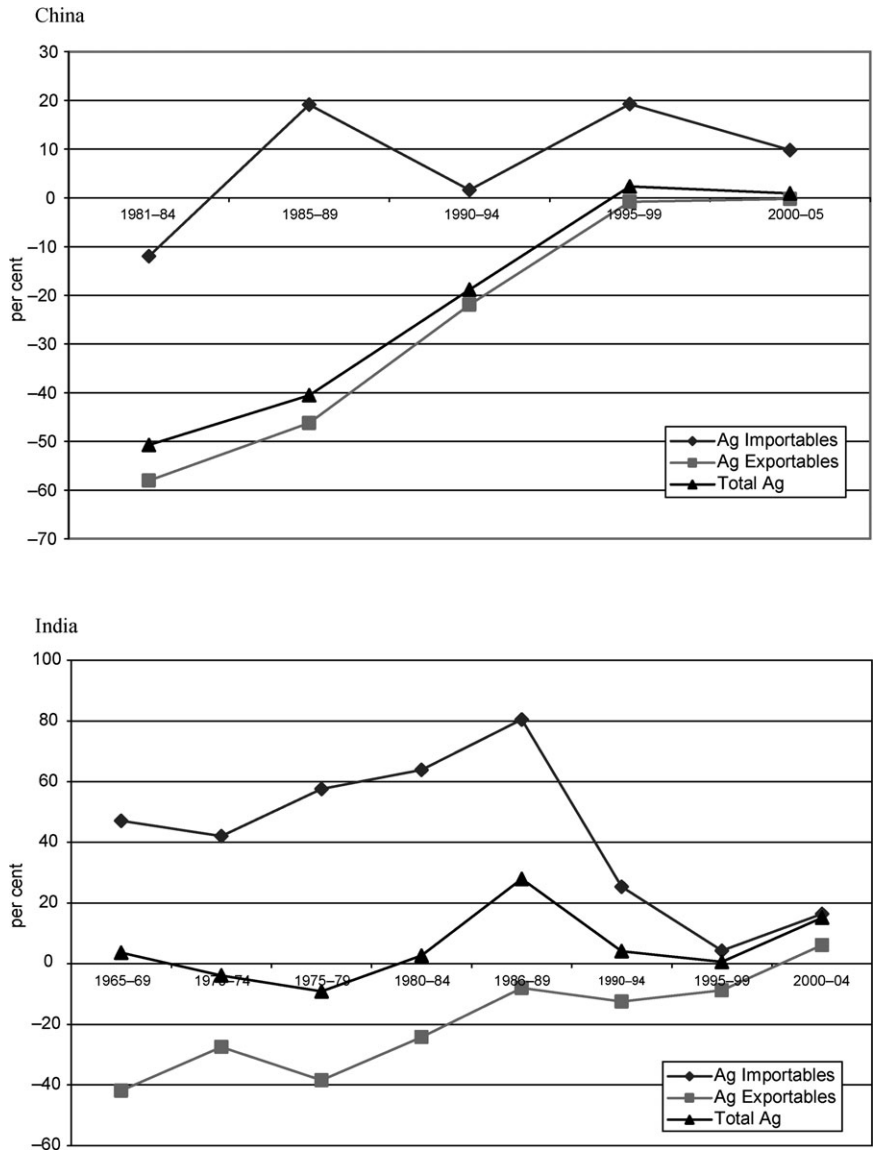

Figure 3. Agricultural protection in China and India. *Source*: Anderson (2008).

expected to result in a positive welfare impact for Europe. Furthermore, such gains might have been compounded by allocative efficiency gains as import volumes passing over European import barriers increased in response to lower world prices. And, of course, if European agricultural policies reverted to the earlier model of the Common Agricultural Policy in seeking to maintain domestic agricultural prices high relative to other prices, there could be substantial welfare losses as European protection rose in response.

Table 5. Welfare impacts of a 20 percentage point increase in agricultural import barriers

Affected regions	Protecting regions		
	China and India, US $ (million)	China, US $ (million)	India, US $ (million)
Australia and New Zealand	−1,342	−1,106	−236
China	−6,011	−6,414	403
Japan	68	19	50
Korea	115	38	77
Hong Kong and Taiwan, China	222	161	62
Indonesia	230	233	−3
Malaysia	−151	9	−160
Philippines	99	81	18
Singapore	60	29	31
Thailand	18	4	14
Vietnam	69	55	13
Rest of South-East Asia	2	4	−2
India	−5,071	503	−5,574
Rest of South Asia	229	248	−19
Canada	−582	−501	−81
US	−3,212	−3,156	−56
Mexico	166	148	18
Argentina and Brazil	−502	−409	−93
Rest of Latin America	−125	−94	−31
European Union 25 and EFTA	−48	−383	335
Former Soviet Union	−271	−154	−117
Middle East and North Africa	−342	−41	−301
Sub-Saharan Africa	−529	−273	−256
Rest of the world	48	39	9
World	−16,861	−10,962	−5,900
Low-income countries	−5,300	537	−5,838
Middle-income countries	−6,843	−6,599	−243
High-income countries	−4,719	−4,900	181

Source: Authors' simulation results.

5. Concluding comments

This study provides some insights into the impacts of higher economic growth in emerging economies on Europe through an examination of the implications of higher-than-expected growth in China and India. In our initial analysis, with all of the growth derived from higher productivity growth, the terms-of-trade effects are favourable for Europe, with expansion in the exports and imports of China and India benefiting Europe through direct trade linkages. A notable feature of this simulation is the decline in the prices of virtually all goods relative to our *numeraire* – the average price of factors of production. An important exception is the price of energy,

which rises following faster growth in China and India because increased demand confronts a relatively inelastic supply.

Using a conventional modelling approach, the resulting small welfare gain to Europe appears to be converted into a small net welfare loss by unfavourable allocative effects in energy markets. This is because consumption of energy in Europe is heavily taxed so that the marginal private value of these goods is above their cost. Higher energy prices compound the apparent welfare loss by further reducing consumption, unless the taxes are reducing the gap between the value of the energy and its social costs, including external costs.

When we consider higher growth in China and India resulting from a combination of higher productivity and more rapid accumulation of capital and human capital, there are strong resource pulls out of agriculture into manufacturing and services in these giants. These shifts, given the greater energy intensity of the expanding sectors, push up world prices of energy products much more than in the initial simulation, increasing the welfare losses to Europe both through terms-of-trade deterioration and potential declines in allocative efficiency.

Our global general equilibrium modelling approach is extended, based on econometric results by Hummels and Klenow (2005), to take into account the impacts on economic welfare of product quality improvement and increases in the range of varieties traded. Hummels and Klenow (2005) provide estimates of the rate at which product quality augments, and the rate at which the range of product variety expands. Converting the expansion in the range of products requires an assumption about the elasticity of substitution between varieties, for which we have relatively limited evidence. If the elasticity of substitution falls at the upper end of the range suggested by Hummels and Klenow (2005), then the impacts of increased product variety are important, but not exclusively so. If we allow for a lower value of the elasticity of substitution, then these gains can greatly increase the gains to Europe.

Our analysis of growth and variety was undertaken assuming policies remain unchanged in China and India, but this may not be the case. One systematic tendency is for agricultural protection to increase as incomes increase, as documented in Anderson (2008). The future evolution of agricultural trade policies in the giants is highly uncertain, particularly given the WTO disciplines currently under negotiation in the Doha Development Round. As a consequence, we explore the impacts of a purely hypothetical increase in protection in China and India that would raise agricultural prices by 20 per cent from current levels assuming no other changes in prices. We find that such an increase in protection would have its largest adverse impacts on the countries imposing the increase in protection. The group next most adversely affected would be countries such as Australia and the US that export to these giant economies. On this initial assessment, the impacts on Europe would be negative but small.

While this analysis integrates many of the key trade issues involved with the rapid growth of China and India, an enormous amount of research will be needed to help ensure that appropriate policies for managing these changes are identified and adopted in emerging and incumbent economies. A key

question for future research is whether the recent, rapid improvement in the terms of trade for exporters of commodities relative to manufactures and services will be sustained, and whether the growth of oil-importing economies such as China and India will continue despite rising commodity prices. Another key question is whether other resource-rich developing countries will be able to implement policies that encourage the strong supply responses needed to attenuate the increase in the prices of food and other commodities.

Other key priorities for future research clearly include the environmental implications of their growth, and particularly the potential implications of climate change. In order to relieve the pressure on commodity prices and environmental quality, China and India may need to be more active than countries whose growth occurred in less environmentally fraught periods in encouraging adoption of less polluting technologies. Future research will also need to quantify the effects of such technology adoption on economic outcomes in the giants and in the rest of the world. Finally, this analysis focused on identifying likely long-term trends. In the short run, outcomes may deviate substantially if one or more major economies are drawn into deep recession associated with financial or currency collapses of a type not considered in this paper.

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