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China in 2005: Implications for the Rest of the World

Channing Arndt
Thomas Hertel
Betina Dimaranan
Karen Huff
and
Robert McDougall
Purdue University

Abstract

This paper analyzes the impact of continued rapid growth in China on her trading partners using a multiregion, applied general equilibrium model. Contrary to conventional wisdom, we find that most developing countries benefit from China's growth. Product differentiation plays a key role in this finding. Systematic analysis of these welfare gains shows that, as expected, simple terms of trade calculations based on net trade positions and average world price changes predict a loss for the developing countries. However, with the exceptions of South Asia and Thailand, this loss is overshadowed by a positive move-

* Correspondence Address: T. Hertel, Director, Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University, 1145 Krannert Building, West Lafayette, IN, 47907-1145, U.S.A, e-mail address: hertel@agecon.purdue.edu; The authors acknowledge valuable comments by seminar participants at the World Bank, the Dutch Central Planning Bureau, the 50th EAAE Seminar in Giessen, Massey University, Monash University and the Conference on Empirical Investigations in International Trade at Purdue University. Eugene Ballieau and Ed Tower provided particularly valuable comments on an earlier drafts of this paper.

ment in region-specific export price indices. Second-best effects also play a significant role in the gains for a number of the developing countries. (JEL Classification: F11, F15)

I. Introduction

A. Rapid Growth in China

Recent projections by the World Bank have China tripling in size over the period 1992-2005 (Table 1). With a population of 1.2 billion, China has attracted investors seeking to gain a foothold in what is potentially the world's largest market. In 1994, China accounted for 20% of all foreign direct investment in developing countries ⟨Garbaccio [1995]⟩. The development of

Table 1
Assumptions Used in the Projections: Cumulative Growth Rates Over the Period 1992-2005 (Percentage Changes)

Regions	Population	Labor Force	Physical Capital	Human Capital	TFP Growth	GDP Growth
US & Canada (USC)	13	13	56	90	–4	40
Western Europe (WEU)	2	1	36	217	8	37
Japan (JPN)	3	–2	69	81	5	44
Korea (KOR)	11	12	209	119	25	132
Taiwan (TWN)	11	18	211	119	23	115
Hong Kong (HKG)	7	9	211	83	14	101
China (CHN)	12	16	303	57	99	214
Indonesia (IDN)	19	30	152	242	24	129
Malaysia (MYS)	28	41	214	257	13	174
Philippines (PHL)	33	40	92	110	1	76
Thailand (THA)	18	26	265	150	5	173
Latin America (LTN)	22	32	59	125	5	58
Sub-Saharan Africa (SSA)	44	49	24	148	15	55
South Asia (SAS)	26	34	97	108	21	93
Rest of World (ROW)	20	25	55	162	–5	40

Sources: International Economic Analysis and Prospects Division, The World Bank. Cumulative TFP growth implied by other assumptions.

the Chinese economy has become a focal point for the attentions of economists, businessmen, and politicians around the world.

During the period 1977-1994, China's exports and imports grew much more rapidly than did the worldwide average. Indeed, over this 17 year period, China's share of global trade quadrupled, raising it to the world's 11th largest exporter in 1994 ⟨Garbaccio [1995]⟩. China's share of merchandise imports coming into the U.S. have grown exponentially, from a negligible 0.06% in 1972, to 6.0% in 1994 ⟨Garbaccio [1995], Table 1⟩. The prospect of continued rapid growth in Chinese exports of light manufactures raises concerns among other developing countries about potential adverse effects on their prospects for growth. Will continued rapid growth in China displace its labor-abundant competitors in the largest consumer goods market in the world? On the other hand, simultaneous, rapid growth in Chinese imports has created significant opportunities for other exporters. Which of China's trading partners are most likely to benefit from this growth, and which are likely to lose?

The objective of this paper is to provide a systematic analysis of the impact which rapid growth in China is likely to have on other countries over the next decade. To achieve this objective, three unique methods of analysis are employed. First, to account for critical interaction between China and other regions, an applied general equilibrium model is employed. Second, the sensitivity of model results to values employed for trade parameters is systematically investigated through a highly efficient numerical integration approach. Third, in order to thoroughly analyze the welfare impacts of China's growth, a newly developed technique for decomposing welfare changes is employed.

The paper is structured as follows. First, the methods mentioned in the preceding paragraph are presented in more detail. This section also includes a discussion of the mechanisms through which China's growth can affect the welfare of other regions. Second, results from a base case projection where China grows rapidly over the period 1992-2005 are presented. Third, the welfare impacts of rapid growth in China are examined in more detail by comparing the base case scenario of rapid growth in China to a scenario where China stagnates. We conclude that fears of negative welfare effects stemming from China's growth are overblown, and altogether misguided in some cases.

II. Projections Methodology

A. Applied General Equilibrium Analysis

In order to quantify the impact of China's growth on her trading partners, it is necessary to have a tool for projecting future patterns of global production, consumption, trade and prices, conditional on rates of regional economic growth. The basic idea is to simulate these patterns to the year 2005, with and without rapid growth in China. By taking the difference between these two projections, we will then be able to ascertain the impact that China's growth is likely to have on its trading partners.

While there are many vehicles for constructing projections, few of these satisfy the requirements for this exercise. First of all, due to the importance of third country effects, the analysis should include *all of China's trading partners* at some level of aggregation. Since growth is inherently economy-wide in nature, the framework must also cover *all economic activity* in each country. This would normally point towards the use of a global macroeconomic model. However, as will be seen below, *intersectoral effects* play an important role in determining how others respond to China's growth. These effects are generally not well-developed in macroeconometric models. This combination of the need for sectoral detail, while maintaining global, macroeconomic coverage leads us to the use of a multiregion, applied general equilibrium (AGE) approach. In this paper we employ a modified version of the Global Trade Analysis Project (GTAP) model ⟨Hertel and Tsigas [1997]⟩ to make projections to the year 2005.

The GTAP model is a relatively standard, multiregion, AGE model, which assumes perfectly competitive markets and constant returns to scale technology. It is implemented in Gempack and is solved via non-linear methods. Unlike most multiregion AGE models, GTAP utilizes a sophisticated representation of consumer demands ⟨the constant difference elasticity implicit expenditure function first proposed by Hanoch in [1975]⟩ which allows for differences in both the price and income responsiveness of demand in different regions depending upon both the level of development of the region and the particular consumption patterns observed in that region. This plays an important role on the demand side in constructing projections during a period of rapid growth in a subset of countries, as is the case here.

On the supply-side, differences in relative rates of factor accumulation interact with differential sectoral factor intensities to drive the projections. The production system used in this paper goes beyond the standard GTAP model by distinguishing sectors by their intensities, not only in agricultural land, labor, and physical capital, but also in human capital. (All factors are assumed perfectly mobile within regions but internationally immobile.) Thus, in a region where human capital is accumulating rapidly, relative to other factors, we expect the human capital intensive sectors to expand at the expense of other activities. These "Rybczynski effects" have been found to be important determinants of structural change ⟨Krueger [1977]; Leamer [1987]; Martin and Warr [1993]; Gehlhar, *et al.* [1994]⟩.

The 37 sector input-output structure imbedded in the GTAP data base also captures differences in intermediate input intensities, as well as import intensities, by use. Product differentiation between imports and domestic goods, and among imports by region of origin, allows for two-way trade in each product category, depending upon the ease of substitution between products from different regions. This is essential if we are to assess the implications of economic growth for bilateral trade patterns in the Pacific Rim. The regional aggregation employed is presented in Table 1. Note that Hong Kong and Taiwan are treated as separate regions (*i.e.*, as trading partners of China).

Macroeconomic closure in the model is obtained with several key assumptions. Firstly, land, labor, and capital are fully employed, and all returns to these factors accrue to households in the region in which they are employed. Final demand in each region is governed by a representative, regional household which allocates regional income across private consumption, government expenditure and savings according to a Cobb Douglas utility function. The sum of regional savings equals global savings, which in turn must equal global investment. The latter is normally allocated across regions in order to equate expected rates of return. However, in this paper we are shocking the (normally fixed) capital stocks exogenously. Therefore, we require regional investment to increase in proportion to regional capital stock.[1] Finally, since this is a Walrasian model, only relative price matters. The price of the global investment good is chosen as the numeraire.

In the simulations presented in this paper, we utilize exogenous projections of each region's endowment of agricultural land, physical capital, human capital, population, and labor force as well as total factor productivity (TFP). These are obtained from the World Bank. Capital stock projections were generated by adding investment in each year and subtracting depreciation using the methodology of Nehru and Dhareshwar [1994]. The human capital projections were based simply on the growth in the stock of post-secondary educated labor in each country during the 1980-87 period ⟨Nehru, Swanson, and Dubey [1994]⟩. The stock of agricultural land was held constant throughout the analysis. Base case estimates of sector and factor neutral total factor productivity (TFP) growth rates for each of the 10 regions are derived based on projected growth in factor inputs and the World Bank's real GDP projections. Rates of growth in agricultural sector TFP were assumed to be slightly faster than for nonagriculture (0.7%/year) based on evidence from Bernard and Jones [1993].

From the cumulative growth projections in Table 1, it is clear that China stands out with a very high rate of capital accumulation, and an extraordinary rate of implied total factor productivity growth, which combine to result in a tripling of real GDP over this 13-year period. The high rate of investment and the modest growth in population and labor force in China point towards a significant capital deepening of that economy. This should fuel growth in heavy industry in the coming decade. The high rate of TFP growth may be attributed in part to the changing composition of the economy over this period, as China grows its way out of stagnant state-run industries, becoming more of a market economy.

We also incorporate the recent Uruguay Round agreement into our projections for the year 2005. This is done by specifying the associated cuts in tariffs, tariff equivalents and export subsidies. Most of this information is obtained from the WTO's Integrated Data Base ⟨Reincke [1997]⟩. However, our experiment does not include cuts in protection in China, as that coun-

1. In order to insure that global investment does not exceed savings in this comparative static model, all regional investment must be scaled up or down by a common factor which is endogenously determined.

try's offer to the WTO is still pending. Finally, since reform of the system of textile and apparel quotas is an important part of the Uruguay Round, we also incorporate the accelerated quota growth rates, as specified under the Agreement on Textiles and Clothing ⟨Hertel, Martin, Yanagishima, and Dimaranan [1995]⟩. While these quotas are to be abolished altogether at the end of the year 2005, there are a number of "safeguards" and loopholes in the agreement, and there is some doubt about whether complete reform will be obtained. Therefore, we have chosen to stop the projection prior to this final hour, thereby leaving the quotas in place in 2005, albeit at their accelerated (less-binding) level. All other policy interventions are modeled as ad valorem interventions.

Given projections of these variables, the model can be solved for the level and structure of output in the year 2005. The GTAP model maintains all of the restrictions imposed by economic theory; changes in consumer demands are constrained to add up to changes in total spending; each group's income is determined by spending on its output; each region's total exports equal total imports of these goods, by other regions, less shipping costs. The ability of the GTAP model to perform projections of this type has been investigated through a backcasting exercise designed to examine how well the model can explain the differences in East Asian trade patterns between the model's base year [1992] and those observed a decade earlier ⟨Gehlhar [1994], [1997]⟩. Using only information on the differences in factor endowments between 1992 and 1982, Gehlhar was able to provide reasonably accurate projections of trade shares in 1982, once human capital was included.

The ten aggregated sectors employed for this analysis are listed in Table 2. The relationship between these sectors and the 37 sectors available in the GTAP database are given in appendix Table A1. The Uruguay Round reforms featured in this projections exercise are most significant in the case of the food and clothing sectors. These are also sectors where China's growth is expected to have a significant impact on world markets. Consequently, we have disaggregated food into primary agriculture and manufactured food products and the clothing industry is disaggregated into textiles and wearing apparel. Other sectors have been aggregated into a manageable number of groups, with manufacturing sectors grouped according to their primary factor intensities.

Table 2
Mean Changes in Selected Variables for the Chinese Economy, Base Simulation = 1992-2005[1]

Commodity	Change in Share of Real Value Added	Change in Exports		Change in Imports	
		%	Volume[2]	%	Volume[2]
Primary Agriculture (PAgr)	−17.6 (1.6)	413 (127)	22,495 (6,927)	78 (16)	2,854 (573)
Processed Foods (PFood)	−11.2 (2.7)	212 (85)	12,665 (5,057)	136 (22)	4,094 (659)
Natural Resources (NRes)	21.6 (3.6)	264 (76)	18,729 (5,386)	179 (26)	10,739 (1,530)
Textiles (Text)	6.6 (6.8)	127 (31)	9,309 (2,290)	210 (17)	24,318 (1,925)
Wearing Apparel (WApp)	10.6 (18.0)	207 (63)	30,267 (9,267)	51 (37)	411 (297)
Light Manufactures (LMnfc)	28.8 (16.7)	289 (101)	62,367 (21,809)	196 (12)	19,534 (1,225)
Transport, Machinery Equipment (TM&Eq)	38.2 (12.9)	216 (63)	33,734 (9,864)	231 (17)	90,640 (6,608)
Heavy Manufactures (HMnfc)	52.2 (15.0)	479 (197)	36,525 (14,989)	173 (28)	39,928 (6,428)
Utilities, Housing and Construction (UH&CS)	19.4 (0.3)	84 (1)	1 (0)	296 (10)	839 (28)
Other Services (Svces)	−12.0 (1.7)	−64 (17)	−8,279 (2,154)	549 (150)	31,200 (8,523)
Capital Goods (CGDS)	14.7 (0.5)	NA	NA	NA	NA
All Commodities	0	216	217,813	214	224,557

Note: 1. Standard deviation in parentheses
2. A The change in trade volume is measured in millions of US dollars, evaluated at the base period [1992] prices.

B. Systematic Sensitivity Analysis

For analysis of long term changes in trade patterns, such as these projections, Gehlhar [1994] also found that results were sensitive to values employed for Armington trade parameters. Furthermore, he found that increased values for Armington trade parameters enhanced the capacity of the model to project changes in trade shares. This is a logical result since Armington trade parameters exist primarily to reflect rigidities in actual trade flows. Over longer periods of time, such as the 13 year time span considered in this analysis, these rigidities should diminish. However, Gehlhar's work is only a single exercise. It remains unclear by how much one should increase the values for Armington trade parameters or even whether one should increase them at all. The standard values employed in the GTAP database are obtained from Zeitsch, *et al.*, [1991] who surveyed the econometric literature and performed some additional estimation for New Zealand imports.

Due to this lack of information concerning the appropriate point estimates for Armington trade parameters, we have opted to specify distributions for these parameters. Two trade parameters exist for each commodity. The first, σ_m governs substitutability between imports of commodity i from different sources. The second, σ_d, specifies the elasticity of substitution between aggregate imports of commodity i and domestic i. Here, we assume that the elasticity of substitution between aggregate imports of commodity i and domestically produced i, σ_d, is uniformly distributed over the interval $\gamma_d/2$ to $2\gamma_d$ where γ_d is the value for σ_d as specified in the GTAP database. Furthermore, we maintain the restriction that $2\sigma_d = \sigma_m$ which has been embedded in the GTAP parameter file, based on the work of Zeitsch, *et al.* ([1991], Table 3.7). Consequently, each commodity in the model is associated with one random exogenous parameter governing its overall price responsiveness in trade.

Since these parameters are random variables, the model results are also random variables. We employ advanced numerical integration techniques to obtain estimates of means and standard deviations of model results ⟨DeVuyst and Preckel [1996]; Arndt and Pearson [1996]; Arndt [1996]⟩. The presence of standard deviations allows us to determine systematically which model results are vulnerable to the assumed values for Armington trade parameters and which are robust to the postulated range of values.

C. Decomposition of Welfare Effects

There are four ways in which China's growth can affect other regions. They are: terms of trade effects, allocative efficiency effects, interaction effects between growth in China and endowment growth in other regions, and interaction effects between growth in China and technical change in other regions. We examine each in turn.

Terms of Trade Effects: The most obvious mechanism through which growth in China can affect welfare in other regions is through changes in the terms of trade. Those countries which are net exporters of capital goods are likely to benefit for the simple reason that the investment fueling rapid growth in China generates a surge in imports of investment goods. On the other hand, countries seeking to expand their exports of light manufactures and consumer goods are more likely to be adversely affected by rapid expansion of the Chinese economy since increased capacity to produce and export these goods tends to lower world prices. However, the expansion of Chinese domestic consumption as a result of increased incomes will raise demand worldwide, and this has the potential to improve the terms of trade for exporters of some consumer goods, fuels, and other intermediate goods and services.

Predictions of the likely change in the terms of trade for China's trading partners are complicated by rigidities in bilateral trade patterns, due to product differentiation ⟨*e.g.*, Feenstra [1994]⟩ and various institutional factors. Those countries with close export ties to China are more likely to gain than those countries exporting a small share of their goods to China. Similarly, countries sourcing a large share of imports from China are more likely to gain from Chinese growth (and hence lower prices for Chinese products), than are countries which do not import many of their goods from China. Finally, exporters who find themselves competing head-to-head with Chinese goods in third markets are likely to lose from this growth.

Sorting out these terms of trade effects can be difficult. Here, we adopt the approach of decomposing the change in the ratio of export to import prices, T, proposed by McDougall [1993], and reproduced in equations (1)-

(4). The impact of China's growth on the terms of trade can be decomposed into three separate effects: the world price effect, the export price effect, and the import price effect. The first term on the right hand side of the terms of trade decomposition (1) refers to the *world price effect*. As shown in (2), this equals the sum over all traded commodities of the product of a country's net trade share (the difference between export and import shares) for good i: $(S_{\varepsilon i} - S_{mi})$ and the percent change in the price of i, p_{wi}, relative to an index of average world prices $(p_{wi} - p_w)$.[2] Therefore if, on average, a country is a net exporter of goods for which faster growth in China means higher world prices, then it will benefit. This is very intuitive, and it appears to be what most economists have in mind when they assess the likelihood of an individual country gaining from China's growth.

$$\text{Terms of trade: } \Delta T = \sum_i \Delta T_{1i} + \sum_i \Delta T_{2i} - \sum_i \Delta T_{3i} \quad (1)$$

$$\text{World price effect: } \Delta T_{1i} = (S_{\varepsilon i} - S_{mi})^*(p_{wi} - p_w) \quad (2)$$

$$\text{Export price effect: } \Delta T_{2i} = S_{\varepsilon i}^*(p_{\varepsilon i} - p_{wi}) \quad (3)$$

$$\text{Import price effect: } \Delta T_{3i} = S_{mi}^*(p_{mi} - p_{wi}) \quad (4)$$

The second term in equation (1) refers to the *export price effect* associated with China's growth. As shown in equation (3), this equals the sum of export share-weighted, relative price changes, where the relative price in question is the ratio of the exporter's price for commodity i, relative to the worldwide average. In percentage change form, this is given by: $(p_{\varepsilon i} - p_{wi})$. The degree to which these two prices can diverge is a function of the extent of product differentiation in market i. For a homogeneous product this term will be zero. In contrast, for a commodity with a high degree of product differentiation across regions of origin, such as services, the divergence between prices received by different exporters can be significant.

The final term in equation 1 refers to the *import price effect* on the terms of trade. As seen in (4), this is the mirror image of the export price effect. Here we capture the import share-weighted change in the country-specific price index, relative to the average world price: $(p_{mi} - p_{wi})$. What is likely to

2. $S_{\varepsilon i}$ = (value of exports of i)/(total value of exports), and S_{mi} = (value of imports of i)/(total value of imports).

cause this to change? One of the most important factors will be the share of imports sourced from China. If this share is high, then rapid growth and lower prices in China will translate into cheaper imports (relative to the worldwide average), and hence an improvement in the terms of trade. (Note the negative sign on the last term in equation (1).)

Allocative Efficiency Effects: The second determinant of the impact that China's growth is likely to have on other countries is the allocative efficiency effect. This is less obvious to many analysts, as it hinges critically on second-best arguments. Figures 1*a* and 1*b* ⟨adapted from Loo and Tower [1989]⟩ offer a graphical exposition of this effect. Figure 1a portrays a small, open economy, with two sectors and one mobile factor of production–labor. The lines a-A^*, and b-B^* represent the marginal value product of labor (MVPL) in sectors A and B, evaluated at world prices. Their intersection identifies the optimal allocation of labor (L^*) between the two sectors. However, labor market equilibrium is determined by the intersection of the MVPL lines, *evaluated at producer prices*. This equilibrium lies at point e in this diagram, due to the presence of an *ad valorem* output tax on A, which drives a wedge between the price of A on the world market and returns to domestic producers. As a consequence, a so-called "Harberger triangle" appears in the figure, indicating the value (at world prices) of forgone output due to the excessive use of labor in sector B. At the margin, the magnitude of this distortion is denoted by τ, the difference in marginal value products of labor at world prices in the two sectors at the initial equilibrium, e. The presence of this distortion raises the possibility of second best effects when the economy is subjected to an external shock.

In this paper, the external shock to China's trading partners comes in the form of border price changes. Taking sector B's output as the numeraire, consider the effect of a rise in the relative price of good A, as depicted in Figure 1b. This shifts up sector A's MVPL schedule at world prices, and also at domestic producer prices assuming the distortion is *ad valorem* in nature. ⟨See Loo and Tower [1990] for an in-depth analysis of alternative policy regimes.⟩ Consequently, the allocation of labor shifts in favor of sector A, from e to e'. The resulting gain to this economy – the shaded area in Figure 1b – may be decomposed into two parts. The terms of trade component is given by the shaded area denoted TOT. It reflects the higher price received

Figure 1a
Excess Burden in a Two Sector Economy

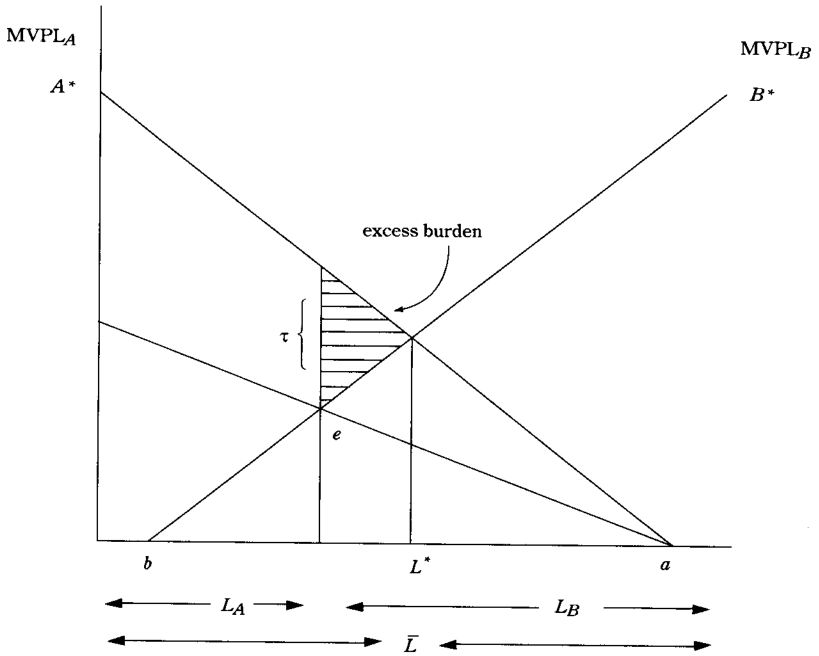
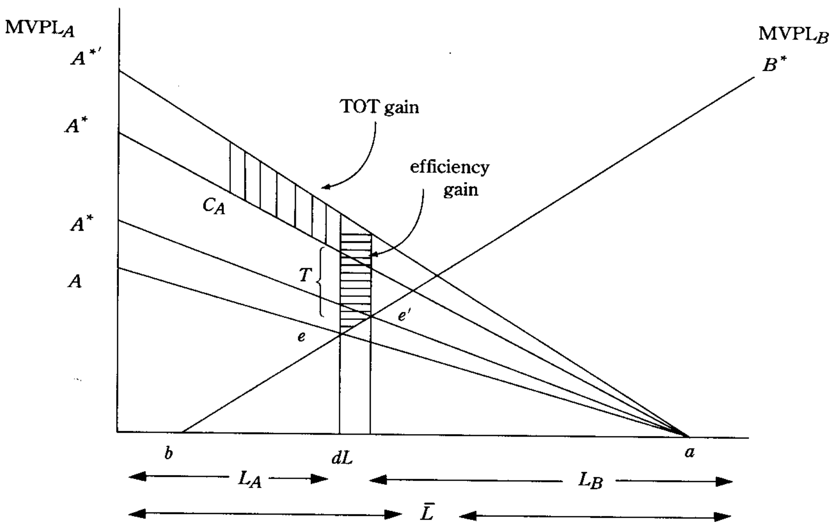


Figure 1b
Consequences of a World Price Rise for Good A



for initial exports, which is the difference between output and domestic consumption. [Consumption of A, in labor units, is denoted by C_A. Here, it is assumed that the income effect precisely offsets the substitution effect in consumption, so that C_A is unchanged.] In a higher dimensional example, with differentiated products, area TOT could be decomposed as outlined in equations (1) - (4).

The second part of the welfare change in Figure 1b, results from the reallocation of labor from sector B to sector A. In an undistorted economy, this would play no role. However, in Figure 1b, reallocation of one unit of labor from B to A generates an immediate gain equal to τ, as the marginal worker moves into the sector with the higher marginal value product at world prices. The reallocation of labor due to the price rise for A results in a gain equal to the area labeled "efficiency gain" in Figure 1b. The size of this area clearly depends on the size of the initial distortion, as well as the change in the associated quantity. Formal quantification of these individual allocative efficiency effects can be generalized to higher dimensions in a small, open economy, as shown by Keller [1980]. Implementation in a multiregion AGE model is more complex, but follows the same principles ⟨Huff and Hertel [1996]⟩.

Endowment Growth and Technical Change: If a region experiences growth in the stock of labor, capital, human capital, and land endowments or technical progress in the use of any of these factors, this leads to changes in aggregate welfare. These increases in the stock of endowments and TFP gains interact with the value of existing endowments to produce aggregate welfare gains. Consequently, a non-linear relationship exists between the (exogenously defined) level of increase in the endowment or rate of technical progress in its use, the value of the endowment, and the magnitude of the welfare shift. For example, if the rental rate on capital falls dramatically following an increase in the capital stock, the increment to the capital stock is a smaller contributor to welfare than would be the case, had the rental rate on capital remained unchanged.

Since China's growth or stagnation affects returns to endowments *in other regions*, endowment growth and technical progress in these other regions do not have the same impact on those regions' welfare in the "China grows" versus the "China stagnates" scenarios. For example, suppose that a rapidly growing China imports significantly more human capital intensive goods, such as aircraft, than a stagnant China. Compared to the stagnates scenario, growth in Chinese imports of human capital intensive goods drives up prices for these goods with a portion of this price increase reflected in increased returns to human capital itself. Since human capital is more valuable in the "grows" versus "stagnates" scenario, increases in the stock of human capital in the non-China regions (or technical progress with respect to human capital) contribute more to non-China welfare in the former case.

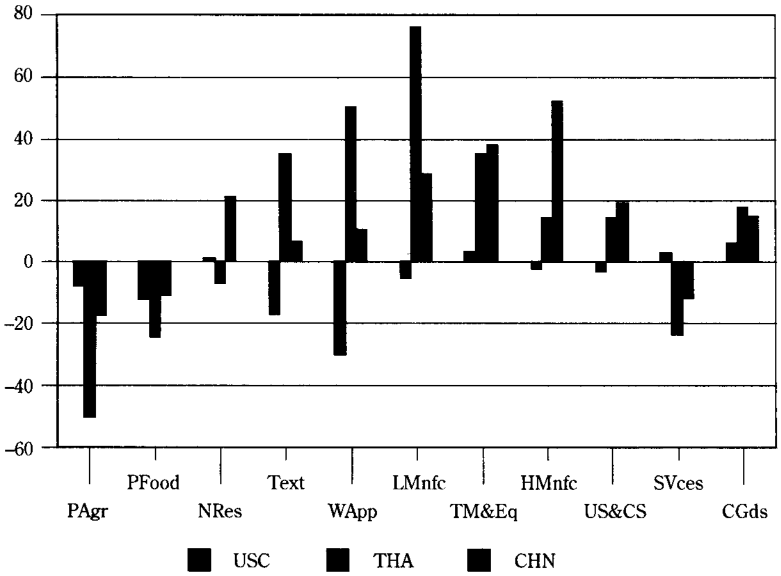
Assessing the relative roles of terms of trade effects, allocative efficiency effects, endowment effects, and technical change effects is a complex task. In this paper, we offer the first application of a multiregion, general equilibrium decomposition of welfare change ⟨Huff and Hertel [1996]⟩, in order to assess the relative magnitudes of the four effects listed above. In addition, the decompositions identify in detail the sources of change in welfare on the part of China's trading partners for each of the four effects.

III. Base Case Results

As explained in Section II, we utilize the exogenous projections of each region's endowment of agricultural land, physical capital, population, labor force, and GDP presented in Table 1 to simulate the world economy in 2005. Policy changes agreed to in the Uruguay Round are also incorporated into the projections. Results from the base case projections may be summarized in a number of different ways. One convenient method is to examine the change in composition of value-added (at constant prices) in each of the regions. As noted above, these structural changes are the combined result of demand side forces (differentials in income elasticities of demand) and supply side forces (differential endowment growth rates interacting with factor intensities). A complete listing of these changes is provided in appendix Table A2.

For purposes of discussion, we have chosen to highlight, in Figure 2, the mean change in composition of value-added for three regions. The first set of bars refers to the combined United States and Canada (USC) region. The most striking effect here is the reduction in the share of total, real value-added generated by the wearing apparel industry (WApp), which falls by

Figure 2
Change in Composition of Value Added: 1992 to 2005



30%. This is due to the combined effects of ongoing structural change and growth in import quotas under the Uruguay Round Agreement. Since wearing apparel is intensive in unskilled labor, it is expected to shrink in a region where physical and human capital is abundant, relative to other regions, and expanding in supply more rapidly, relative to labor. Furthermore, the Agreement on Textiles and Clothing provides for rapid acceleration of quota growth rates over this period. Similar, but less pronounced shifts are evident in textiles (Text) and light manufactures (LMnfc). Declines in the share of food and agricultural production are part of a continuing worldwide trend toward a smaller share of GDP claimed by these activities. As nations grow richer, their propensity to spend additional increments of income on food diminishes, thereby leading to a gradual decline in this sector's overall importance in the economy.

Of course, by construction, the *share* of economywide real value-added cannot decline for all sectors. By definition, reductions in one area must be offset by increases in others. A main area of increase for the USC region in this projection is the large, human capital-intensive, transport, machinery, and equipment (TM&Eq) sector. The share of total value-added generated by these activities is projected to increase by 3%. The share of services (Svces) activity is also projected to increase. This share is already very large; thus the potential for a significant percentage is quite limited. Finally, natural resources' (NRes) share of value-added increases as well (though the standard deviation presented in Appendix Table A1 indicates that the direction of change is sensitive to trade parameter values).

The second set of bars in Figure 2 shows the mean changes in composition of real value-added in Thailand over the 1992-2005 period. This is rather different from the US and Canada projections. Once again, wearing apparel stands out, but this time due to its large percentage increase. The light manufactures sector expands even more dramatically. These are labor intensive sectors in a labor abundant country. Also, the quotas imposed under the Multifiber Arrangement have constrained expansion of the textiles and wearing apparel sectors. Therefore, the Agreement on Textiles and Clothing presents a significant opportunity for expansion of wearing apparel production. To accommodate expanding sectors, resources are shifted out of rural, agricultural activities, as evidenced by the relative contraction of primary agriculture. This shift is further encouraged by the Uruguay Round Agreement in agriculture, which cuts average import tariffs on food into Thailand from 59.8% to 34.5% ⟨Hertel, *et al.* [1995], Table 1⟩.

The final set of bars in Figure 2 shows the mean change in composition of value-added in China over this projections period. (See also table 2, column 1.) Here the rural-urban shift is strongly evident, with light manufactures increasing its share in value-added by 29%, and heavy manufactures by 52%. Meanwhile, the large agricultural sector in China is projected to decline in relative importance by 18%, thereby releasing resources for increased manufacturing activity. This results in a very strong increase in Chinese exports, as shown in the second pair of columns of Table 2. Cumulative (13 year) increases are 289% for light manufactures exports and 479% for heavy manufactures (see Table 2). The third pair of columns in Table 2 show that Chinese imports also grow rapidly in the base case simulation, especially for textiles, transport machinery and equipment, and services. This leads us to the central question in this paper: How will China's trading partners be affected by this rapid growth? Clearly this will depend on where China's growing exports are shipped, and which countries supply the increase in imports required by this rapidly growing economy.

Regarding exports from China, the most striking figures are in light manufactures (LMnfc). High levels of current exports coupled with large percentage increases, result in significant volume changes. These are also reported in Table 2, where volumes are measured in millions of $US, calculated at base period [1992] prices. The majority of this increase in light manufactures exports is directed towards the USC and WEU markets ($20.9 and $18.8 billion, respectively).[3] Standard deviations on these two volume increases are also relatively large ($6.9 and $7.8 billion, respectively) indicating that Chinese penetration into these markets could be even larger for some values of the trade parameters. In light of the fact that many other developing countries are hoping to use North American and Western European markets as a springboard towards further industrialization, this projected increase raises some concerns about their growth prospects.

One possibility is that exporters displaced from the USC and WEU markets will find alternative export opportunities to China itself. Transportation, machinery, and equipment (TM&Eq) impacts dominate the import volume figures in Table 2. The strongest bilateral increases are for WEU, followed by Japan and USC (see appendix Table A6). Compared with these three developed regions, volume increases for Chinese imports from developing countries tend to be much more heavily weighted towards food, fiber, and natural resource-based products. Furthermore, the standard deviations on the volume of Chinese imports are relatively small. Thus, across a broad range of values for trade parameters, the flow of goods between China and the industrialized world (North America, Western Europe, and Japan) appears likely to increase substantially. This reinforces the fears of these countries that China's growth could have adverse consequences for other developing economies. However, without a rigorous analysis of this issue it is difficult to say who will gain and who will lose. The next section provides such an analysis.

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3. A complete set of mean, bilateral trade volume changes and standard deviations for China are reported in apendix tables A5 and A6.

IV. Assessing the Impact of China's Growth

The base case results discussed above involve a combination of all of the growth shocks listed in Table 1. How much of this is attributable to China's rapid growth, and how much is due to the growth (or lack thereof) on the part of her trading partners? In order to evaluate this we introduce an alternative experiment in which the Chinese economy *stagnates*. In particular, all endowments are assumed to grow at the same rate as population (12%), thereby eliminating growth in per capita GDP. Rates of growth for endowments and total factor productivity (TFP) in the other regions remain the same as in the base case. Gross domestic product in the non-China regions adjusts endogenously to the new global economic environment. *We then deduct the results in this alternative projection for 2005, from those in the base case, in order to isolate the effect of rapid growth in China on her trading partners.* Results from this scenario are presented in Tables 3-5.

A. Trade Effects

Appendix Table A7 reports the impact of China's growth (*i.e.*, base case minus stagnant case) on global trade by commodity. China's growth boosts trade in textiles (10.2%) and wearing apparel (8.8%) most. (These large increases occur despite the existence of quotas on exports to USC and WEU.) Next come light and heavy manufactures (5.9% and 5.8%), followed by transport, machinery, and equipment and services. The relatively small standard deviations shown in appendix Table A6 indicate that these trade volume changes are quite robust to uncertainty in the trade elasticities. However, our main goal in this paper is to calculate the *welfare effects* of China's growth – a topic to which we turn now.

B. Welfare Effects

The first two columns in Table 3 present the impact of China's rapid growth on per capita utility and aggregate welfare (equivalent variation) in the other regions identified in the model. (Note that in this table, figures in parentheses represent the ratio of mean to standard deviation). The most striking point is that *most regions gain from China's growth*. Indeed, only two

Table 3
The Change in Incremental Impact of China's Growth on Other Regions in 1992 $US Million

Region	% Change in Welfare	Aggregate Welfare Effect[1]	Contribution of TOT Effects	Contribution of Allocative Effects	Contribution of Endowment Effects	Contribution of Technical Progress	Residual Effect
USC	0.1	8,444 (6.4)[2]	4,485 (4.3)	2,030 (4.5)	2,068 (5.2)	–172 (2.0)	32
WEU	0.2	17,930 (5.7)	10,045 (4.8)	5,046 (5.2)	2,744 (5.2)	402 (4.0)	–307
JPN	0.2	10,890 (4.0)	7,901 (3.8)	1,480 (2.8)	1,788 (3.7)	206 (3.5)	–486
KOR	0.8	4,288 (2.8)	1,571 (3.3)	2,369 (2.3)	686 (1.9)	162 (2.3)	–500
TWN	0.6	2,278 (3.6)	1,480 (3.6)	33 (0.3)	664 (3.0)	216 (3.6)	–115
HKG	7.1	7,492 (5.8)	5,448 (5.6)	–47 (1.9)	1,851 (6.6)	502 (5.9)	–263
IDN	0.1	247 (0.7)	263 (1.3)	42 (0.5)	–21 (0.2)	18 (0.6)	–55
MYS	1.1	1,616 (2.7)	282 (1.8)	1,051 (2.2)	336 (2.6)	34 (3.6)	–87
PHL	0.2	164 (2.8)	124 (3.8)	–15 (0.7)	59 (3.5)	–2 (0.9)	–2
THA	–0.2	–496 (0.4)	–212 (0.5)	140 (0.3)	–368 (0.9)	–17 (1.1)	–38
LTN	0.1	1,311 (3.7)	450 (2.1)	627 (3.1)	297 (3.3)	10 (0.6)	–74
SSA	0.1	396 (2.9)	218 (2.2)	107 (2.5)	60 (3.7)	19 (1.5)	–9
SAS	–0.0	–216 (1.4)	–35 (0.3)	–56 (0.8)	–40 (0.8)	–48 (2.3)	–37
ROW	0.3	8,420 (6.6)	4,840 (5.0)	2,085 (5.9)	1,912 (6.0)	–266 (3.8)	–151
Total	Na	62,764	36,862	14,892	12,035	1,066	–2,091

Notes: 1. Equivalent variation.
2. Parenthetic numbers in ***this table*** represent the ratio of mean to standard deviation.

regions are expected to lose. They are Thailand and South Asia (THA and SAS). Furthermore, for the regions expecting a welfare gain, only one, Indonesia, lies within two standard deviations of a welfare loss. The overall gain to China's trading partners totals $62,764 million, or about 10% of global welfare gains (the remaining 90% accrues to China). The greatest absolute gains are realized by the largest economies, namely Western Europe, Japan, and the US & Canada. However, in percentage terms (the first column of the table), the largest gains accrue to Hong Kong (7.1%), followed by Malaysia, Korea, and Taiwan.

The remaining columns of Table 3 decompose these regional welfare gains into the four components discussed earlier.[4] The terms of trade effect evaluates the impact of changing world prices on the welfare of each region, *conditional on the current allocation of resources in that region.* The terms of trade effect is positive for most regions excepting those regions which suffer an overall welfare loss, Thailand and South Asia. Also, for Thailand, the TOT effect is highly variable with a standard deviation of $402 million, which is almost as large as the aggregate welfare loss of $496 million. For the remaining regions, the ratio of mean to standard deviation for the terms of trade effects reveals that, with the exception of Indonesia, most regions can confidently expect terms of trade gains (using a threshold of two standard deviations). The gains to non-China regions owing to the terms of trade effects amount to $36,862 million, or about 58% of the total welfare gain.

Allocative efficiency effects, *i.e.* changes in the efficiency of resource use in these regions, also contribute significantly to the aggregate welfare effect. Here, the impacts are less definitive. In six instances, the mean effect lies less than two standard deviations from zero. Among this group of six, three negative signs indicate a possible decrease in efficiency in Hong Kong, the Philippines, and South Asia. For five of these six regions, this effect is negligible. However, in Thailand, the allocative efficiency effect is highly variable (standard deviation $US 487 million) and potentially a significant contributor to aggregate welfare change.

The next column of Table 3 reports the effects of interactions between

4. An exhaustive derivation of the decomposition equations used in this paper is proved in Huff and Hertel [1996].

endowment growth in other regions, on the one hand, and China's growth, on the other. Since China's growth or stagnation affects world prices, the contribution of an increment to endowments is not the same in the China grows versus the China stagnates scenario. For most regions, endowment growth contributes significantly more to aggregate welfare in the "grows" versus the "stagnates" scenarios. This occurs because China's growth tends to lead to an appreciation in factor prices in other regions. Only Indonesia, Thailand, and South Asia benefit more from endowment growth in the stagnates versus the grows scenario. Not coincidentally, these are the same regions which experience negative or uncertain terms of trade effects.

The final two columns in Table 3 report the impacts of interactions between technical change in other regions and China's growth as well as a residual term. The decomposition of welfare into the four preceding effects fails to capture the impact of capital depreciation as well as an adjustment due to non-homotheticity of preferences [see Huff and Hertel [1996] for more details] These impacts are included in the residual column. Both the impacts of technical change and the residual are quite small in relative terms and will not be discussed further.

The three main effects, terms of trade, allocative efficiency, and endowment growth are all important. In fact, each of the effects is the most important effect (largest absolute value) for at least one region. The terms of trade and welfare decompositions mentioned earlier permit one to trace, in detail, the origins of these welfare figures. The decompositions enhance transparency of model results. To illustrate the decompositions, we investigate in more detail selected terms of trade and allocative efficiency results from Table 3.

C. Terms of Trade Decomposition

Recall from equations (1)-(4) that the change in a region's terms of trade may be decomposed into three distinct parts: that portion owing to the interaction of net trade shares with average world price changes, and the two increments owing to changes in region-specific export and import prices. Table 4 presents this decomposition for all regions. From the first column in this table, we see that the average world price effect of China's growth is beneficial for the wealthier regions. In particular, United States and Canada, Western Europe, Japan, and ROW (ROW trade is dominated by Australia and New Zealand) all gain from the world price changes induced by China's growth. This result stands in sharp contrast to the effect on the lower and middle-income countries, all of which show a negative sign in this column of Table 4. Furthermore, the world price effect is significant, using the two standard deviation threshold, for all lower and middle-income countries excepting Hong Kong. Therefore, if we assumed that all goods were homogeneous (only one price), then we would conclude that China's growth is indeed detrimental to other developing countries' terms of trade. The world price effect may be further decomposed by examining the individual components of this expression, as suggested by equation (2). (Appendix Table A11 presents this decomposition of the world price effect of China's growth on Thailand.)

Since products are in fact differentiated by source (not homogeneous), total terms of trade changes also depend upon destinations for exports and sourcing of imports (recall equation (3)). The second column denotes the *export price effect's* contribution to the total terms of trade change. This effect is positive and significant for all non-China regions except Thailand. Further, the standard deviation on the export price effect in Thailand indicates that this effect is positive for many parameter values. The sign on the export price effect indicates that, for most regions, export prices rise, relative to the world average. How can this be? Owing to very rapid growth in China, the average export price for Chinese products is about 12% lower in 2005 under the base case than under the China stagnates scenario. Relatively speaking, all other regions' export prices are, therefore, enhanced. The strongest export price effects are felt by Taiwan and Hong Kong, which are the two countries most closely tied to China. Rapid growth in China translates strongly into increased demand for products supplied by these two regions.

The *import price effect* (recall equation (4)) associated with China's rapid growth over the period 1992-2005 is given in the third column of Table 4. Here, again, Hong Kong stands out, this time due to the fact that it sources a very large share of its imports from China. Therefore, lower Chinese export prices, relative to other regions' prices, translate into lower import prices for Hong Kong, relative to the worldwide average. Impacts on

Table 4
Decomposition of the Regional TOT Changes
(Percent Change in Index)

	Different Components of TOT			
	World Price Effect	Export Price Effect	(Import Price Effect)	Total Effect
USC	0.052 (0.021)	0.395 (0.099)	–0.104 (0.021)	0.342 (0.082)
WEU	0.111 (0.018)	0.587 (0.123)	–0.225 (0.031)	0.473 (0.104)
JPN	0.020 (0.030)	0.427 (0.117)	0.171 (0.029)	0.619 (0.166)
KOR	–0.229 (0.037)	0.533 (0.133)	0.254 (0.048)	0.558 (0.190)
TWN	–0.400 (0.051)	1.285 (0.239)	–0.016 (0.017)	0.863 (0.238)
HKG	–0.119 (0.069)	2.315 (0.615)	4.047 (0.614)	6.510 (1.153)
CHN	–0.436 (0.182)	–11.917 (2.100)	–0.474 (0.072)	–12.715 (2.073)
IDN	–0.286 (0.062)	0.564 (0.178)	0.000 (0.007)	0.276 (0.215)
MYS	–0.155 (0.049)	0.334 (0.107)	0.105 (0.034)	0.284 (0.130)
PHL	–0.121 (0.051)	0.611 (0.107)	–0.075 (0.035)	0.414 (0.108)
THA	–0.309 (0.069)	–0.016 (0.279)	0.125 (0.017)	–0.201 (0.315)
LTN	–0.133 (0.048)	0.420 (0.101)	–0.156 (0.032)	0.131 (0.058)
SSA	–0.235 (0.103)	0.478 (0.109)	–0.019 (0.022)	0.222 (0.092)
SAS	–0.385 (0.058)	0.318 (0.093)	0.037 (0.010)	–0.032 (0.100)
ROW	0.021 (0.047)	0.492 (0.095)	0.071 (0.010)	0.584 (0.113)

remaining regions are diverse with half experiencing positive and half experiencing negative import price effects. These effects are relatively consistent in sign across trade parameters. The mean import price effect lies within two standard deviations of zero for only three regions: Taiwan, Indonesia, and Sub-Saharan Africa.

The last column in Table 4 reports the total terms of trade effect. It is clear from these entries that Hong Kong is far and away the largest beneficiary of rapid growth in China.[5] This gain accrues primarily through the export and import price effects due to Hong Kong's close trading relationship with China. Hong Kong is followed by Taiwan, Japan, ROW, Korea, and Western Europe. The remaining less affluent countries tend to benefit to a much smaller degree. The direction of terms of trade impacts in Indonesia, Thailand, and South Asia appears to be dependent on trade parameter values.

D. Allocative Efficiency Effects

Appendix Table A12 provides a decomposition of the allocative efficiency effects, by commodity, for each region. Recall that these changes in efficiency are the product of distortions in individual markets τ in Figures 1a and 1b) and changes in the quantity of each commodity transacted under that tax/subsidy (dL in Figure 1b). Thus, for example, with relatively high tariffs on light manufacturing imports into United States and Canada, increased purchases from China result in an improved allocation of resources. Indeed, the total efficiency gains associated with light manufactures in the USC equal $1100 million, which is about 55% of the allocative efficiency gain for the United States and Canada region as a whole.

For Thailand, Table 3 showed that allocative efficiency effects are highly variable relative to the aggregate welfare loss. Both the strong allocative gains in United States and Canada as well as the high variability in allocative effects in Thailand offer evidence of significant interactions between post-Uruguay Round distortions and quantity responses to China's growth. In

5. This result occurs despite the fact that the version 3 GTAP data set used in this analysis places all of Hong Kong's reexport trade on a direct basis. Thus countries trading with China, via Hong Kong, but using the latter solely as an intermediary, are viewed in the model as trading directly with China.

order to illustrate a further decomposition of these efficiency effects, we provide in Table 5 a more detailed breakdown of import-related allocative efficiency effects in Thailand, (see also Appendix Tables A8-A10).

Table 5 shows the decomposition of allocative efficiency effects, by commodity, with respect to import taxation for Thailand. The bulk of the import allocation losses arise in the textile sector. Mean import volume declines by $760 million as a result of China's growth (column 2 of Table 5). Column 3

Table 5
Decomposition of Import Tax Portion of Allocative Efficiency Component of Welfare in Thailand[1]

Sector	Contribution To Welfare (millions of $US 1992)	Change in Imports (volume in $ mill.)	Tariff Equivalent (Post UR level in %)
Primary Agriculture (PAgr)	387 (354)	15 (169)	58
Processed Food (Pfood)	29 (47)	187 (180)	18
Natural Resources (NRes)	–8 (18)	–121 (98)	18
Textiles (Text)	–308 (201)	–760 (515)	29
Wearing Apparel (WApp)	6 (2)	19 (9)	29
Light Manufactures (LMnfc)	–2 (5)	–90 (52)	25
Transport, Machinery & Equipment (TM&Eq)	–16 (39)	–190 (97)	30
Heavy Manufactures (HMnfc)	–43 (35)	211 (123)	24
Utilities, Housing, and Construction (UH&CS)	0 (0)	0 (0)	0
Other Services (Svces)	0 (0)	–406 (382)	0
Total	46	NA	NA

Note: 1. Standard deviations in parentheses of Table 5 shows that the bilateral trade-weighted, *average*, post-Uruguay Round tariff equivalent on imports is 29%. This tariff on textiles restricts volume of textiles imports. As shown in the preceding column, an emergent China has the effect of reducing imports of textiles still further. This reduction in imports occurs even though world prices for textiles decline as a result of China's growth (see appendix Table A7). The behavior of the wearing apparel industry helps to explain the contraction in imports of textiles. Competition from China in wearing apparel causes Thailand's production of wearing apparel to decline (-14%). Since textiles are major intermediate inputs into wearing apparel production, imports of textiles and domestic production of textiles decline by 11% and 6% respectively. Thus, China's growth causes the share of imported textiles in total use to decline despite the decline in world prices. This interaction of China's growth with the existing tariff distortion produces an allocative efficiency loss. However, this loss is uncertain, due to the fact that the decline in textile import volumes is highly variable (standard deviation $515 million).

V. Summary and Conclusions

If China continues to grow at the rate projected by the World Bank, it will be three times as large in 2005 as it was in 1992. If this growth continues for another decade beyond that, China may become the world's largest economy. This paper has evaluated the likely impacts of this rapid growth on other regions. We isolate the impact of China's growth on its trading partners by examining the difference between two scenarios: one which follows the World Bank's macroeconomic forecasts for the period 1992-2005, and an alternative scenario in which China stagnates (while all other regional growth rates are unchanged). Due to the importance of trade elasticities and a lack of information concerning appropriate values, we assume a uniform distribution for these parameter values in each scenario. When exogenous inputs into the model, such as trade parameters, are random variables, then model results are also random variables. We employ advanced techniques in numerical integration to estimate means and standard deviations of model results. We also employ a recently developed welfare decomposition procedure which permits detailed explanation of the sources of welfare gains and losses.

We find that if one simply looks at net trade positions, and the likely changes in world prices, China's growth has an adverse effect on non-OECD countries. This confirms fears of those who see China's growth coming at the expense of other developing countries. However, when one looks at the entire set of effects, including changes in region-specific export and import price indices, allocative, and endowment effects, China's growth can be expected to benefit 12 of the 14 other regions. Furthermore, the gains in 11 of the 12 benefiting regions are robust to a wide distribution for trade parameter values. In contrast, the expectation of welfare losses in two regions is found to be dependent on values employed for trade parameters.

When China grows at projected levels as opposed to stagnating, we find that world trade is 4.8% higher. Chinese exports of textiles, wearing apparel, and light manufactures exhibit large increases. As a result, world prices for these commodities are driven down. In contrast, world prices for products which China tends to import such as natural resources; transport, machinery, and equipment; and services are relatively higher in 2005 when China grows. Due to product differentiation, however, the prices of Chinese exports decline significantly, relative to products from other regions. This results in a substantial terms of trade gain for most other countries. The net effect is that all regions except Thailand and South Asia show a mean terms of trade improvement resulting from Chinese growth. Standard deviations on terms of trade effects indicate that these predictions are robust to a wide range of trade parameters for nearly all benefiting regions.

Terms of trade losses in Thailand and South Asia, as a consequence of China's growth, stem from strong negative correlations between their net trade positions and changes in average world prices. This is hardly surprising given the similarity in trade profiles between these regions and China. What is perhaps more surprising is the important role played by allocative efficiency effects in determining non-China welfare changes. In most regions, further growth in China generates more trade, which in turn creates secondary benefits due to the tendency of countries to tax traded goods more heavily, relative to their domestic counterparts. Finally, even though endowment growth rates are the same between the two scenarios, because China's emergence tends to boost factor prices in other regions, this in turn increases the contribution of non-Chinese endowment growth to welfare over the 1992-2005 period. These three effects proved to be important determinants of welfare in most regions. In fact, each of the effects is the most important effect (largest absolute value) for at least one region. Thus highlighting the importance of the welfare decomposition approach used in this paper.

In closing, we must note a key limitation of the present study. We have not been able to take account of the impact which China's growth has on international capital markets. There are two dimensions to this problem. First of all, by increasing the demands on global capital markets, China's growth is expected to benefit net creditor regions and hurt net debtor regions. This effect could be captured in a model which accounted for international capital mobility. A second dimension of this problem relates to the impact of China's growth on each region's specific portfolio of investments. Those regions which are heavily involved in the Chinese economy (e.g., Taiwan) obviously stand to gain more from its growth. However, assessment of this effect will have to await availability of an international data base on bilateral factor ownership comparable to the bilateral trade data base used in this study.

Appendix Table A1
Commodity Aggregation

Aggregate Groups	Original GTAP Industries
1. Primary Agriculture (PAgr)	Paddy Rice, Wheat, Grains (other than wheat & rice), Non-Grain Crops, Wool, and Other Livestock Products
2. Processed Food (PFood)	Fisheries, Processed Rice, Meat Products Milk Products, Other Food Products Beverages & Tobacco
3. Natural Resource Based Industries (NRes)	Forestry Coal, Oil, Gas Petroleum & Coal Products Non Metallic Minerals, Other Minerals
4. Textiles (Text)	Textiles
5. Wearing Apparel (WApp)	Wearing Apparel
6. Light Manufactures (LMnfc)	Leather Industries Lumber, Pulp, Paper, etc. Fabricated Metal Products Other Manufacturing
7. Transportation, Machinery & Equipment (TM&Eq)	Transport Industries Machinery & Equipment
8. Heavy Manufactures (HMnfc)	Chemicals, Rubber, & Plastic Primary Ferrous Metals, Nonferrous Metals
9. Utilities, Housing & Construction Services (UH&CS)	Electricity, Gas, & Water Construction Ownership of Dwellings
10. Other Services (Svces)	Trade & Transport Other Services (Private and Government)

Appendix Table A2
Mean Percentage Change in the Composition of Value Added[1] (Base Simulation = 1992-2005)

	USC	WEU	JPN	KOR	TWN	HKG	CHN	IDN	MYS	PHL	THA	LTN	SSA	SAS	ROW
PAgr	–8.3 (1.0)	–22.8 (2.0)	–22.1 (2.6)	–41.6 (3.6)	–24.2 (1.4)	–30.9 (1.4)	–17.6 (1.6)	–31.4 (1.3)	–50.0 (3.9)	–32.9 (6.3)	–50.4 (2.9)	–11.2 (0.3)	8.2 (2.6)	–13.9 (0.4)	–10.7 (1.4)
PFood	–12.4 (0.8)	–20.5 (2.0)	–16.2 (1.3)	–19.8 (2.8)	–16.7 (2.0)	300.2 (187.7)	–11.2 (2.7)	–24.1 (0.9)	18.0 (27.2)	3.4 (6.4)	–24.7 (8.8)	–9.4 (0.8)	6.2 (2.5)	2.9 (5.7)	–11.3 (2.3)
NRes	0.8 (0.7)	–1.6 (0.3)	10.9 (2.4)	5.8 (1.2)	16.4 (1.6)	47.6 (7.2)	21.6 (3.6)	–11.2 (1.9)	–25.9 (4.3)	–2.1 (2.2)	–7.1 (3.9)	0.2 (0.4)	–10.1 (1.2)	7.0 (1.1)	–13.9 (2.7)
Text	–17.3 (1.5)	–19.3 (2.2)	–13.8 (4.1)	29.5 (14.6)	18.9 (6.2)	–7.9 (4.1)	6.6 (6.8)	6.3 (5.5)	–14.9 (4.4)	10.4 (4.7)	35.4 (18.6)	–4.3 (2.2)	1.9 (2.4)	–3.6 (1.0)	–17.5 (6.3)
WApp	–30.4 (2.8)	–31.7 (3.6)	–25.1 (8.4)	–20.2 (2.2)	–26.7 (1.3)	–39.3 (4.7)	10.6 (18.0)	28.1 (12.7)	–11.8 (3.3)	35.9 (3.9)	50.5 (37.9)	–4.0 (4.6)	13.7 (15.5)	9.7 (1.0)	–18.2 (9.6)
LMnfc	–5.7 (2.0)	–9.6 (3.0)	0.2 (0.9)	10.7 (7.1)	16.2 (8.6)	26.0 (8.2)	28.8 (16.7)	21.6 (10.6)	4.6 (12.5)	3.2 (5.8)	76.2 (39.3)	0.0 (0.4)	–2.5 (1.3)	14.7 (5.1)	–3.8 (2.8)
TM&Eq	3.1 (1.2)	11.0 (1.9)	0.2 (1.5)	4.3 (5.4)	–4.4 (6.1)	–26.8 (11.2)	38.2 (12.9)	29.1 (12.1)	8.8 (16.3)	0.6 (8.3)	35.4 (24.5)	–8.7 (2.6)	–23.3 (5.7)	–5.8 (2.7)	2.5 (4.6)
HMnfc	–2.7 (1.2)	–7.6 (2.8)	2.4 (0.7)	28.6 (8.4)	38.5 (10.1)	39.5 (7.8)	52.2 (15.0)	23.7 (8.8)	33.2 (22.0)	4.7 (3.6)	14.3 (7.8)	0.5 (0.6)	–2.7 (1.8)	3.9 (1.7)	–5.2 (4.1)
UH&CS	–3.4 (0.0)	–9.4 (0.0)	3.1 (0.1)	13.0 (0.6)	19.1 (0.3)	24.2 (0.2)	19.4 (0.3)	–0.1 (0.2)	2.6 (2.0)	–0.6 (1.0)	14.5 (1.3)	–3.2 (0.0)	–9.1 (0.1)	–2.0 (0.1)	0.0 (0.1)
Svces	2.7 (0.1)	7.4 (0.2)	0.6 (0.1)	–6.0 (0.7)	–8.4 (1.0)	1.8 (1.6)	–12.0 (1.7)	20.0 (2.2)	9.0 (4.9)	2.7 (1.7)	–2.7 (1.3)	5.6 (0.2)	5.2 (0.4)	9.3 (0.6)	8.1 (0.6)
CGDS	6.3 (0.1)	–6.7 (0.1)	6.9 (0.1)	17.9 (0.9)	29.7 (0.2)	41.3 (0.4)	14.7 (0.5)	–1.8 (0.3)	2.5 (2.3)	1.4 (1.4)	17.8 (1.5)	–4.7 (0.1)	–22.9 (0.0)	–7.0 (0.0)	4.3 (0.1)

Note: 1. Standard deviation in parentheses.

Appendix Table A3
Mean Percentage Change in Regional Exports for Selected Commodities[1]
(Base Simulation = 1992-2005)

	USC	WEU	JPN	KOR	TWN	HKG	IDN	MYS	PHL	THA	LTN	SSA	SAS	ROW
PAgr	131 (43)	95 (37)	188 (62)	1162 (376)	295 (66)	98 (13)	519 (159)	1920 (647)	-74 (25)	2254 (1068)	167 (52)	87 (26)	150 (28)	226 (73)
PFood	198 (85)	279 (137)	122 (48)	105 (40)	198 (56)	138 (39)	180 (69)	890 (287)	179 (73)	1459 (847)	259 (111)	247 (90)	113 (37)	268 (109)
NRes	179 (64)	222 (84)	202 (58)	524 (130)	335 (66)	301 (59)	503 (135)	596 (154)	339 (95)	645 (152)	209 (70)	244 (85)	325 (83)	264 (90)
Text	50 (0)	69 (0)	131 (46)	217 (42)	199 (31)	61 (13)	157 (14)	236 (37)	170 (20)	428 (119)	219 (75)	193 (54)	154 (26)	229 (90)
WApp	60 (0)	53 (0)	364 (146)	414 (110)	427 (110)	238 (70)	421 (91)	267 (51)	253 (54)	1101 (565)	503 (194)	174 (33)	191 (39)	372 (124)
LMnfc	239 (79)	363 (150)	239 (78)	572 (198)	360 (95)	227 (40)	394 (105)	539 (141)	282 (79)	625 (212)	310 (108)	318 (112)	280 (70)	320 (123)
TM&Eq	197 (74)	157 (66)	189 (65)	417 (129)	328 (91)	249 (46)	283 (82)	431 (137)	225 (71)	495 (150)	190 (71)	173 (67)	114 (36)	158 (62)
HMnfc	443 (211)	541 (279)	402 (172)	746 (300)	498 (163)	348 (79)	569 (184)	685 (227)	379 (134)	745 (220)	489 (227)	502 (231)	421 (140)	452 (210)

Note: 1. Standard deviations in parentheses.

Appendix Table A4
Mean Percentage Change in Regional Imports for Selected Commodities[1]
(Base Simulation = 1992-2005)

	USC	WEU	JPN	KOR	TWN	HKG	IDN	MYS	PHL	THA	LTN	SSA	SAS	ROW
PAgr	70 (25)	−39 (30)	240 (74)	502 (334)	72 (12)	142 (18)	18 (12)	110 (76)	488 (365)	−41 (9)	126 (19)	391 (95)	224 (34)	88 (21)
PFood	36 (39)	−3 (39)	124 (30)	390 (128)	93 (34)	999 (413)	90 (40)	437 (150)	316 (96)	188 (72)	65 (38)	100 (35)	195 (23)	36 (38)
NRes	279 (37)	246 (39)	400 (59)	226 (16)	374 (22)	437 (61)	173 (23)	149 (24)	164 (33)	143 (39)	254 (33)	163 (34)	254 (26)	103 (30)
Text	47 (0)	18 (0)	79 (44)	387 (56)	267 (19)	219 (28)	275 (24)	221 (22)	261 (27)	603 (166)	82 (43)	125 (38)	182 (27)	56 (45)
WApp	−7 (0)	−38 (0)	16 (49)	311 (35)	170 (33)	40 (46)	538 (135)	441 (103)	399 (80)	1442 (609)	46 (50)	87 (55)	292 (47)	9 (49)
LMnfc	105 (32)	60 (38)	124 (32)	273 (16)	262 (11)	293 (32)	308 (28)	260 (33)	169 (26)	697 (178)	151 (24)	118 (32)	298 (27)	95 (37)
TM&Eq	233 (21)	328 (31)	166 (22)	366 (30)	243 (19)	120 (41)	507 (93)	468 (63)	248 (28)	625 (137)	208 (24)	121 (44)	415 (67)	221 (35)
HMnfc	111 (44)	83 (46)	150 (40)	438 (48)	380 (27)	219 (27)	312 (17)	375 (58)	193 (31)	276 (28)	142 (40)	125 (42)	274 (16)	91 (46)

Note: 1. Standard deviations in parentheses

Appendix Table A5
Mean Change in the Volume of Chinese Bilateral Exports,[1] by Destination[2]
(Base Simulation: 1992-2005)

Commodity	USC	WEU	JPN	KOR	TWN	HKG	IDN	MYS	PHL	THA	LTN	SSA	SAS	ROW
Pagr	270	768	2184	8107	301	862	697	4476	−10	2612	81	78	155	1912
	(90)	(301)	(714)	(2624)	(68)	(111)	(214)	(1509)	(3)	(1238)	(25)	(23)	(29)	(614)
Pfood	1043	1744	2142	190	320	1236	71	411	69	1214	167	270	75	3714
	(449)	(855)	(845)	(73)	(91)	(347)	(27)	(133)	(28)	(704)	(72)	(98)	(25)	(1508)
Nres	1583	1156	5098	3336	486	1759	173	220	195	582	172	119	292	3561
	(568)	(438)	(1476)	(829)	(96)	(345)	(47)	(57)	(55)	(137)	(57)	(42)	(74)	(1209)
Text	329	552	1187	945	177	1315	69	165	140	404	579	501	236	3031
	(0)	(0)	(419)	(183)	(28)	(276)	(6)	(26)	(16)	(112)	(198)	(140)	(40)	(1192)
Wapp	1574	1558	13527	403	373	4567	31	40	31	62	3454	249	18	8731
	(0)	(0)	(5411)	(107)	(97)	(1338)	(7)	(8)	(7)	(32)	(1330)	(47)	(4)	(2907)
LMnfc	20947	18841	4701	1324	1006	3458	321	481	209	564	2002	960	301	7251
	(6911)	(7768)	(1547)	(457)	(267)	(617)	(85)	(126)	(59)	(191)	(697)	(338)	(76)	(2793)
TM&Eq	5338	3198	1698	1016	1458	12964	477	777	219	1188	1138	675	575	3011
	(2017)	(1349)	(579)	(313)	(405)	(2402)	(139)	(247)	(69)	(359)	(426)	(261)	(180)	(1192)
HMnfc	4473	7173	4225	3300	1231	4639	823	799	193	2490	718	432	841	5149
	(2126)	(3702)	(1804)	(1325)	(402)	(1055)	(266)	(265)	(68)	(735)	(334)	(199)	(281)	(2389)

Notes: 1. One unit of volume equals $1 million worth of product in 1992.
2. Standard deviations in parentheses.

Appendix Table A6
Mean Change in the Volume of Chinese Bilateral Imports,[1] by Source[2]
(Base Simulation: 1992-2005)

Commodity	USC	WEU	JPN	KOR	TWN	HKG	IDN	MYS	PHL	THA	LTN	SSA	SAS	ROW
PAgr	1196 (419)	-229 (177)	57 (17)	101 (68)	30 (5)	10 (1)	9 (6)	81 (56)	47 (35)	-63 (13)	106 (16)	297 (72)	125 (19)	687 (161)
PFood	115 (124)	-12 (170)	157 (38)	97 (32)	46 (17)	1537 (635)	35 (15)	741 (255)	59 (18)	218 (84)	418 (240)	72 (25)	50 (6)	148 (157)
NRes	1589 (209)	531 (84)	1391 (205)	198 (14)	241 (14)	151 (21)	1249 (168)	319 (52)	88 (18)	25 (7)	509 (67)	228 (47)	311 (32)	2526 (743)
Text	230 (0)	115 (0)	1521 (850)	6207 (903)	7539 (530)	2139 (275)	294 (26)	124 (12)	33 (3)	663 (182)	127 (67)	21 (6)	510 (75)	185 (149)
WApp	-1 (0)	-38 (0)	15 (46)	49 (6)	51 (10)	162 (187)	9 (2)	8 (2)	10 (2)	90 (38)	0 (0)	7 (4)	13 (2)	2 (12)
LMnfc	1139 (347)	590 (376)	1772 (459)	1547 (91)	3693 (153)	4556 (496)	2176 (198)	479 (61)	17 (3)	453 (116)	192 (31)	36 (10)	138 (12)	364 (141)
TM&Eq	12853 (1158)	28713 (2723)	17524 (2327)	2688 (221)	8304 (650)	3725 (1260)	111 (20)	1205 (162)	139 (15)	995 (219)	104 (12)	108 (39)	110 (18)	6489 (1022)
HMnfc	3270 (1309)	2874 (1613)	6600 (1746)	7224 (787)	6776 (487)	2586 (315)	286 (16)	378 (58)	198 (32)	294 (30)	1072 (301)	170 (57)	190 (11)	3431 (1743)

Notes: 1. One unit of volume equals $1 million worth of product in 1992.
2. Standard deviations in parentheses

Appendix Table A7
Impact of China's Growth on Global Trade and Prices: Mean Trade Volumes Measured at Constant World Prices[1]

Trade Volume					
	By Region			By Commodity	
	Exports	Imports		Imports	Prices
USC	1.2 (0.2)	1.0 (0.2)	Pagr	2.6 (0.4)	–1.76 (0.36)
WEU	1.3 (0.2)	1.0 (0.2)	PFood	3.1 (0.7)	–0.40 (0.10)
JPN	3.9 (0.5)	3.2 (0.6)	NRes	2.2 (0.1)	0.10 (0.06)
KOR	2.2 (0.3)	1.3 (0.3)	Text	10.2 (0.8)	–0.63 (0.06)
TWN	2.3 (0.2)	2.5 (0.4)	WApp	8.8 (2.7)	–0.54 (0.11)
HKG	6.3 (1.6)	10.7 (1.2)	LMnfc	5.9 (0.8)	–0.18 (0.09)
CHN	140.2 (9.5)	148.5 (8.2)	TM&Eq	4.6 (0.5)	0.21 (0.08)
IDN	–0.2 (0.4)	–0.4 (0.5)	HMnfc	5.8 (0.7)	–0.50 (0.09)
MYS	0.9 (0.3)	0.5 (0.2)	UH&CS	4.5 (0.2)	0.20 (0.07)
PHL	–0.1 (0.2)	0.0 (0.2)	Svces	4.7 (0.7)	0.88 (0.09)
THA	0.1 (0.8)	–0.8 (0.8)			
LTN	0.9 (0.2)	0.5 (0.2)			
SSA	0.6 (0.1)	0.7 (0.2)			
SAS	0.4 (0.1)	–0.2 (0.2)			
ROW	1.4 (0.2)	1.5 (0.2)			
World	4.8 (0.3)	4.8 (0.3)			

Note: 1. Standard deviation in parentheses

Appendix Table A8
Decomposition of Allocative Efficiency Effect of China's Growth on Thailand[1]

Tax Instrument	Contribution to Welfare (millions of $US 1992)
Output taxes	31 (67)
Input taxes	0 (0)
Export taxes	62 (29)
Import taxes	46 (439)
Total	140

Note: 1. Standard deviation in parentheses

Appendix Table A9
Decomposition of Import Tax on Textiles Contribution to Allocative Efficiency for Thailand by Trading Source[1]

	Contribution to Welfare (millions of $US 1992)	Bilateral Imports (volume in $ mill.)	Tariff Equivalent (%)
USC	–9 (5)	–20 (11)	30
WEU	–13 (7)	–28 (16)	29
JPN	–50 (25)	–114 (59)	30
KOR	–88 (57)	–241 (164)	29
TWN	–155 (88)	–424 (246)	28
HKG	–69 (38)	–177 (100)	28
CHN	113 (53)	306 (136)	28
IDN	–9 (4)	–25 (13)	30
MYS	–11 (7)	–27 (18)	30

(continued)

	Contribution to Welfare (millions of $US 1992)	Bilateral Imports (volume in $ mill.)	Tariff Equivalent (%)
PHL	–1 (0)	–2 (1)	24
LTN	0 (0)	–1 (1)	23
SSA	0 (0)	0 (0)	30
SAS	–7 (4)	–21 (12)	23
ROW	–9 (5)	–19 (10)	29
Total	–308	–793	29

Note: 1. Standard deviations in parentheses

Appendix Table A10
Decomposition of Import Tax on Primary Agriculture Contribution to Allocative Efficiency for Thailand by Trading Source[1]

	Contribution to Welfare (millions of $US 1992)	Change in Bilateral Imports (volume in $ mill.)	Tariff Equivalent (%)
USC	–282 (170)	–422 (246)	47
WEU	–27 (8)	–31 (8)	68
JPN	–9 (4)	–15 (6)	57
KOR	–1 (1)	–2 (1)	55
TWN	–2 (1)	–3 (1)	50
HKG	0 (0)	0 (0)	54
CHN	1048 (724)	1164 (767)	74
IDN	–1 (0)	–1 (0)	56
MYS	–1 (1)	–2 (1)	56
PHL	–8 (9)	–13 (14)	58

(continued)

	Contribution to Welfare (millions of $US 1992)	Change in Bilateral Imports (volume in $ mill.)	Tariff Equivalent (%)
LTN	–24 (10)	–36 (14)	52
SSA	–51 (18)	–107 (34)	48
SAS	–23 (8)	–46 (16)	48
ROW	–230 (160)	–360 (247)	43
Total	387	126	58

Note: 1. Standard deviation in parentheses

Appendix Table A11
Decomposition of World Price Effects for Thailand

Commodity	Relative Price Change	Net Trade Share	Contribution to TOT (Standard deviation)
PAgr	–1.185	–0.044	0.052 (0.023)
PFood	–0.745	0.065	–0.048 (0.026)
NRes	0.238	–0.029	–0.007 (0.009)
Text	–1.111	–0.038	0.042 (0.006)
WApp	–1.939	0.099	–0.192 (0.029)
LMnfc	–1.375	0.021	–0.029 (0.007)
TM&Eq	0.375	–0.135	–0.051 (0.009)
HMnfc	–0.411	–0.103	0.042 (0.014)
UH&CS	0.304	0.006	0.002 (0.001)
Svces	0.91	0.070	0.063 (0.013)
CGDS	0.066	0.076	0.005 (0.003)
All Commodities	NA	NA	–0.309 (0.069)

Appendix Table A12
Decomposition of the Regional Allocative Efficiency Effects[1]
(Millions of $US 1992)

	USC	WEU	JPN	KOR	TWN	HKG	IDN	MYS	PHL	THA	LTN	SSA	SAS	ROW
Pagr	457 (341)	1343 (674)	448 (265)	1993 (928)	39 (102)	0 (0)	85 (45)	947 (427)	−29 (22)	388 (355)	4 (1)	−29 (22)	10 (5)	74 (31)
Pfood	34 (18)	749 (303)	−398 (198)	45 (56)	−70 (53)	0 (0)	6 (5)	199 (102)	1 (2)	144 (89)	8 (29)	−16 (14)	11 (10)	138 (73)
Nres	9 (13)	−179 (109)	14 (30)	77 (25)	−9 (12)	0 (0)	18 (4)	−30 (26)	18 (5)	16 (15)	38 (19)	23 (16)	91 (15)	194 (46)
Text	−5 (2)	21 (5)	−22 (37)	25 (46)	22 (10)	−3 (1)	−92 (47)	−13 (17)	−55 (30)	−349 (228)	−6 (28)	16 (8)	10 (14)	−7 (139)
WApp	1 (2)	33 (20)	691 (286)	−3 (10)	23 (11)	−12 (11)	−5 (7)	−25 (17)	10 (3)	−158 (106)	370 (172)	65 (27)	10 (12)	691 (206)
LMnfc	1100 (417)	876 (317)	53 (18)	−4 (22)	−51 (41)	−9 (6)	43 (16)	−128 (100)	4 (2)	1 (34)	145 (60)	1 (6)	−22 (21)	495 (211)
TM&Eq	−238 (102)	396 (89)	404 (155)	34 (56)	45 (80)	−22 (13)	−23 (4)	−4 (118)	13 (6)	113 (107)	−78 (19)	10 (8)	−127 (23)	159 (80)
HMnfc	452 (241)	573 (247)	169 (265)	151 (29)	9 (42)	0 (0)	−8 (11)	87 (37)	8 (5)	−29 (38)	5 (19)	−25 (39)	−57 (35)	128 (61)
UH&CS	113 (21)	−76 (9)	−126 (6)	−34 (14)	−1 (3)	0 (0)	−6 (1)	2 (4)	0 (0)	−6 (1)	0 (1)	−1 (1)	−17 (1)	−2 (5)
Svces	108 (36)	1311 (219)	247 (37)	84 (22)	26 (8)	0 (0)	25 (10)	15 (21)	15 (2)	20 (8)	142 (26)	62 (16)	37 (12)	214 (23)
Total[2]	2031	5046	1480	2369	33	−47	42	1051	−15	140	627	107	−56	2085

Note: 1. Standard deviation in parentheses
2. Totals correspond to allocative efficiency entries in Table 3. Differences may arise due to rounding errors.

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