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**Annex to chapter II**

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## **SIMULATION OF THE TRADE AND EMPLOYMENT EFFECTS OF GLOBAL REBALANCING: A TECHNICAL NOTE**

The simulation employs the standard model of the Global Trade Analysis Project (GTAP) – a computable general equilibrium model of the global economy which emphasizes the role of intersectoral factor mobility in determining sectoral output supply, and which assumes output to be produced with constant returns to scale.<sup>1</sup> The model also assumes product differentiation between imported and domestic goods, and among imports from different regions. This assumption allows for two-way trade in each product category, depending on the ease of substitution between products from different regions. The model’s demand system allows for differential price and income responsiveness across countries. An assumed “global” bank mediates world savings and investment. In addition to five production factors (land, capital, unskilled and skilled labour,<sup>2</sup> and natural resources), the GTAP database covers 113 countries (or regions) and 57 product sectors, which for this simulation have been aggregated to 25 regions and 25 sectors (see tables 2.1 and 2.2).

The simulation assumes: (i) a 5 percentage point decline in United States consumption as a share of GDP (i.e. equivalent to the difference in 2008 between the actual share and the long-term average share as shown in chart 2.2 in this chapter), and (ii) a 7 percentage point increase in China’s household

consumption as a share of GDP (i.e. equivalent to the decline between 2005 and 2008 as shown in chart 2.8 in this chapter). In technical terms, conducting simulations based on these assumptions requires, for both the United States and China, (i) the variable “private consumption expenditure ( $yp$ )” to become exogenous and the “private consumption distribution parameter ( $dppriv$ )” to become endogenous, and (ii) the “savings distribution parameter ( $dpsave$ )” to become exogenous and the “average distribution parameter shift ( $dpav$ )” to become endogenous. These two modifications ensure that any change in the share of income used for private consumption will be reflected entirely in changes in the share of savings in income.

The simulation further assumes (iii) a reduction in the United States’ potential output by 1 percentage point relative to 2008 (i.e. the starting point of the simulation). This reduction is implemented by assuming a respective decline in output-augmenting technological change. The motivation for this assumption is that the decline in household consumption leads to a slowdown in aggregate domestic demand in the United States which, over the medium term, cannot be compensated in a sustainable manner by an increase in another element of aggregate demand.<sup>3</sup> This slowdown in United States domestic

demand, in turn, has spillover effects on other economies, since a greater emphasis on consumption-led growth relative to export-led growth in China and a shift in the opposite direction in the United States would reduce aggregate imports of these countries from the rest of the world. In other words, global rebalancing confined to adjustment in the United States and China would remove the demand stimulus that, prior to the outbreak of the current crisis, the United States was providing to the world economy without replacing it with a stimulus of similar size from increased consumption in China, as already mentioned in the main text.

The GTAP model's most updated database refers to 2004. Given that both global current-account imbalances and the share in GDP of consumption in the United States and China have changed significantly since 2004, the ratios of trade balances to income were updated to 2008 (i.e. roughly the onset of the current global economic and financial crisis). More precisely, each region's current-account balance as a share of income was updated on the basis of the respective growth rates between 2004 and 2008, calculated from the IMF's *World Economic Outlook* database. This was done by treating the change in the ratio of the trade balance on goods and services to regional income (*dtbalr*) as an exogenous variable, and the slack variable that represents the risk premium on investment (*cgdslack*) as an endogenous variable. These modifications cause investment to adjust such that it compensates for the assumed changes in the trade balance, thus ensuring that the savings-investment balance equals the trade balance. Given that the sum of all regions' trade balances must be zero, so that *dtbalr* cannot be treated as exogenous for all regions, the trade balances of two groups (West Asia and North Africa and Rest of the World) were left to be determined endogenously. This methodology may be considered broadly equivalent to simulating a shock to real exchange rates. The simulation uses this updated database as the baseline scenario (i.e. the benchmark against which the impact of the assumed changes is measured). To test the robustness of the results obtained in this way, the simulation was run also on the original 2004 database with adjustment in United States consumption assumed to be equivalent to 4 percentage points and that in China's consumption equivalent to 5 percentage points. While the

changes resulting from this alternative simulation are quantitatively smaller, partly because the underlying current-account imbalances in 2004 were smaller than in 2008, they are qualitatively identical.

Simulations were undertaken for a scenario that assumes adjustments in the United States and China occur at the same time (the results of which are reported in the main text), as well as with a scenario that assumes adjustments occur separately in China and the United States. Doing so gives some indications as to the importance of adjustment in either of these two countries for global rebalancing. The results for the scenario in which adjustment is confined to China (table 2.A1) indicate that the assumed increase in the share of China's consumption in GDP would have a minor impact on trade flows for individual countries, except for China itself. They also indicate that the countries in East and South-East Asia taken together would benefit the most. This latter finding is probably due to the fact that these countries and China are part of the same international production networks, so that the simulated adjustments, helped by an appreciation of the renminbi by about 5 per cent, would imply a relocation of the exit point of these networks from China to other developing countries in the region. This finding also mirrors the results generally obtained from GTAP models that simulate an increase in China's exports, where adverse effects are usually concentrated in the other Asian developing countries (*TDR 2002*, chapter V).

Given the relatively small overall impact of adjustment when confined to China, it is no surprise that the results for the scenario in which adjustment is confined to the United States (not shown) are similar to those for the scenario that assumes simultaneous adjustments in China and the United States, shown in table 2.1. The only major difference is that the impact on China's trade balance in the scenario where adjustment is confined to the United States is much smaller than in the scenario in which adjustment occurs in both countries at the same time. The fact that the impact on China also is significantly smaller than for the vast majority of the other regions shown in table 2.1 suggests that the United States trade deficit is indeed multilateral in nature, rather than the result of bilateral trade flows between the United States and China. In terms of employment, these results

Table 2.A1

**GTAP SIMULATION RESULTS OF THE IMPACT OF REBALANCING IN CHINA ON  
TRADE FLOWS AND FACTOR PRICES, SELECTED COUNTRIES/GROUPS**

(1)	Change in trade balance	Share of trade balance in GDP	Change in export volume	Change in import volume	Change in terms of trade <sup>a</sup>	Appre- ciation <sup>b</sup>	Change in wages <sup>c</sup>	
	(Percent- age points)				(Per cent)		Unskilled labour	Skilled labour
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
China	-6.7	3.4	-14.6	2.9	2.8	4.8	4.3	6.4
United States	0.2	-4.4	1.4	-1.2	-0.4	-0.3	-0.3	-0.3
China, Hong Kong SAR	0.2	16.5	0.1	-0.3	-0.1	0.4	0.5	0.4
China, Taiwan Province of	0.2	15.5	0.1	-0.2	0.0	0.2	0.2	0.1
Indonesia	0.2	2.2	0.5	-0.2	-0.1	0.2	0.2	0.1
Malaysia	0.3	44.3	0.0	-0.3	-0.1	0.1	0.0	-0.1
Philippines	0.3	5.3	0.3	-0.3	-0.1	0.0	-0.0	-0.1
Republic of Korea	0.3	3.5	0.6	-0.3	-0.2	-0.1	-0.2	-0.2
Singapore	0.3	-0.6	0.1	-0.2	-0.1	-0.2	-0.2	-0.2
Thailand	0.7	10.3	0.6	-0.5	-0.0	0.0	0.0	-0.1
Rest of East and South East Asia	0.4	4.0	0.4	-0.4	-0.2	0.1	0.0	-0.2
India	0.2	-6.3	1.1	-0.3	-0.1	0.0	0.0	-0.1
South Asia, excl. India	0.2	-15.6	0.9	-0.4	-0.0	0.0	0.0	-0.1
West Asia and North Africa	0.2	15.6	0.3	-0.3	-0.1	-0.1	-0.0	-0.1
Sub-Saharan Africa	0.3	3.3	0.4	-0.6	-0.2	-0.1	-0.1	-0.2
Argentina and Brazil	0.3	2.8	1.3	-0.5	-0.1	-0.2	-0.2	-0.3
Mexico	0.2	0.2	0.7	-0.1	0.0	-0.1	-0.1	-0.2
Rest of developing America	0.3	0.1	0.6	-0.4	-0.1	-0.1	-0.1	-0.2
Canada	0.2	-0.8	0.6	-0.2	-0.1	-0.1	-0.2	-0.2
Germany	0.3	6.0	0.6	-0.5	-0.2	-0.2	-0.2	-0.2
Rest of EU-25 and EFTA	0.3	-1.6	0.6	-0.4	-0.1	-0.2	-0.2	-0.2
Australia and New Zealand	0.3	-0.1	0.9	-0.6	-0.2	-0.1	-0.1	-0.1
Japan	0.4	1.4	2.0	-1.7	-0.7	-0.4	-0.4	-0.4
CIS, excl. the Republic of Moldova	0.1	7.5	0.3	-0.2	-0.1	-0.1	-0.1	-0.1
Rest of the world	0.3	-7.5	0.5	-0.2	-0.0	-0.1	-0.1	-0.2

**Source:** UNCTAD secretariat calculations.

**Note:** All changes are relative to 2008.

- a** An improvement in the terms of trade indicates that the price of exports increased more (or fell less) than the price for imports.  
**b** An appreciation indicates an increase in the price for primary factors, which may be likened to an appreciation of the real exchange rate.  
**c** For the definition of skilled and unskilled labour and the wage ratio between skilled and unskilled labour, see note 2 of this annex.

suggest that rebalancing China's growth trajectory will do little for other developing countries in terms of compensating for adverse effects stemming from adjustment in the United States. This is because China

imports mainly intermediate goods (including parts and components), and primary commodities (primarily energy products and metals), which are not very employment intensive. ■

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## Notes

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- 1 For documentation of the model, see Hertel (1997), and for the GTAP-7 database, see Narayanan and Walmsley, 2008.
- 2 In the GTAP-model, the split between skilled and unskilled labour is based on occupational data. Skilled labour refers to professional workers (managers and administrators, professionals and para-professionals), while unskilled labour refers to production workers (tradespersons, clerks, salespersons and personal service workers, plant and machine operators and drivers, labourers and related workers, and farm workers). The relationship between the wages of skilled and unskilled workers in the GTAP model is determined on the basis of an econometric estimation, as explained in Dimaranan and Narayanan, 2008.
- 3 This assumption is consistent with the simulations by the United Nations (2010) which indicate that the ratio

of the United States current-account deficit to GDP would increase, rather than shrink, over the coming five years if the United States economy were to grow at a rate similar to that prior to the current crisis. It is also in line with earlier experiences of rebalancing in countries with an external deficit that is typically associated with a slowdown in output growth, as noted by the IMF (2010). Another main finding of the IMF study is that policy-induced reversals of external surpluses are not typically associated with lower growth, which accords with the assumptions made here with regard to China. However, to the extent that exporting brings dynamic external benefits (e.g., through learning-by-doing effects) that are not present in output production for the domestic market, rebalancing from exports to domestic consumer demand may imply a slowdown in output growth.

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