



Munich Personal RePEc Archive

The Global Financial Crisis, LDC Exports and Welfare: Analysis with a World Trade Model

Willenbockel, Dirk and Robinson, Sherman
Institute of Development Studies at University of Sussex

April 2009

Online at <http://mpa.ub.uni-muenchen.de/15377/>
MPRA Paper No. 15377, posted 22. May 2009 / 21:55

**The Global Financial Crisis, LDC Exports and Welfare:
Analysis with a World Trade Model**

Dirk Willenbockel and Sherman Robinson

Institute of Development Studies

at the

University of Sussex

Brighton BN1 9RE

April 2009

12th Annual Conference on Global Economic Analysis

Santiago - Chile

Research for this study has been funded by the Department for International Development – United Kingdom

1. Introduction

Changes in international trade flows and world prices are major channels through which the global financial crisis will hit developing countries. The recession in the ‘global North’ triggered by the financial crisis and the resulting slowdown of growth in China and other major emerging economies will generate declines in demand for exports from developing countries, along with a reversal of the beneficial terms-of-trade trends that have favoured net exporters of primary commodities over the last few years. How these trade shocks and terms-of-trade trends affect economic performance and welfare in low-income countries depends on country-specific characteristics, especially initial trade patterns, and requires a differentiated analysis across countries.

This study uses a multi-region computable general equilibrium (CGE) world trade model to gauge the impact of a slowdown in economic activity in the OECD on trade performance, world prices, and aggregate welfare in the rest of the world with a particular focus on the least developed countries (LDCs) in sub-Saharan Africa and Asia and on other DfID focus countries. The results of the simulation analysis indicate the degree of vulnerability of different developing countries and regions distinguished in the model to impacts arising from the recession via the trade channel. Using these results, one can quantify the general order of magnitude of additional external assistance that would be required to compensate developing countries for the negative trade shocks emanating from the ‘North’.

In addition to the trade channel, there are important potential impacts that work through financial channels such as contractions of trade credit, declines in foreign investment, drops in remittances, and changes in foreign debt servicing burdens. This study focuses on the trade channel using a model of real trade flows in which financial flows are held fixed. While it is possible to use such a real trade model to explore the impact on global trade and production of exogenous macro shocks working through financial flows, it is useful to analyze the impacts working only through the trade channel to get a sense of

how the structure of trade affects the diffusion of the real shocks across the global economy.¹

The following section provides a brief outline of the analytical framework and the simulation approach adopted in this study, and discusses its scope and limitations. Section 3 highlights the main features of pre-crisis trade patterns in the benchmark data set that codetermine the direction and magnitude of OECD recession impacts on low-income countries through the trade channel. Section 4 presents and discusses the main simulation results. Section 5 decomposes the effects of an OECD-wide recession into impacts due to the slowdown in high-income America, high-income Europe and high-income Asia respectively and also considers the implications of a stronger growth decline in China. Section 6 examines the sensitivity of the main results to alternative factor market closures and behavioural parameter settings, and section 7 concludes.

2. Analytic Framework and Simulation Approach

2.1 The GLOBE Model

The analytic framework for the analysis is the GLOBE model, a theory-grounded, comparative-static, multi-region, multi-sectoral CGE model of global production and trade.² The model is calibrated to the new GTAP7 database that reflects the global input-output structure of production and trade by origin and destination in 2004. The database distinguishes 113 geographical regions and 57 commodity groups. For the present study, we retain the full geographical detail for the individual least developed country (LDC) regions and other DfID focus countries identified in the dataset along with a range of other developing country (DC) regions and three OECD⁺ regions.³ As shown in Table 1, the model distinguishes 32 regions including 19 DfID focus regions and 9 other DC

¹ See, for example, Noland et al. (1998) for an analysis using a global real trade model of the impacts of the Asian financial crisis.

² For recent applications of this model, see, e.g., McDonald, Thierfelder and Robinson (2008) and McDonald and Willenbockel (2008). For detailed technical documentation of the model, see McDonald, Thierfelder and Robinson (2007).

³ OECDAsia and OECEurope in the model include a number of non-OECD high-income countries – hence the label OECD⁺.

regions. To keep the analysis tractable and allow a compact presentation of results, the sectoral aggregation used in this study distinguishes five broad commodity groups and activities: food and food products, fuels, other primary products, non-food manufacturing, and services. The model includes five primary production factors: skilled labour, unskilled labour, capital, land and natural resources.

International Trade

Domestically produced commodities are assumed to be imperfect substitutes for traded goods. Import demand is modelled via a series of nested constant elasticity of substitution (CES) functions; imported commodities from different source regions to a destination region are assumed to be imperfect substitutes for each other and are aggregated to form composite import commodities that are assumed to be imperfect substitutes for their counterpart domestic commodities. The composite imported commodities and their counterpart domestic commodities are then combined to produce composite consumption commodities, which are the commodities demanded by domestic agents as intermediate inputs and final demand (private consumption, government, and investment). Export supply is modelled via a series of nested constant elasticity of transformation (CET) functions; the composite export commodities are assumed to be imperfect substitutes for domestically consumed commodities, while the exported commodities from a source region to different destination regions are assumed to be imperfect substitutes for each other. The composite exported commodities and their counterpart domestic commodities are then combined as composite production commodities. The use of nested CET functions for export supply implies that domestic producers adjust their export supply decisions in response to changes in the relative prices of exports and domestic commodities. This specification is desirable in a global model with a mix of developing and developed countries that produce different kinds of traded goods with the same aggregate commodity classification, and yields more realistic behaviour of international prices than models assuming perfect substitution on the export side.

Production, Input Demand and Factor Markets

Production relationships by activities are characterized by nested Constant Elasticity of Substitution (CES) production functions. Activity output is a CES composite of aggregate intermediate inputs and aggregate value added, while aggregate intermediate inputs are a Leontief aggregate of the individual intermediate commodity inputs and aggregate value added is a CES composite of primary factors demanded by each activity. The determination of product supply and input demand is based on the assumption of profit maximizing behaviour.

Factor markets in developed countries are characterized by inelastic factor supplies and the model solves for market-clearing factor prices. In developing regions, however, we assume that the real wage of skilled and unskilled labour is fixed in terms of the domestic consumer price index and that the supply of skilled and unskilled labour is infinitely elastic at that wage. In this specification, any shock that would otherwise reduce the equilibrium wage will instead lead to increased unemployment.

While skilled and unskilled labour is mobile across activities, land and natural resources are activity-specific under the activity aggregation used in the present study. Given the short-run perspective of the present study, physical capital is likewise treated as sector-specific in the simulations reported below.

Final Domestic Demand by Commodity

The commodity composition of government consumption demand and investment demand is fixed, with demand patterns from the benchmark data set. Households are utility maximizers who respond to changes in relative prices and incomes. In this version of the model, the utility functions for private households take the Stone-Geary form and hence consumer demand by commodity is described by a Linear Expenditure System (LES) specification.

Macro Closure

For this exercise a “neutral” or “balanced” set of macro closure rules is specified. Current account balances for all regions are assumed to be fixed at initial benchmark levels in terms of the global numeraire and real exchange rates adjust to maintain external

equilibrium. Since the model only solves for relative prices, we assume that the consumer price index in each country/region is fixed and that a trade-weighted average of the exchange rates for the OECD-America countries is also fixed, defining the global numeraire for the model. This treatment implies that the regional current account balances are fixed in terms of the basket of goods underlying the OECD-America consumer price index. Any change in, say, the nominal value of export earnings at world market prices in the model can be seen as changes in dollars of constant purchasing power in terms of this basket of goods.

The assumption of fixed current account balances reflects our focus on the trade channel, assuming away the effects of the crisis on capital flows. It ensures that there are no changes in future “claims” on exports across the regions in the model, i.e., net asset positions are fixed. In addition, we assume a “balanced” macro adjustment to the shock within countries. Changes in aggregate absorption are assumed to be shared equally (to maintain the shares from the base data) among private consumption, government, and investment demands.

Benchmark Data and Calibration

The model is calibrated to a social accounting matrix representation of the GTAP 7.0 database (Narayanan and Walmsley (eds.), 2008) that combines detailed bilateral trade, and protection data reflecting economic linkages among regions with individual country input-output data, which account for intersectoral linkages within regions, for the benchmark year 2004. Production, trade and income elasticities are drawn from the GTAP behavioural data base. Appendix A provides further detail and reports the key elasticity figures.

Table 1: Regional Disaggregation of the Model

DfID focus countries in italics

Code	Description	Notes on Composite Regions
<i>Cambodia</i>	<i>Cambodia</i>	
<i>Vietnam</i>	<i>Vietnam</i>	
Myanmar	Myanmar	
<i>Indonesia</i>	<i>Indonesia</i>	
<i>Bangladesh</i>	<i>Bangladesh</i>	
<i>India</i>	<i>India</i>	
<i>Pakistan</i>	<i>Pakistan</i>	
<i>China</i>	<i>China</i>	
<i>KyrgyzRepub</i>	<i>Kyrgyz Republic</i>	
<i>RoSoAsia</i>	<i>Rest of South Asia</i> ⁴	<i>Afghanistan, Nepal</i> , Bhutan, Maldives
RoAsia	Rest of Asia	except Middle East
RoAmericas	Rest of the Americas	Central and South America, Caribbean
NorthAfrica	North Africa	Algeria, Libya, Morocco, Tunisia
<i>Nigeria</i>	<i>Nigeria</i>	
Senegal	Senegal	
RoWAfrica	Rest of Western Africa	Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauretania, Niger, <i>Sierra Leone</i> , Togo
CntrlAfrica	Central Africa	Cameroon, CAR, Chad, Congo, Equatorial Guinea, Gabon, Sao Tome and Principe
SCntrlAfrica	South Central Africa	<i>Democratic Republic Congo</i> , Angola
<i>Ethiopia</i>	<i>Ethiopia</i>	
<i>Malawi</i>	<i>Malawi</i>	
<i>Mozambique</i>	<i>Mozambique</i>	
<i>Tanzania</i>	<i>Tanzania</i>	
<i>Uganda</i>	<i>Uganda</i>	
<i>Zambia</i>	<i>Zambia</i>	
<i>Zimbabwe</i>	<i>Zimbabwe</i>	
RoEAfrica	<i>Rest of Eastern Africa</i> ⁵	<i>Kenya, Rwanda, Sudan</i> , Burundi, Djibuti, Eritrea, Somalia, East African island states
<i>SouthAfrica</i>	<i>Republic South Africa</i>	
RoSACU	Rest of South African Customs Union	Lesotho, Namibia, Swaziland
OECDAsia	OECD Asia and Oceania, Other High-Income Asia	Japan, Korea, Australia, New Zealand, Singapore, Taiwan, Hong Kong
OECEurope	OECD Europe and Other EU	includes EU candidate countries inc. Turkey
OECDAmerica	OECD North America	Canada, Mexico, USA
RoW	Rest of the World	Former Soviet Union, Rest of Eastern Europe, Middle East

⁴ Afghanistan and Nepal jointly account for 91.1% of the region's 2007 GDP.

⁵ Kenya, Rwanda and Sudan jointly account for 85.1 % of the region's 2007 GDP.

2.2 The Simulation Approach

To generate a recession scenario with a drop in real GDP in the OECD⁺ region, we reduce OECD⁺ primary factor endowments—reducing employment as well as capital, land and natural resource utilisation. As a result, with the fall in income, OECD⁺ commodity demand from all regions of origin will drop, forcing real adjustments in the rest of the world. The set-up allows decomposing the total effect into effects due to a recession in high-income Europe, North America and high-income Asia. The analysis is also extended to include a recession in China (Table 2).

Table 2: The Simulation Scenarios

Scenario Code	Description
oecdall	5% real GDP drop in all OECD ⁺ regions
oecdam	5% real GDP drop in OECD America
oecdeu	5% real GDP drop in OECD Europe
oecdas	5% real GDP drop in High-Income Asia (OECD Asia)
chin	5% real GDP drop in China
oecdchin	5% real GDP drop in OECD ⁺ and China

The assumption of a 5% drop in real GDP at factor cost in high-income countries is based on an inspection of pre-crisis OECD growth trends and recent macroeconomic forecasts for 2009 by the IMF, the World Bank and the OECD: The five-year average real annual OECD GDP growth rate over the period 2004-08 has been on the order of 2.7%. This rate may be considered as the medium-run trend growth rate that would have prevailed through 2009 in the absence of the financial crisis shock. The end-of-2008 forecasts by the IMF World Bank and OECD⁶ predict an OECD-wide GDP growth rate on the order of -0.3% for 2009 - that is, OECD GDP in 2009 is predicted to be 3% below trend GDP. However, more recent macroeconomic forecasts including the end-of-January IMF World Economic Outlook update are substantially more pessimistic – hence we assume an OECD-wide GDP drop of 5% relative to a “no-global-financial-crisis” benchmark.

⁶ See World Bank (2009), IMF (2008), OECD (2008).

2.3 Scope and Limitations of the Approach

The distinct advantage of using a global CGE modelling approach to study the transmission of the crisis to developing countries through the trade channel is its unique ability to take systematic account of observable differences in the commodity composition of exports and imports across countries as well as differences in their openness to trade. For a regionally differentiated analysis of economic shocks that affect the structure of world market prices in a significant manner, this ability is of crucial importance. Impact analyses which do not take account of the commodity and geographical patterns of trade by country are bound to generate essentially misleading results.

The approach is based on a coherent theoretical framework with transparent micro-foundations, which allows explaining simulation results in terms of the responses of producers and consumers to changes in their environment. In contrast to partial-analytic ad hoc forecasts, the global general equilibrium nature of the analysis avoids fallacies of composition and ensures the internal consistency of results.⁷

However, it must be borne in mind that comparative-static real-sphere CGE models like GLOBE are not built for the analysis of shocks of a monetary macroeconomic nature in which volatile expectations play a key role. The financial system in this class of models is implicitly assumed to perform its intermediary role to channel savings into productive investment in a smooth and neutral fashion without influence on real economic fundamentals. In short, the classical dichotomy between the real and monetary sphere of the economy is assumed to hold and credit crunches are ruled out. The equilibrium concept is a steady state with stationary expectations.

One important implication of the absence of expectations-driven macro-dynamics in the model is its inability to replicate the orders of magnitude for the observed declines in oil prices and other primary raw materials since the onset of the crisis (see Figure 1). To the extent that these storable commodities have been subject to speculative investment, their

⁷ As a case in point, a recent IMF Report (IMF, 2009) presents partial-analytic simulation results of global financial crisis impacts on low-income countries (LICs). In these simulations, all LICs experience large increases in trade balance and current account deficits. It remains unclear, however, which other countries precisely are meant to generate the corresponding enormous additional trade balance and current account surpluses implied by this analysis.

prices share the characteristics of asset prices, which tend initially to over- or undershoot their new long-run equilibria in response to positive or negative shocks in the presence of forward-looking expectations or in response to news that change market expectations of future shocks.⁸ Besides such short-run undershooting effects, the model with its 2004 benchmark data base also does not capture the speculative bubble elements in the 2008 pre-crisis oil price hike.⁹ Thus, the simulation compare equilibrium positions in the absence of pure speculative bubbles (that arguably would have burst anyway) and after initial undershooting effects have run their course.

Moreover, the analytical framework precludes deflationary downward spirals in which negative expectations feed upon themselves and savings are hoarded rather than re-invested.

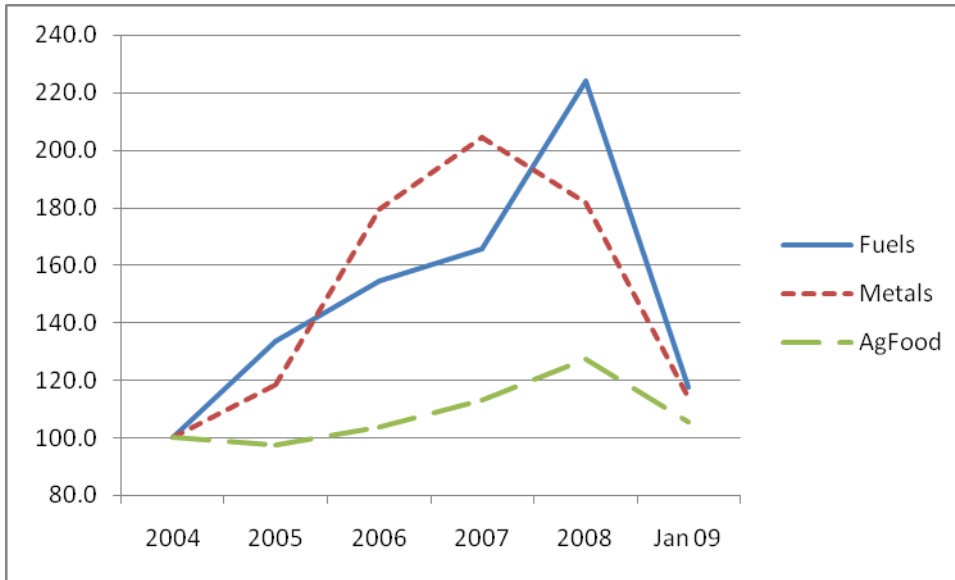
The comparative-static equilibrium nature of the analysis implies that the simulation results presented below are not meant to provide precise point predictions for a specific date. To reiterate, the usefulness of the approach lies in its ability to provide geographically differentiated insights about the transmission of the OECD recession to developing countries through the channel of international trade, and thus to identify country characteristics that determine the degree of exposure to the crisis shock due to trade links in isolation from other potential crisis impacts. While the emerging global financial crisis literature is already replete with generic pronouncements about trade impacts on “the” developing countries and with anecdotal evidence for individual countries, this is – to the best of our knowledge – the first systematic study that provides such geographically differentiated information.

Recent global macroeconomic growth forecasts have turned out to be highly unreliable and the quantitative simulation results presented in this study are likewise subject to uncertainty. However, the main qualitative insights from the analysis are independent of the exact scale of the crisis shock.

⁸ Asset price overshooting is a common phenomenon in macroeconomic models with forward-looking expectations. A celebrated early example is the well-known Dornbusch overshooting model.

⁹ Nevertheless, as shown below, the model indeed generates substantial price reductions for fuels and other primary commodities relative to other goods, yet the main reason is that the spot demand for these commodities is to a large extent price-inelastic (but income-elastic) intermediate input demand, and hence relatively large price drops are required to re-establish equilibrium after the recession shock.

Figure1: World Market Commodity Price Developments



2004-2008: Annual average Price indices relative to OECD America CPI (2004=100).
Source: Own calculations based on IMF Primary Commodity Prices, March 5, 2009 and OECD CPI statistics.

3. Pre-Crisis Regional Trade Patterns

Tables 3 to 5 show features of 2004 trade patterns for the 28 developing countries and regions in the benchmark data set. Here we highlight features that are crucial for the interpretation of the simulation results presented in section 4.

The first column of Table 3 shows the shares of individual country/region in total exports of goods and services of developing countries to all destinations.¹⁰ China alone accounts for 35 percent of the total, while sub-Saharan Africa accounts for less than 10 percent of total DC exports. The remaining columns of Table 3 show the commodity composition of exports by region. While the Asian DCs predominantly export manufactures, the exports of a subset of African regions including North Africa, Nigeria, Central and South Central Africa, and Uganda are strongly dominated by fuels.

Table 4 shows the shares of DC exports to OECD⁺ regions in total DC exports by country. On average, nearly three-quarters of DC exports go to high-income countries. Table 5 exhibits net exports – i.e. the difference between exports and imports - by country and commodity group. The signs and magnitudes of these figures determine the direction of aggregate net welfare effects associated with relative price changes due to the crisis shock. The importance of exports in aggregate economic activity as measured by the ratio of exports to GDP is shown in Table 6 along with information on the economic and demographic size by developing region.

¹⁰ Note that for aggregate regions, the figures include intra-region trade.

Table 3: Commodity Composition of Developing Country Exports - 2004*Percentage commodity shares in total exports of goods and services by region 2004*

	Share in DC Exports	AgFood	Fuels	OPrimary	NfManuf	Services	Main Export
Cambodia	0.2	3.1	1.6	0.1	79.2	16.0	m
Vietnam	1.7	17.8	11.3	0.3	59.6	10.9	m
Myanmar	0.1	19.5	28.1	12.6	31.9	7.9	m
Indonesia	4.4	11.4	16.2	2.6	62.5	7.2	m
Bangladesh	0.5	5.7	0.0	0.1	83.0	11.1	m
India	5.3	8.9	3.6	1.8	63.3	22.4	m
Pakistan	0.8	9.8	1.0	0.3	70.3	18.6	m
China	35.2	3.6	1.9	0.4	85.7	8.5	m
KyrgyzRepub	0.1	14.3	0.4	0.4	47.1	37.8	m
RoSoAsia	0.1	11.5	11.7	1.2	31.4	44.3	s
RoAsia	18.4	8.4	4.5	0.8	71.8	14.5	m
RoAmericas	18.3	21.9	15.7	4.5	41.0	16.8	m
NorthAfrica	5.2	5.8	42.3	1.1	24.7	26.1	f
Nigeria	1.9	1.5	86.8	0.2	2.6	8.9	f
Senegal	0.1	28.6	1.5	2.4	31.9	35.5	s
RoWAfrica	1.0	38.1	9.9	8.1	28.7	15.1	a
CntrlAfrica	0.7	7.1	55.0	10.7	11.5	15.6	f
SCntrlAfrica	0.7	0.9	86.0	4.1	2.4	6.6	f
Ethiopia	0.1	31.8	0.0	2.1	12.5	53.6	s
Malawi	0.0	57.2	23.1	0.1	13.5	6.0	a
Mozambique	0.1	14.6	0.1	0.7	54.1	30.4	m
Tanzania	0.1	37.3	0.0	6.8	19.6	36.2	a
Uganda	0.1	33.9	38.5	0.4	10.9	16.3	f
Zambia	0.1	16.8	0.0	3.5	71.7	7.9	m
Zimbabwe	0.1	36.5	0.3	13.3	39.9	9.9	a
RoEAfrica	0.9	25.3	17.7	1.5	29.2	26.2	m
SouthAfrica	3.2	10.3	7.4	7.6	61.3	13.4	m
RoSACU	0.6	13.5	3.2	32.3	37.8	13.2	m
Total	100	9.8	10.7	2.0	64.0	13.5	m

Last column: m: NfManuf; f: Fuels; s: Services; a: AgFood

Source: Own calculations based on GTAP7 Database

Table 4: DC Exports to OECD⁺ as Share of all Exports by Region - 2004

Percentage Shares

	Share in DC Exports		OECD ⁺ Shares				Main Destination
	to All	to OECD ⁺	OECD ⁺ All	OECD America	OECD Asia	OECD Europe	
Cambodia	0.2	0.3	90.7	50.1	7.9	32.7	OECDAmerica
Vietnam	1.7	1.7	75.8	21.3	26.5	28.0	OECDEurope
Myanmar	0.1	0.1	38.4	2.4	12.3	23.6	OECDEurope
Indonesia	4.4	4.3	70.9	15.2	37.6	18.1	OECDAsia
Bangladesh	0.5	0.7	91.4	31.1	4.4	55.9	OECDEurope
India	5.3	4.4	61.4	19.4	10.6	31.4	OECDEurope
Pakistan	0.8	0.8	68.3	26.3	7.9	34.1	OECDEurope
China	35.2	39.2	81.9	29.9	26.3	25.7	OECDAmerica
KyrgyzRepub	0.1	0.0	31.0	4.7	2.6	23.6	OECDEurope
RoSoAsia	0.1	0.1	65.1	19.9	8.2	36.9	OECDEurope
RoAsia	18.4	17.1	68.4	19.2	28.5	20.7	OECDAsia
RoAmericas	18.3	16.8	67.3	32.8	8.0	26.5	OECDAmerica
NorthAfrica	5.2	5.9	83.9	16.1	4.6	63.2	OECDEurope
Nigeria	1.9	1.7	65.1	37.3	6.4	21.4	OECDAmerica
Senegal	0.1	0.1	53.5	8.1	6.2	39.2	OECDEurope
RoWAfrica	1.0	0.9	68.0	11.9	5.9	50.2	OECDEurope
CntrlAfrica	0.7	0.8	79.9	31.8	11.5	36.7	OECDEurope
SCntrlAfrica	0.7	0.5	54.4	35.2	7.9	11.3	OECDAmerica
Ethiopia	0.1	0.1	70.6	18.5	11.3	40.8	OECDEurope
Malawi	0.0	0.0	64.9	19.1	8.6	37.1	OECDEurope
Mozambique	0.1	0.1	72.8	3.9	3.1	65.9	OECDEurope
Tanzania	0.1	0.1	57.0	10.8	10.3	35.9	OECDEurope
Uganda	0.1	0.1	70.3	15.4	12.8	42.1	OECDEurope
Zambia	0.1	0.1	43.4	2.3	18.0	23.0	OECDEurope
Zimbabwe	0.1	0.1	50.9	6.4	10.0	34.5	OECDEurope
RoEAfrica	0.9	0.8	66.3	14.7	14.5	37.1	OECDEurope
SouthAfrica	3.2	2.8	64.2	11.0	14.9	38.3	OECDEurope
RoSACU	0.6	0.5	66.1	15.0	5.3	45.9	OECDEurope
Total	100	100	73.4	25.4	20.0	28.0	OECDEurope

Source: Own calculations based on GTAP7 Database

Table 5: DC Net Exports by Commodity Group – 2004*in bill US\$ 2004*

	AgFood	Fuels	OPrimary	NfManuf	Services
Cambodia	-0.32	-0.03	0.00	0.55	0.37
Vietnam	2.36	1.26	-0.16	-10.86	-0.72
Myanmar	0.10	0.40	0.46	-1.34	-0.03
Indonesia	3.19	3.96	1.59	7.83	-9.37
Bangladesh	-2.46	-1.43	-0.12	-0.97	0.33
India	0.95	-29.19	-5.79	-8.88	3.02
Pakistan	-1.68	-4.24	-0.13	-5.28	-2.90
China	-3.91	-31.70	-16.87	104.36	-0.85
KyrgyzRepub	-0.01	-0.27	-0.01	-0.61	0.23
RoSoAsia	-0.69	-0.32	0.00	-3.08	0.57
RoAsia	5.89	-8.37	0.39	40.73	13.20
RoAmericas	52.68	22.70	16.63	-63.20	7.15
NorthAfrica	-9.53	36.71	-0.04	-43.49	13.15
Nigeria	-2.59	29.23	0.05	-13.14	-1.45
Senegal	-0.55	-0.49	-0.03	-1.38	0.23
RoWAfrica	1.65	0.07	1.45	-14.55	-0.63
CntrlAfrica	-0.55	7.42	1.57	-3.69	-1.13
SCntrlAfrica	-1.72	11.55	0.47	-6.79	-3.80
Ethiopia	0.20	-0.49	0.03	-2.31	0.24
Malawi	0.21	0.12	-0.01	-0.71	-0.07
Mozambique	-0.28	-0.21	0.04	-0.10	0.16
Tanzania	0.33	-0.33	0.19	-2.15	0.19
Uganda	0.34	0.52	-0.01	-1.07	-0.10
Zambia	0.19	-0.19	0.04	0.02	-0.15
Zimbabwe	0.48	-0.19	0.28	-0.74	-0.08
RoEAfrica	0.15	2.88	0.11	-11.76	1.40
SouthAfrica	2.46	-2.07	4.18	-3.96	1.60
RoSACU	0.13	-0.25	3.45	-1.79	-0.02
Total	9.8	10.7	2.0	64.0	13.5

Source: Own calculations based on GTAP7 Database

Table 6: Selected Other Macro Indicators by Developing Region - 2004

	GDP (mp) <i>US\$ mill</i>	Population <i>mill</i>	GDP p.c. <i>US\$</i>	Exports/ GDP	Net Exports <i>US\$ mill</i>
Cambodia	4,443	13.8	322	0.95	580
Vietnam	38,895	83.1	468	0.84	-8,115
Myanmar	7,592	50.0	152	0.39	-416
Indonesia	251,298	220.1	1142	0.35	7,195
Bangladesh	53,688	139.2	386	0.20	-4,645
India	624,480	1087.1	574	0.17	-39,878
Pakistan	91,073	154.8	588	0.18	-14,242
China	1,630,257	1308.0	1246	0.42	51,024
KyrgyzRepub	2,088	5.2	402	0.53	-667
RoSoAsia	13,083	56.3	232	0.22	-3,527
RoAsia	1,662,659	384.3	4326	0.75	176,631
RoAmericas	1,456,045	447.7	3252	0.25	35,957
NorthAfrica	254,183	151.8	1675	0.40	-3,203
Nigeria	64,819	128.7	504	0.57	12,109
Senegal	6,902	11.4	606	0.26	-2,227
RoWAfrica	47,993	117.4	409	0.39	-12,008
CntrlAfrica	37,063	35.4	1048	0.38	3,623
SCntrlAfrica	23,248	71.3	326	0.58	-293
Ethiopia	6,964	75.6	92	0.25	-2,318
Malawi	1,704	12.6	135	0.43	-460
Mozambique	5,902	19.4	304	0.36	-382
Tanzania	11,145	37.6	296	0.22	-1,779
Uganda	7,177	27.8	258	0.26	-318
Zambia	5,261	11.5	458	0.40	-86
Zimbabwe	3,796	12.9	293	0.61	-257
RoEAfrica	57,581	119.1	484	0.30	-7,216
SouthAfrica	210,388	47.2	4456	0.29	2,206
RoSACU	17,600	6.6	2663	0.62	1,524
Total	6,597,329	4,836	1364	0.43	188,814

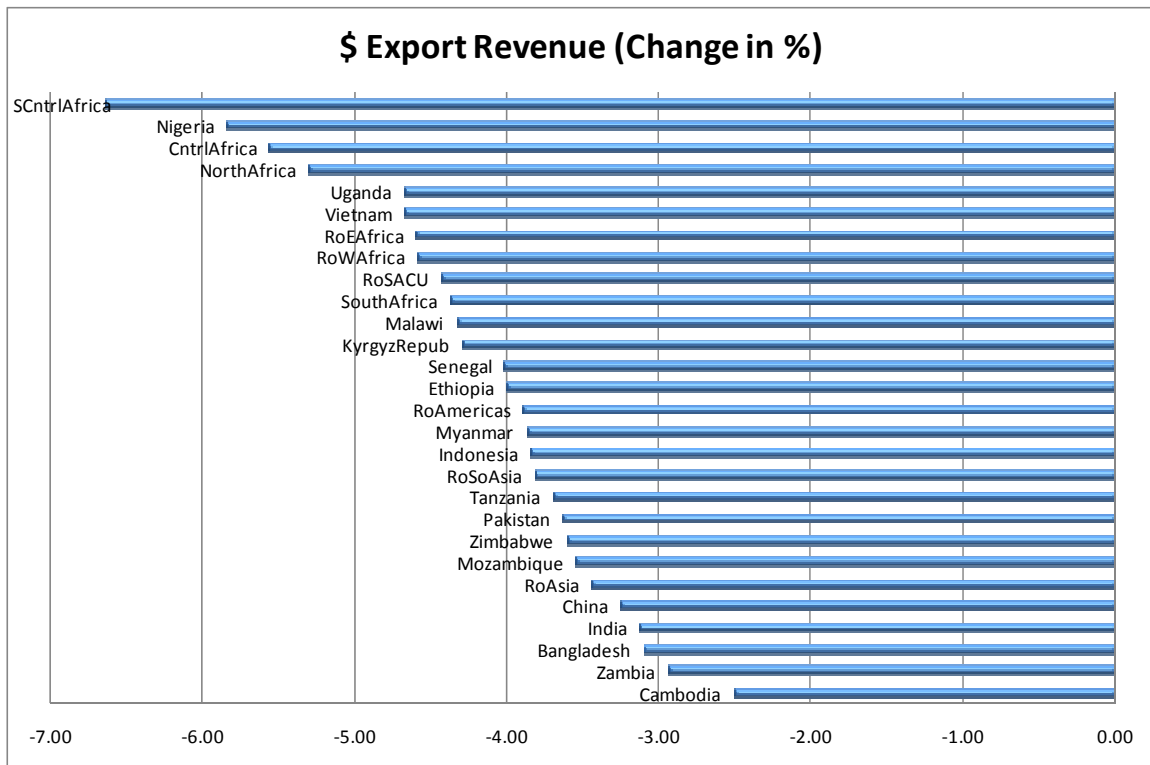
Source: Own calculations based on GTAP7 Database

4. Impact of an OECD-Wide Recession

This section presents the main simulation results for the “oecdall” crisis scenario, while section 5 summarizes results for the other scenarios listed in Table 2.

The downturn in high-income regions reduces OECD⁺ final demand and intermediate input demand for goods and services from all regions and entails a terms of trade deterioration for all other countries vis-à-vis the OECD⁺ bloc. Due to the slowdown of economic activity, the average world market price of fuels drops markedly relative to other goods and services, and the world market price of other primary commodities also falls relative to agricultural goods and processed food, manufactures and traded services.¹¹

Figure 2: Change in US\$ Value of Export Earnings by Developing Country

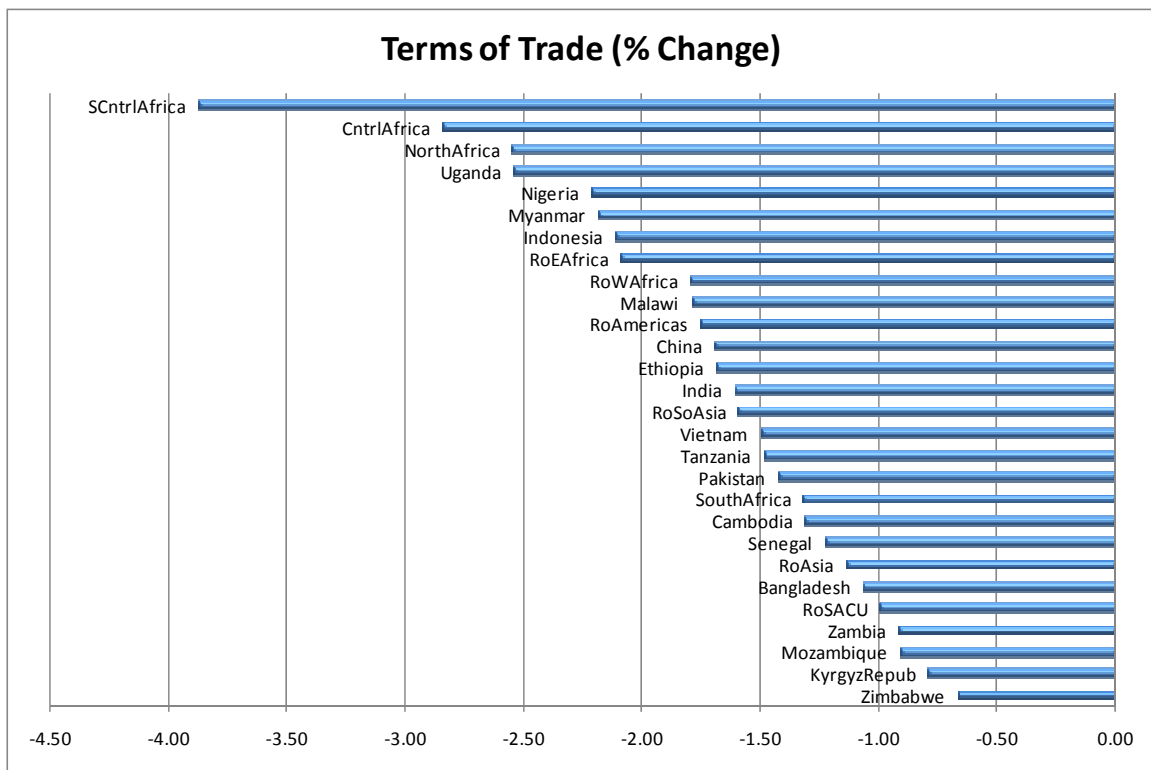


¹¹ Relative to the OECD America consumer price index basket, which serves as the numeraire of the model, average world market fuel prices drop by 6.2%, and world market prices of other primary goods drop by 2.8 % in the simulations. As the model is benchmarked to a 2004 data base and does not capture the speculative bubble elements in the 2008 pre-crisis oil price hike, the simulations certainly underestimate the actual oil price reductions in relation to 2008 peak levels.

The value of world trade falls by around 5.6 percent. Figures 2 and 3 show the effects on foreign exchange revenue from exports of goods and services and the terms of trade (i.e. the relative price of aggregate exports to aggregate imports) for the 28 DC regions in the model. Table 7 shows in addition the changes in real export and import volumes.

Figure 4 exhibits the implications for aggregate welfare by DC region as measured by the percentage change in real final absorption (i.e. the sum of real private consumption, real government consumption and real investment).¹²

Figure 3: Terms of Trade Effect by Developing Country



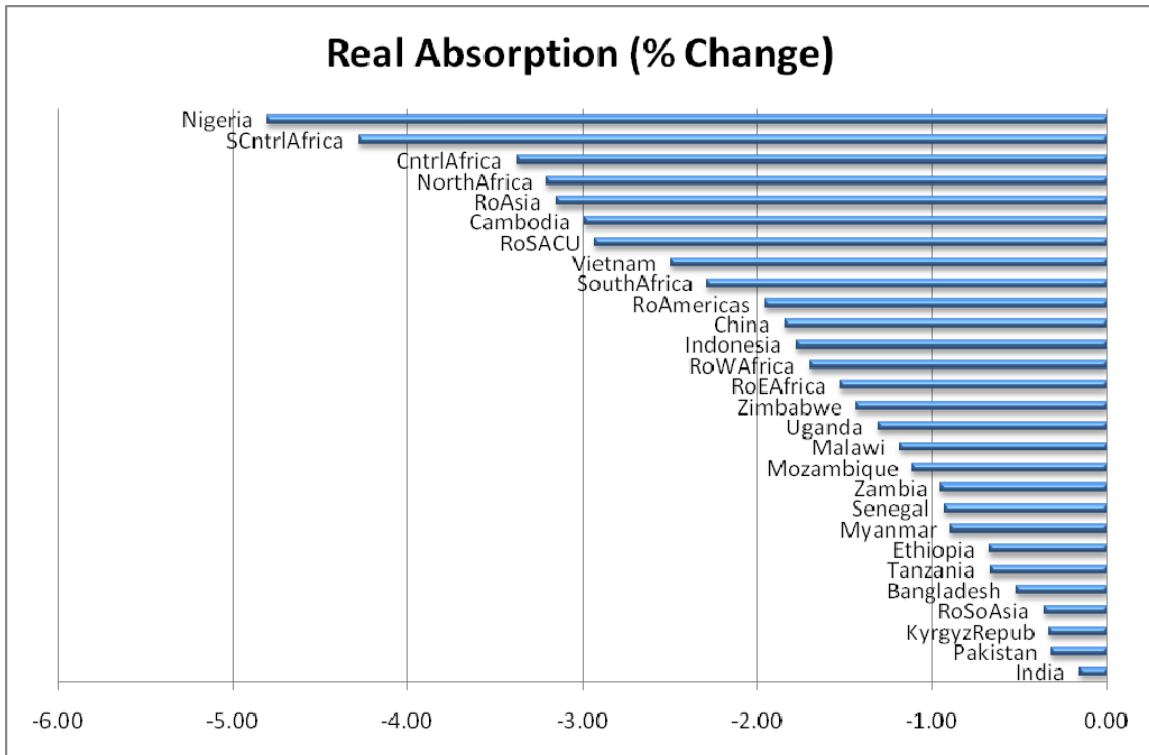
Simulation: oecdall

The four regions suffering the strongest drop in export earnings, the strongest terms of trade deterioration, and the most severe reduction in aggregate welfare are Nigeria, South Central Africa (Angola and Democratic Republic of Congo), Central Africa and North Africa. Leaving apart their location on the same continent, the common features of these

¹² The changes in real absorption are closely correlated with the proper Hicksian measures of consumer welfare change in this model, e.g. the correlation coefficient between real absorption change and the equivalent variation in percent of benchmark consumption by country is 0.9946.

regions are their status as net fuel exporters in combination with very high shares of fuel exports in total export revenue – ranging from 87% for Nigeria and 86% for South Central Africa¹³ to 42% for North Africa. Within this “top-four” group of worst-hit regions, the terms of trade deterioration translates into a substantially more pronounced welfare loss for Nigeria and South Central Africa compared to North Africa and Central Africa, because the former two regions feature significantly higher export/GDP ratios (nearly 60%) than the latter (around 40%) and are therefore more vulnerable to the adverse external shock. For the same reason, a number of regions with low export/GDP ratios including Uganda and the Rest of East Africa show relatively moderate aggregate welfare losses despite a strong negative terms of trade effect, while for countries with a high degree of openness – e.g. Cambodia and Vietnam – relatively mild terms of trade losses entail considerable aggregate welfare losses.

Figure 4: Change in Real Absorption by Country



¹³ This figure is largely due to the oil exports of Angola while DR Congo is not a major fuel exporter. Within the Central Africa region, mineral fuels are the dominant source of export revenue for Cameroon, Chad, Congo, Equatorial Guinea and Gabon, but not for the Central African Republic and Sao Tome and Principe.

The 8 DC countries that suffer terms-of-trade losses in excess of 2 percent all belong to the 12 net fuel exporters among the 28 DC regions according to Table 6. The two countries with the lowest terms of trade losses at the bottom of Figure 3 – the Kyrgyz Republic and Zimbabwe¹⁴ – are not only net fuel importers, but are also characterized by OECD shares in total exports that are well below the average for developing countries as a whole.

The three countries with the lowest real absorption loss in Figure 4 – India, Pakistan and the Kyrgyz Republic – are net importers of fuels and other primaries and have a high share of manufactures and services in total exports. India and Pakistan also have the lowest export/GDP ratios of all developing regions in the model while the Kyrgyz Republic features the lowest OECD share in total exports of all model regions.¹⁵

Expressed in terms of absolute numbers, the simulated drop in the foreign currency value of export revenue for all DC regions amounts to around 71 billion US\$. The real absorption loss in 2004 prices amounts to 47 billion US\$ for low-income Asia, 25 billion US\$ for Africa and 17 billion US\$ for Latin America and the Caribbean.¹⁶ A rough calculation of the aggregate welfare loss across *least* developed countries amounts to about 9 billion US\$ (which is 2.3% of LDC GDP). The transmission of the shock from the OECD+ countries to these poor countries is relatively weak, half as large as the initial shock, which largely reflects the fact that this country group plays only a minor role in global trade.

Table 8 expresses the main simulation results in the form of elasticities with respect to a change in OECD⁺ real income; the figures show the effect of a one-percentage-point drop in OECD⁺ real GDP. While computed for a 5% OECD⁺ GDP shock, these figures

¹⁴ Of course, the results for Zimbabwe assume a hypothetical state of the world as of 2004, in which the economy had not been wrecked by hyperinflation.

¹⁵ Moreover, both countries have sizable trade balance deficits in the status quo ante, which are kept frozen in terms of the numeraire in the simulations to avoid “free lunch” effects. As world market prices of all goods and services drop relative to the numeraire, the given deficits buy larger import quantities after the shock.

¹⁶ For this calculation, the simulated figures that refer to a 2004 base have been scaled up using country-specific 2005-2008 real growth rates drawn from USDA-ERS (2009).

indicate the magnitude of the effects under alternative assumptions about the depth of the recession in high-income countries. The country-specific results show a lot of variation across the world and even within the group of least developed countries. The variation depends mostly on their exposure to world markets for primary exports and major imports, especially oil.

Table 7: Impact of OECD⁺ Recession on DC Real Macro Aggregates

Percentage Changes

	Absorption	Imports	Exports	Exports	Terms of	GDP
	real	Volume	Volume	Value	Trade	real
Cambodia	-2.98	-1.91	0.17	-2.50	-1.31	-0.84
Vietnam	-2.49	-2.66	-1.71	-4.66	-1.50	-1.69
Myanmar	-0.89	-1.62	0.23	-3.86	-2.18	-0.22
Indonesia	-1.78	-2.91	-0.32	-3.84	-2.11	-0.90
Bangladesh	-0.52	-1.02	-0.62	-3.09	-1.06	-0.40
India	-0.15	-1.10	-0.13	-3.12	-1.61	0.06
Pakistan	-0.31	-1.07	-1.15	-3.63	-1.42	-0.21
China	-1.84	-2.88	-0.71	-3.25	-1.69	-0.94
KyrgyzRepub	-0.33	-0.73	-1.36	-4.30	-0.79	-0.55
RoSoAsia	-0.36	-0.59	-0.90	-3.81	-1.59	-0.36
RoAsia	-3.43	-2.89	-0.96	-3.44	-1.14	-1.73
RoAmericas	-1.95	-3.17	-0.73	-3.89	-1.76	-1.37
NorthAfrica	-3.20	-4.09	-1.03	-5.30	-2.55	-1.98
Nigeria	-4.81	-6.24	0.14	-5.84	-2.21	-1.33
Senegal	-0.93	-1.09	-2.00	-4.01	-1.23	-1.11
RoWAfrica	-1.70	-2.18	-1.96	-4.59	-1.80	-1.45
CntrlAfrica	-3.37	-5.53	-0.07	-5.56	-2.84	-1.54
SCntrlAfrica	-4.28	-4.72	-0.74	-6.65	-3.88	-2.00
Ethiopia	-0.67	-1.01	-1.55	-3.99	-1.68	-0.69
Malawi	-1.18	-1.39	-1.09	-4.33	-1.79	-0.99
Mozambique	-1.11	-1.60	-1.06	-3.54	-0.90	-0.89
Tanzania	-0.67	-1.12	-1.08	-3.69	-1.48	-0.59
Uganda	-1.31	-2.31	-0.30	-4.67	-2.54	-0.74
Zambia	-0.95	-1.31	-0.37	-2.94	-0.91	-0.64
Zimbabwe	-1.44	-1.52	-0.84	-3.60	-0.67	-1.03
RoEAfrica	-1.52	-2.15	-1.04	-4.59	-2.09	-1.15
SouthAfrica	-2.28	-3.12	-1.41	-4.37	-1.32	-1.80
RoSACU	-2.93	-2.69	-0.92	-4.43	-0.99	-1.79
OECDAsia	-4.88	-4.08	-4.65	-5.46	1.52	-5.00
OECDAmerica	-4.68	-3.49	-5.65	-6.34	0.52	-5.01
OECDEurope	-4.78	-4.39	-4.95	-6.02	0.53	-5.00
RoW	-3.39	-4.02	-0.10	-5.13	-2.85	-1.71

Simulation: oecdall

Table 8: Elasticities of DC Macro Aggregates with Respect to a 1%-Point Reduction in OECD⁺ Real GDP

	Absorption	Imports	Exports	Exports	Terms of	GDP
	real	Volume	Volume	Value	Trade	real
Cambodia	-0.60	-0.38	0.03	-0.50	-0.26	-0.17
Vietnam	-0.50	-0.53	-0.34	-0.93	-0.30	-0.34
Myanmar	-0.18	-0.32	0.05	-0.77	-0.44	-0.04
Indonesia	-0.36	-0.58	-0.06	-0.77	-0.42	-0.18
Bangladesh	-0.10	-0.20	-0.12	-0.62	-0.21	-0.08
India	-0.03	-0.22	-0.03	-0.62	-0.32	0.01
Pakistan	-0.06	-0.21	-0.23	-0.73	-0.28	-0.04
China	-0.37	-0.58	-0.14	-0.65	-0.34	-0.19
KyrgyzRepub	-0.07	-0.15	-0.27	-0.86	-0.16	-0.11
RoSoAsia	-0.07	-0.12	-0.18	-0.76	-0.32	-0.07
RoAsia	-0.69	-0.58	-0.19	-0.69	-0.23	-0.35
RoAmericas	-0.39	-0.63	-0.15	-0.78	-0.35	-0.27
NorthAfrica	-0.64	-0.82	-0.21	-1.06	-0.51	-0.40
Nigeria	-0.96	-1.25	0.03	-1.17	-0.44	-0.27
Senegal	-0.19	-0.22	-0.40	-0.80	-0.25	-0.22
RoWAfrica	-0.34	-0.44	-0.39	-0.92	-0.36	-0.29
CntrlAfrica	-0.67	-1.11	-0.01	-1.11	-0.57	-0.31
SCntrlAfrica	-0.86	-0.94	-0.15	-1.33	-0.78	-0.40
Ethiopia	-0.13	-0.20	-0.31	-0.80	-0.34	-0.14
Malawi	-0.24	-0.28	-0.22	-0.87	-0.36	-0.20
Mozambique	-0.22	-0.32	-0.21	-0.71	-0.18	-0.18
Tanzania	-0.13	-0.22	-0.22	-0.74	-0.30	-0.12
Uganda	-0.26	-0.46	-0.06	-0.93	-0.51	-0.15
Zambia	-0.19	-0.26	-0.07	-0.59	-0.18	-0.13
Zimbabwe	-0.29	-0.30	-0.17	-0.72	-0.13	-0.21
RoEAfrica	-0.30	-0.43	-0.21	-0.92	-0.42	-0.23
SouthAfrica	-0.46	-0.62	-0.28	-0.87	-0.26	-0.36
RoSACU	-0.59	-0.54	-0.18	-0.89	-0.20	-0.36

Simulation: oecdall

5. Decomposition of OECD Shocks by Origin and the Impact of a Growth Slowdown in China

Tables 9 and 10 show the real absorption and export revenue effects for all simulation runs listed in Table 2 above. The *oecd*dam, *oecdeu* and *oecd*as scenarios decompose the total impact of the OECD⁺ recession (*oecd*all) discussed in section 4 into the partial effects due to a slowdown of economic activity in high-income America, high-income Europe and high-income Asia respectively. Generally, the pattern of welfare losses in Table 9 matches closely with the distribution of export destination shares by OECD region in Table 4: The DC regions suffer most from a recession within the economy of their main OECD export destination.

An interesting exception is China whose main export destination is high-income America but which is hit hardest by the recession in high-income Asia. The reason is that high-income Asia is China's dominant OECD⁺ trade partner on the import side with an import share of 51% in total imports of goods and services and a share of 60% in manufacturing imports. China is linked to East and Southeast Asia through value chains. It is a major importer of semi-finished manufactures for final assembly and exporter to the rest of the world in regional East and Southeast Asian production networks.¹⁷ The OECD Asia recession entails a deterioration of China's real exchange rate and thus raises the prices of these intermediate inputs for China.

The *chin* scenario in Tables 9 and 10 simulates the effects of a 5% growth slowdown in China. As shown in Figure 5, which ranks the real absorption impacts on other DC regions in Table 9 by size, the welfare consequences for other countries remain moderate compared to the OECD recession impacts. Only for three regions – the Kyrgyz Republic, South Central Africa and Vietnam – does this shock add more than 0.2 percentage points to the welfare loss. However, it should be noted that the benchmark data set does not reflect the strong growth in China's trade with a range of other developing countries,

¹⁷ See e.g. Ng and Yeats (2003), Athukorala and Yamashita (2006).

including countries in sub-Saharan Africa and Latin America, over the last few years, and thus the simulation results are again likely to underestimate the magnitude of the trade and welfare effects.

Table 9: Impacts on Real Absorption by DC Region

Percentage Changes

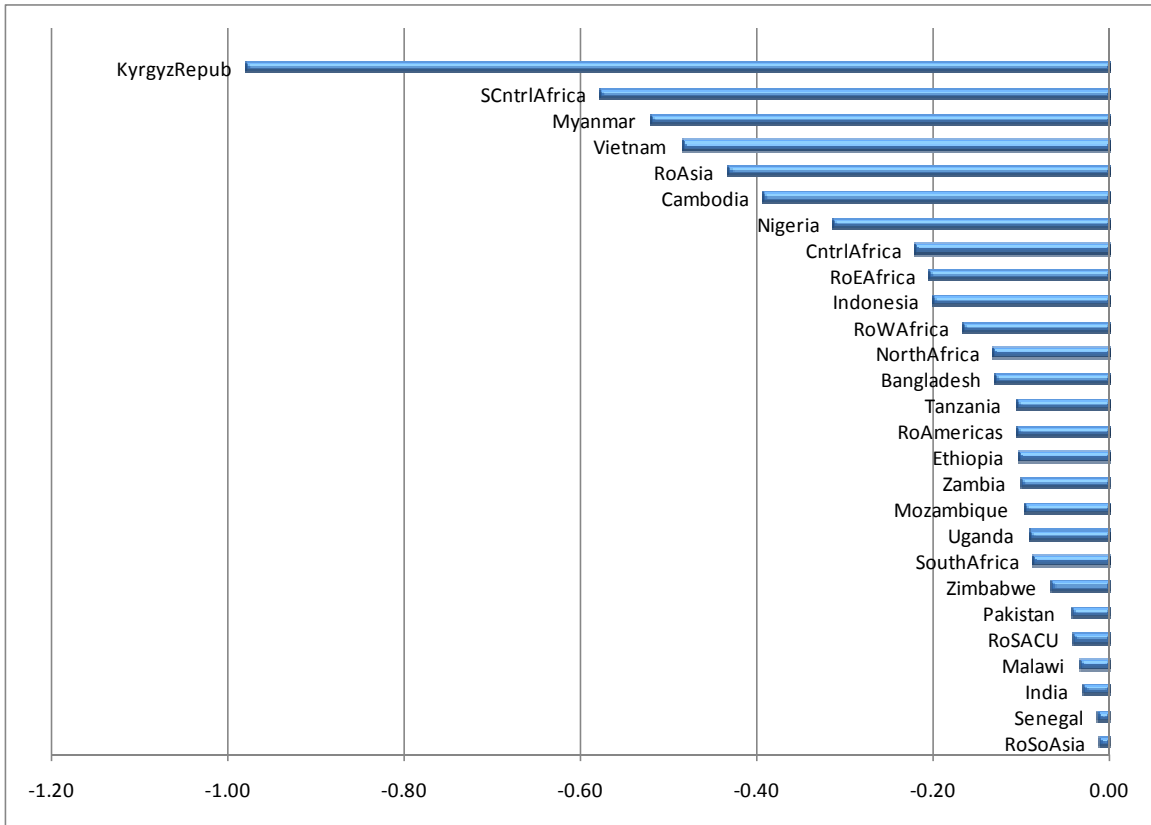
	ABSORPTION					
	oecdall	oecdam	oecdeu	oecdas	chin	oecdchin
Cambodia	-2.98	-0.86	-0.86	-1.25	-0.39	-3.31
Vietnam	-2.49	0.06	-0.84	-1.72	-0.49	-2.87
Myanmar	-0.89	0.11	-0.31	-0.68	-0.52	-1.32
Indonesia	-1.78	-0.22	-0.52	-1.03	-0.20	-1.95
Bangladesh	-0.52	0.07	-0.31	-0.27	-0.13	-0.63
India	-0.15	0.11	-0.32	0.06	-0.03	-0.19
Pakistan	-0.31	0.11	-0.34	-0.07	-0.04	-0.36
China	-1.84	-0.27	-0.38	-1.17	-3.96	-5.02
KyrgyzRepub	-0.33	0.38	-0.65	-0.04	-0.98	-1.11
RoSoAsia	-0.36	0.31	-0.52	-0.13	-0.01	-0.38
RoAsia	-3.43	-0.81	-0.84	-1.77	-0.43	-3.80
RoAmericas	-1.95	-0.84	-0.83	-0.26	-0.11	-2.04
NorthAfrica	-3.20	-0.57	-2.22	-0.41	-0.13	-3.30
Nigeria	-4.81	-1.70	-2.07	-1.02	-0.31	-5.01
Senegal	-0.93	0.52	-1.41	-0.02	-0.01	-0.95
RoWAfrica	-1.70	0.16	-1.39	-0.45	-0.17	-1.83
CntrlAfrica	-3.37	-0.92	-1.94	-0.51	-0.22	-3.52
SCntrlAfrica	-4.28	-0.96	-1.95	-1.39	-0.58	-4.62
Ethiopia	-0.67	0.13	-0.72	-0.06	-0.10	-0.77
Malawi	-1.18	0.14	-0.95	-0.36	-0.03	-1.21
Mozambique	-1.11	-0.08	-0.96	-0.05	-0.10	-1.20
Tanzania	-0.67	0.08	-0.59	-0.14	-0.11	-0.76
Uganda	-1.31	-0.18	-0.80	-0.33	-0.09	-1.38
Zambia	-0.95	-0.13	-0.63	-0.15	-0.10	-1.04
Zimbabwe	-1.44	-0.17	-0.96	-0.27	-0.07	-1.49
RoEAfrica	-1.52	-0.09	-1.08	-0.34	-0.20	-1.68
SouthAfrica	-2.28	-0.24	-1.63	-0.37	-0.09	-2.37
RoSACU	-2.93	-0.42	-2.28	-0.18	-0.04	-2.97

Table 10: Impacts on Foreign Currency Value of Exports by DC Region

Percentage Changes

	VALUE OF EXPORTS					
	oecdall	oecdam	oecdeu	oecdas	chin	oecdchin
Cambodia	-2.50	-1.97	-0.33	-0.19	-0.01	-2.52
Vietnam	-4.66	-2.47	-0.86	-1.33	-0.37	-4.94
Myanmar	-3.86	-2.38	-0.67	-0.77	-0.41	-4.20
Indonesia	-3.84	-2.27	-0.50	-1.06	-0.28	-4.08
Bangladesh	-3.09	-2.51	-0.59	0.02	0.07	-3.04
India	-3.12	-2.44	-0.52	-0.14	-0.22	-3.30
Pakistan	-3.63	-2.88	-0.63	-0.12	-0.06	-3.68
China	-3.25	-2.24	-0.26	-0.73	-3.28	-5.77
KyrgyzRepub	-4.30	-2.85	-1.00	-0.43	-0.97	-5.05
RoSoAsia	-3.81	-2.67	-0.89	-0.26	-0.13	-3.91
RoAsia	-3.44	-2.18	-0.39	-0.84	-0.40	-3.79
RoAmericas	-3.89	-2.68	-0.79	-0.39	-0.15	-3.99
NorthAfrica	-5.30	-2.74	-1.92	-0.60	-0.19	-5.43
Nigeria	-5.84	-3.13	-1.51	-1.09	-0.25	-6.00
Senegal	-4.01	-2.41	-1.49	-0.14	-0.03	-4.03
RoWAfrica	-4.59	-2.56	-1.56	-0.47	-0.12	-4.66
CntrlAfrica	-5.56	-2.88	-1.67	-0.93	-0.43	-5.84
SCntrlAfrica	-6.65	-3.43	-1.60	-1.59	-1.11	-7.33
Ethiopia	-3.99	-2.84	-0.86	-0.29	-0.25	-4.18
Malawi	-4.33	-2.65	-1.04	-0.63	-0.14	-4.41
Mozambique	-3.54	-2.36	-1.16	0.01	-0.11	-3.62
Tanzania	-3.69	-2.56	-0.74	-0.37	-0.26	-3.89
Uganda	-4.67	-2.73	-1.08	-0.81	-0.23	-4.81
Zambia	-2.94	-2.27	-0.39	-0.25	-0.19	-3.11
Zimbabwe	-3.60	-2.32	-0.86	-0.39	-0.04	-3.61
RoEAfrica	-4.59	-2.68	-1.13	-0.77	-0.36	-4.82
SouthAfrica	-4.37	-2.32	-1.55	-0.47	-0.13	-4.47
RoSACU	-4.43	-2.25	-2.02	-0.11	-0.02	-4.44

Figure 5: Impact of China Recession on Real Absorption by DC Region



6. Sensitivity Analysis

6.1 Overview

This section examines the sensitivity of the simulation results to variations in the assumptions about: (1) factor market flexibility, (2) elasticities of substitution between goods of different origin in demand (trade elasticities), (3) elasticities of substitution between primary factors in production (factor elasticities), and (4) size of the impacts on fuel prices. We discuss the results in detail below, but can summarize the major findings.

In general, in the short run, factor markets do not adjust quickly—factors are immobile—and it is not easy to substitute among sources of supply of imports and destinations of exports. We capture these rigidities by specifying low trade elasticities, factor immobility, and low factor substitution elasticities. The results indicate that, when quantities are unable to adjust, price adjustments are more extreme and the welfare losses arising from adverse shocks are worse, especially when there is unemployment. The easier it is for demanders to adjust consumption patterns and producers to adjust factor utilization and supply, the more the economy is able to adjust to the shock with moderate welfare losses (section 6.2).

The specification of a cut in GDP in the OECD+ economies leads to a decrease in the price of fuels and other primary commodities. As noted above, the model does not capture speculative forces or price bubbles. The projected fall in the world prices of these commodities in the recession scenarios is not as great as has occurred over the past few months, which is a reflection of the model's market equilibrium specification. To explore the impact of a more extreme drop in the world prices of primary commodities, we specified a scenario where primary commodity markets are assumed to be highly distorted, with price wedges that may reflect restricted supply due to monopoly behaviour or speculative forces. When we remove the distortions, supply increases and the world price falls by far more than in the recession scenario alone. The result is that net primary commodity importers gain much more than in the recession only scenarios, while the real

welfare losses for fuel exporting developing countries are magnified. The result is that a number of very fuel-import dependent countries gain more from the drop in world prices than they lose from the adverse impact on their export markets—they are net gainers in these scenarios (section 6.3).

6.2 Sensitivity to Factor Market Closures and Elasticities

Table 11 provides an overview of the alternative factor market closures and elasticity configurations considered here. The main scenario presented in sections 4 and 5 is labelled as simulation run R0. This scenario allows for unemployment of skilled and unskilled labour as well as for underutilization of capital in response to adverse demand shocks in non-OECD countries by assuming rigid real factor prices, while these factors are mobile across sectors: fixed wages and unemployment (UEM closure). Natural resources, which enter the production of value added in the Agfood, Fuels and Other Primary sectors only, and land, which is only used in Agfood, are treated as sector-specific factors, i.e. these factors are immobile across sectors. The supply of these factors is inelastic and sector-specific factor prices adjust flexibly to exogenous shocks: full employment but sectorally immobile factors (FES closure). For natural resources and land, the FES closure is maintained across all sensitivity simulations considered here.

Simulation runs R1 and R2 extend the FES closure to capital markets and then to labour markets. Note that closure configuration R2 treats all primary factors as sector-specific, and hence effectively freezes the factor allocation and production in non-OECD regions at initial levels. As shown in Table 12, real absorption losses are significantly stronger under the UEM closure, while average world market prices for all goods except Agfood drop more pronouncedly under the FES closure (Table 13).¹⁸ This is particularly the case for fuels and other primary commodities, and therefore the net fuel exporters experience stronger adverse terms-of-trade shocks under scenario R2 compared to R0 (Table 14). However, the assumption under scenario R2 that all factors remain fully employed in developing countries after the crisis shock certainly stretches the imagination, and we

¹⁸ Note that the income elasticity of household demand for Agfood is significantly lower than for the other commodity groups, and hence the adverse demand shock due the OECD recession is less pronounced in the Agfood sector than in other sectors.

consider the factor market closure employed in the main scenario to be more appropriate in the present context.

Table 11: Alternative Closures and Elasticity Configurations

	Factor Market Closure		Elasticity Scalar	
	Capital	Labour	Trade	Factors
R0	UEM	UEM	1	1
R1	FES	UEM	1	1
R2	FES	FES	1	1
R3	FES	UEM	4	3
R4	FES	UEM	2	3
R5	FES	UEM	1	3
R6	FES	UEM	1	1

R0: Main Scenario; R1 to R5: Alternative Scenarios.

UEM: Unemployment with intersectoral factor mobility. Real factor price is fixed relative to CPI.

FES: Full employment with sector-specificity. Factor price is flexible and sector-specific. Note: Land and NatRes are sector-specific in all scenarios.

Elasticity scalar: Proportional scaling factor for elasticities of substitution between goods of different origin and elasticities of substitution between primary factors of production.

Turning to sensitivity with respect to elasticities, a comparison of simulation runs R1 and R4 illustrates the implications of different assumptions about substitutability among factors of production. In the main scenario, R0, and in R1, the sectoral factor elasticities are set to 1/3 of the elasticities from the GTAP behavioural database in order to reflect the short-run nature of the analysis. The elasticity figures are reported in Appendix Table A2.

In R4, the factor elasticity figures are tripled and thus correspond with the parameter settings usually employed in the GTAP model for long-run trade policy analysis. Although in these two scenarios factor substitutability is also severely constrained by the factor market closure assumptions—so that in fact only skilled and unskilled employment can adapt within and across sectors—the comparison clearly indicates, that lower factor elasticities raise the welfare losses in terms of real absorption for developing countries across the board, while the reductions in world market prices are stronger and the terms of trade deteriorate more severely for all developing countries.

A comparison of R3 with R4 and R5 illustrates the sensitivity of results to variations in the trade elasticity settings. In the main scenarios and in R3, the elasticities of substitution between domestic goods and imports as well as the elasticities of substitution between imports of different origin are set to $\frac{1}{2}$ of the corresponding GTAP behavioural parameters, again in line with the short-run horizon of the analysis. In R4 these elasticities are ceteris paribus doubled vis-a-vis R3 and doubled again when we move to R5. As shown in Table 13, the world market price reductions for all commodities are stronger, the lower the trade elasticities. The comparison of R3 with R4 suggests stronger terms of trade deteriorations and stronger welfare losses for all developing countries under a proportional reduction of all trade elasticities. However, when trade elasticities are scaled down further as we turn from R4 to R5, we observe some interesting nonlinearities or “U turns” for a subset of countries; i.e., the terms of trade loss and/or the real absorption loss becomes slightly smaller for a minority of countries.¹⁹

¹⁹ To understand these U turns in the relationship between the terms of trade effect and trade elasticities, note that the overall terms of trade of each developing country can be analytically decomposed into an import-weighted average of its terms of trade with OECD partners and its terms of trade with non-OECD partners. While the former unequivocally deteriorate for all developing countries due to the OECD recession shock (whereby the deterioration is the stronger, the lower the trade elasticities), the sign of the effect on the terms of trade with other non-OECD regions is theoretically indeterminate, since the world market prices of non-OECD exports in the numerator and the world market prices of non-OECD imports in the denominator both decline simultaneously (whereby the size of the price effects in numerator and denominator are the larger, the lower the trade elasticities). Obviously, the sign of the non-OECD terms of trade effect must be positive for some countries and negative for others (since it is logically impossible that the non-OECD terms of trade of all non-OECD countries deteriorate against each other), depending on the initial commodity and geographic composition of a country’s non-OECD imports and exports. Thus, for a sub-set of countries the OECD and non-OECD terms of trade effects drag in opposite directions. While the former effect dominates in all cases, it is evident that for some fuel-importing countries with relatively low OECD shares in total imports (Bangla Desh, Pakistan, Senegal and Ethiopia), the influence of an improvement in their terms of trade against other non-OECD countries becomes stronger under very low trade elasticities (R5) relative to the OECD terms of trade deterioration effect, so that the overall terms of trade deterioration is lower than under R4.

Table 12: Sensitivity Analysis: Real Absorption*Percentage changes*

	R0	R1	R2	R3	R4	R5
Cambodia	-2.98	-2.23	-2.25	-0.80	-1.24	-1.81
Vietnam	-2.49	-1.80	-1.50	-0.73	-1.19	-1.33
Myanmar	-0.89	-0.55	-0.82	0.07	-0.16	-0.29
Indonesia	-1.78	-0.96	-0.90	-0.23	-0.51	-0.77
Bangladesh	-0.52	-0.13	-0.06	-0.06	-0.14	-0.06
India	-0.15	0.01	0.08	0.26	0.14	0.19
Pakistan	-0.31	0.01	0.06	0.09	-0.01	0.14
China	-1.84	-1.11	-0.86	-0.25	-0.49	-0.65
KyrgyzRepub	-0.33	0.09	0.11	0.29	0.17	0.38
RoSoAsia	-0.36	-0.01	0.07	-0.01	-0.07	0.12
RoAsia	-3.43	-2.21	-2.08	-0.58	-1.17	-1.76
RoAmericas	-1.95	-0.83	-0.76	-0.13	-0.45	-0.82
NorthAfrica	-3.20	-2.19	-2.21	-0.91	-1.36	-2.05
Nigeria	-4.81	-4.57	-5.35	-2.13	-2.76	-4.38
Senegal	-0.93	-0.08	0.10	-0.01	-0.16	0.13
RoWAfrica	-1.70	-0.82	-0.75	-0.26	-0.53	-0.50
CntrlAfrica	-3.37	-2.68	-2.93	-1.04	-1.54	-2.68
SCntrlAfrica	-4.28	-3.81	-3.81	-1.79	-2.37	-3.43
Ethiopia	-0.67	-0.10	0.08	0.05	-0.10	0.15
Malawi	-1.18	-0.45	-0.24	-0.25	-0.43	-0.34
Mozambique	-1.11	-0.31	-0.26	-0.07	-0.23	-0.23
Tanzania	-0.67	-0.13	-0.02	0.00	-0.11	-0.01
Uganda	-1.31	-0.79	-0.75	-0.32	-0.50	-0.71
Zambia	-0.95	-0.21	-0.17	0.09	-0.04	-0.07
Zimbabwe	-1.44	-0.32	-0.44	0.05	-0.21	-0.32
RoEAfrica	-1.52	-0.84	-0.77	-0.31	-0.55	-0.72
SouthAfrica	-2.28	-0.79	-0.78	-0.11	-0.42	-0.67
RoSACU	-2.93	-1.77	-2.43	-0.37	-0.86	-1.63

Simulation: oecdall

Table 13: Sensitivity Analysis: World Market Prices

Percentage changes

	R0	R1	R2	R3	R4	R5	R6
cAgFood	-1.6	-1.1	0.1	0.1	-0.3	-1.0	-6.8
cFuels	-6.2	-8.8	-11.0	-3.3	-4.3	-5.7	-26.7
cOPrimary	-2.8	-4.3	-10.4	-0.3	-1.0	-2.0	-11.5
cNfManuf	-1.3	-1.7	-2.2	-0.2	-0.5	-1.0	-2.1
cServices	-0.5	-1.5	-3.2	-0.1	-0.2	-0.8	-1.9

Simulation: oecdall

Note: All price changes are **relative to** the CPI for OECD America, and must not be misinterpreted as absolute \$ price changes.

Table 14: Sensitivity Analysis: Terms of Trade*Percentage Changes*

	R0	R1	R2	R3	R4	R5
Cambodia	-1.31	-1.26	-1.12	-0.40	-0.68	-0.93
Vietnam	-1.50	-2.13	-2.28	-0.65	-1.01	-1.21
Myanmar	-2.18	-2.06	-2.67	-0.67	-1.10	-1.56
Indonesia	-2.11	-2.22	-2.02	-0.67	-1.19	-1.61
Bangladesh	-1.06	-0.99	-0.93	-0.22	-0.51	-0.46
India	-1.61	-1.04	-0.71	-0.08	-0.52	-0.55
Pakistan	-1.42	-1.32	-1.29	-0.15	-0.55	-0.45
China	-1.69	-1.92	-1.53	-0.45	-0.91	-1.15
KyrgyzRepub	-0.79	-1.14	-1.69	0.10	-0.18	-0.22
RoSoAsia	-1.59	-1.86	-2.21	-0.48	-0.86	-0.90
RoAsia	-1.14	-1.62	-1.45	-0.39	-0.74	-1.02
RoAmericas	-1.76	-2.22	-2.25	-0.67	-1.16	-1.64
NorthAfrica	-2.55	-3.94	-4.60	-1.67	-2.24	-3.00
Nigeria	-2.21	-2.56	-2.79	-2.18	-2.35	-3.55
Senegal	-1.23	-1.56	-1.49	-0.20	-0.65	-0.60
RoWAfrica	-1.80	-2.64	-2.91	-0.65	-1.20	-1.46
CntrlAfrica	-2.84	-3.76	-4.31	-2.00	-2.52	-3.66
SCntrlAfrica	-3.88	-5.13	-6.07	-2.69	-3.23	-4.19
Ethiopia	-1.68	-1.88	-1.98	-0.22	-0.75	-0.68
Malawi	-1.79	-2.00	-1.95	-0.71	-1.07	-1.26
Mozambique	-0.90	-1.02	-1.13	-0.20	-0.47	-0.54
Tanzania	-1.48	-1.41	-1.58	-0.16	-0.59	-0.62
Uganda	-2.54	-3.06	-3.33	-1.17	-1.66	-2.19
Zambia	-0.91	-0.47	-0.36	-0.02	-0.24	-0.30
Zimbabwe	-0.67	-0.45	-0.68	-0.02	-0.22	-0.33
RoEAfrica	-2.09	-2.75	-3.21	-0.94	-1.41	-1.80
SouthAfrica	-1.32	-2.03	-2.19	-0.48	-0.96	-1.31
RoSACU	-0.99	-1.79	-2.59	-0.48	-0.95	-1.40

Table 15: Impact of OECD⁺ Recession on DC Real Macro Aggregates for R2

Percentage Changes

	Absorption	Imports	Exports	Exports	Terms of	GDP
	real	Volume	Volume	Value	Trade	real
Cambodia	-2.25	-2.02	0.27	-3.83	-1.12	0.00
Vietnam	-1.50	-1.78	-0.08	-5.04	-2.28	-0.07
Myanmar	-0.82	-1.81	0.32	-6.21	-2.67	-0.15
Indonesia	-0.90	-2.70	-0.02	-5.37	-2.02	0.01
Bangladesh	-0.06	-0.57	-0.50	-4.06	-0.93	-0.01
India	0.08	-0.36	-0.66	-5.00	-0.71	0.01
Pakistan	0.06	-0.38	-1.03	-4.70	-1.29	0.00
China	-0.86	-2.45	-0.30	-4.27	-1.53	0.10
KyrgyzRepub	0.11	-0.43	-0.98	-6.68	-1.69	-0.05
RoSoAsia	0.07	-0.15	-0.64	-5.46	-2.21	0.01
RoAsia	-2.08	-2.31	0.09	-4.09	-1.45	-0.10
RoAmericas	-0.76	-2.78	0.35	-5.09	-2.25	-0.02
NorthAfrica	-2.21	-4.49	0.90	-7.53	-4.60	-0.06
Nigeria	-5.35	-9.04	1.09	-11.10	-2.79	0.03
Senegal	0.10	-0.14	-0.81	-4.01	-1.49	0.00
RoWAfrica	-0.75	-1.44	-0.17	-4.81	-2.91	0.00
CntrlAfrica	-2.93	-7.09	1.55	-9.67	-4.31	0.17
SCntrlAfrica	-3.81	-6.05	0.29	-11.54	-6.07	0.04
Ethiopia	0.08	-0.24	-1.03	-4.95	-1.98	0.00
Malawi	-0.24	-0.42	0.00	-4.47	-1.95	0.00
Mozambique	-0.26	-0.81	-0.14	-4.46	-1.13	0.00
Tanzania	-0.02	-0.37	-0.55	-4.50	-1.58	-0.03
Uganda	-0.75	-1.96	0.69	-6.18	-3.33	0.00
Zambia	-0.17	-0.49	-0.10	-3.90	-0.36	-0.14
Zimbabwe	-0.44	-0.63	0.06	-4.34	-0.68	-0.06
RoEAfrica	-0.77	-1.87	0.16	-5.87	-3.21	-0.07
SouthAfrica	-0.78	-2.60	0.09	-5.57	-2.19	-0.02
RoSACU	-2.43	-3.02	0.88	-7.38	-2.59	-0.02
OECDAsia	-4.80	-3.90	-4.74	-6.76	2.04	-5.00
OECDAmerica	-4.61	-3.08	-5.64	-7.51	0.59	-5.04
OECDEurope	-4.71	-4.31	-5.03	-7.44	0.69	-4.99
RoW	-2.58	-4.98	0.86	-8.49	-4.07	-0.13

Simulation: oecdall: All factors sector-specific

Table 16: Impact of OECD⁺ Recession on DC Real Macro Aggregates for R4

Percentage Changes

	Absorption	Imports	Exports	Exports	Terms of	GDP
	real	Volume	Volume	Value	Trade	real
Cambodia	-1.24	-1.47	-0.31	-1.51	-0.68	-0.15
Vietnam	-1.19	-1.72	-1.01	-2.58	-1.01	-0.51
Myanmar	-0.16	-0.81	0.14	-1.69	-1.10	0.12
Indonesia	-0.51	-1.77	-0.32	-2.02	-1.19	-0.03
Bangladesh	-0.14	-0.69	-0.57	-1.71	-0.51	-0.07
India	0.14	-0.39	-0.19	-1.41	-0.52	0.19
Pakistan	-0.01	-0.53	-0.75	-1.83	-0.55	0.02
China	-0.49	-1.82	-0.64	-1.78	-0.91	-0.04
KyrgyzRepub	0.17	0.08	-0.18	-1.37	-0.18	0.03
RoSoAsia	-0.07	-0.31	-0.40	-1.89	-0.86	-0.03
RoAsia	-1.17	-1.67	-0.54	-1.69	-0.74	-0.28
RoAmericas	-0.45	-1.75	-0.27	-1.83	-1.16	-0.10
NorthAfrica	-1.36	-2.64	-0.13	-2.83	-2.24	-0.36
Nigeria	-2.76	-4.69	0.22	-3.71	-2.35	-0.23
Senegal	-0.16	-0.40	-0.58	-1.56	-0.65	-0.11
RoWAfrica	-0.53	-1.13	-0.63	-2.03	-1.20	-0.14
CntrlAfrica	-1.54	-3.84	0.16	-3.13	-2.52	-0.30
SCntrlAfrica	-2.37	-3.48	-0.19	-4.08	-3.23	-0.48
Ethiopia	-0.10	-0.46	-0.81	-1.94	-0.75	-0.07
Malawi	-0.43	-0.74	-0.37	-2.05	-1.07	-0.16
Mozambique	-0.23	-0.78	-0.50	-1.63	-0.47	-0.10
Tanzania	-0.11	-0.47	-0.53	-1.58	-0.59	-0.06
Uganda	-0.50	-1.41	-0.03	-2.41	-1.66	-0.10
Zambia	-0.04	-0.28	-0.05	-0.99	-0.24	-0.03
Zimbabwe	-0.21	-0.36	-0.14	-1.20	-0.22	-0.07
RoEAfrica	-0.55	-1.29	-0.39	-2.32	-1.41	-0.22
SouthAfrica	-0.42	-1.56	-0.44	-1.92	-0.96	-0.09
RoSACU	-0.86	-1.01	0.24	-1.62	-0.95	-0.09

Simulation: oecdall

6.3 Simulation of Stronger Primary Commodity Price Effects

Scenario R6 combines the OECD⁺ recession shock with significantly stronger world market price reductions for fuels and other primary commodities than in scenarios R0 to R5. These stronger price effects are generated in an ad hoc manner by imposing initial wedges or mark-ups between price and marginal costs for fuels, agricultural and other primary commodities produced in the OECD and RoW regions, which are then eliminated in the crisis simulation. As shown in Table 13, in this scenario the average world market price for fuels drops by 27 percent relative to the numeraire, while the world market prices for other primary commodities and agfood products fall by 12 percent and 7 percent respectively.²⁰ The factor market closure assumptions and elasticity settings for this scenario are the same as for R1.

Table 17 reports the simulated impacts on the main macro aggregates for developing countries while Figure 6 shows the ranking by size of the real absorption effects. This scenario magnifies the welfare losses in particular for the African net fuel exporters. On the other hand, for 12 of the net importers of fuels and other primary commodities, the gains from lower import prices are sufficiently strong to generate a positive net welfare gain in this illustrative scenario.

²⁰ The assumed initial mark-ups are 20% for fuels, 12% for Oprimary and 5% for Agfood.

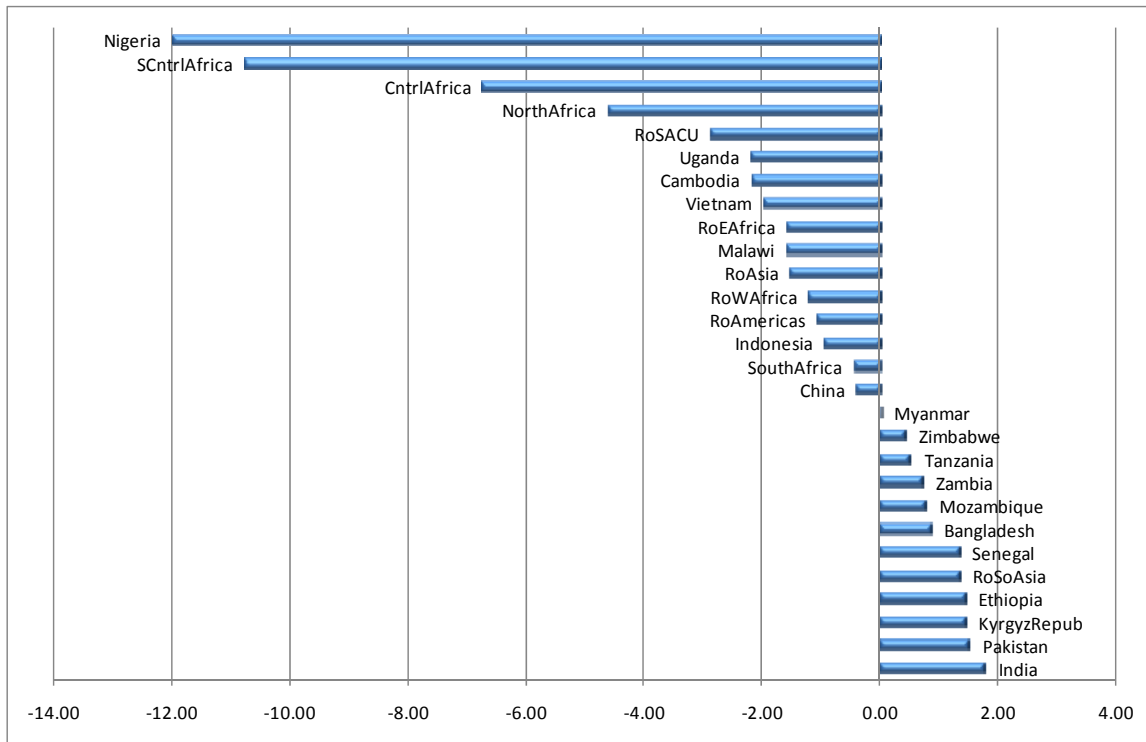
Table 17: Impact of OECD⁺ Recession on DC Real Macro Aggregates for R6

Percentage Changes

	Absorption	Imports	Exports	Exports	Terms of	GDP
	real	Volume	Volume	Value	Trade	real
Cambodia	-2.16	-1.22	1.07	-2.29	-1.41	0.13
Vietnam	-1.96	-1.62	1.40	-3.02	-4.38	0.47
Myanmar	0.02	-0.90	3.71	-4.61	-6.17	0.77
Indonesia	-0.94	-2.34	1.75	-4.09	-3.75	0.52
Bangladesh	0.87	1.43	0.00	1.43	0.28	0.47
India	1.79	2.91	-0.18	3.08	1.05	1.05
Pakistan	1.51	1.70	-1.45	3.14	0.25	0.87
China	-0.40	-1.58	0.49	-2.07	-1.84	0.43
KyrgyzRepub	1.45	0.74	-1.88	2.63	-1.46	0.19
RoSoAsia	1.36	1.83	0.05	1.78	-2.05	0.78
RoAsia	-1.52	-1.30	1.09	-2.39	-1.69	0.24
RoAmericas	-1.07	-3.92	1.44	-5.36	-4.21	0.21
NorthAfrica	-4.61	-7.77	2.48	-10.25	-8.97	-0.56
Nigeria	-12.00	-19.25	2.30	-21.55	-6.94	-0.95
Senegal	1.34	1.61	-1.56	3.17	-0.79	0.40
RoWAfrica	-1.22	-2.20	-0.37	-1.83	-5.23	-0.12
CntrlAfrica	-6.74	-14.11	3.27	-17.38	-9.44	-0.82
SCntrlAfrica	-10.79	-14.18	0.75	-14.93	-14.46	-2.18
Ethiopia	1.45	1.85	-1.27	3.12	-1.19	0.46
Malawi	-1.58	-2.35	-0.08	-2.27	-6.47	-0.29
Mozambique	0.78	0.71	-0.07	0.77	0.06	0.39
Tanzania	0.52	0.68	-1.11	1.79	-1.14	0.09
Uganda	-2.17	-4.76	1.89	-6.65	-8.33	-0.33
Zambia	0.71	0.82	0.23	0.59	0.39	-0.06
Zimbabwe	0.44	0.26	0.39	-0.14	-0.27	0.51
RoEAfrica	-1.58	-3.29	0.84	-4.13	-6.80	-0.31
SouthAfrica	-0.44	-2.22	0.75	-2.98	-2.64	0.42
RoSACU	-2.86	-2.52	2.28	-4.80	-3.44	0.19

Simulation: oecdall

Figure 6: Change in Real Absorption by Country - Scenario R6



7. Concluding Remarks

The simulation analysis presented in this study suggests that the impacts of the global financial crisis on developing countries through the channel of changes in international trade differ widely in magnitude across country groups. The main determinants of the size of aggregate welfare losses due to adverse terms-of-trade effects triggered by a recession in high income countries are the commodity composition of exports and the degree of openness to international trade. The highest percentage reductions in final domestic absorption are suffered by net fuel exporters in sub-Saharan Africa with an undiversified export structure in which fuels are the dominant source of export revenue. Among country groups with a similar export diversification structure, those with a higher ratio of exports to GDP and a higher share of OECD exports in total exports of good and services experience higher aggregate welfare losses. The elasticity of real absorption with respect to one percentage-point drop in OECD real GDP ranges from -0.1 for net importers of fuels and other primary commodities with low OECD export-to-GDP ratios

to nearly -1 for Nigeria. While the precise magnitudes of the simulated effects are inevitably subject to of uncertainty, the aforementioned qualitative results and the associated relative ranking of developing countries in terms of their exposure to trade-related crisis impacts are quite robust to variations in the assumptions about factor market rigidities and behavioural parameters,

An approximate calculation of the absolute value of the annual welfare reduction due to adverse crisis-related trade effects for the least developed countries suggests that the additional external assistance that would be required to compensate these very poor countries for the purely trade-related economic losses due to the shock inflicted on them by the “North” are relatively small, roughly ten billion US\$, and are certainly tiny relative to the magnitudes of the costs of bail-out and domestic economic stimulation packages currently being implemented in the major OECD economies.

However, to keep a proper perspective on these results, it must be borne in mind that this study focuses only on impacts through changes in real trade flows due to changes in relative prices triggered by the recession in high-income countries and is not designed to provide a comprehensive quantification of all global financial crisis impacts on developing countries. In particular, the analysis excludes other potentially important monetary transmission channels such as a contraction of trade credit, drops in remittances, changes in foreign debt servicing burdens and reductions or reversals of foreign investment inflows.

Appendix

A. Behavioural Elasticity Parameters

Tables A.1 and A.2 report the trade elasticities used in the main scenarios. The elasticities of substitution between imports by origin in Table A.2 are aggregated from the GTAP behavioural parameter database (Dimaran, McDougall and Hertel, 2006) after re-scaling by a factor 0.5 to reflect the short-run nature of the present analysis. The elasticities in this database are based on an econometric study by Hertel, Hummels, Ivanic and Keeney (2007) and distinguish 57 commodity groups. In the same database, the Armington elasticities of substitution between domestic commodities and aggregate imports are determined by the so-called “rule of two”, i.e. the Armington elasticities are assumed to be half as large as the elasticities of substitution between imports by origin. Some empirical support for this ad-hoc rule is provided by Liu, Arndt and Hertel (2004). The elasticities for the 57 GTAP sectors are aggregated to the 5 sectors of the present model using each destination region’s sub-sectoral benchmark gross absorption shares and sub-sectoral import shares as weights. The sectoral factor substitution elasticities reported in Table 3 are likewise re-scaled aggregations of the corresponding GTAP database parameters using region-specific sectoral value added shares. Section 6 reports sensitivity analyses for alternative elasticity configurations.

**Table A.1: Elasticity of Substitution between Domestic Goods and Imports:
Main Scenarios**

	cAgFood	cFuels	cOPrimary	cNfManuf	cServices
OECDAsia	1.14	1.80	0.62	1.78	0.97
Cambodia	1.18	1.97	1.02	1.80	0.98
Vietnam	1.42	1.17	1.05	1.82	1.03
Myanmar	1.42	1.81	0.91	1.84	1.03
Indonesia	1.23	1.94	0.69	1.79	0.97
Bangladesh	1.44	3.84	1.13	1.83	0.98
India	1.35	1.77	0.78	1.80	1.00
Pakistan	1.43	1.73	0.78	1.80	1.01
China	1.04	1.58	0.76	1.82	0.98
KyrgyzRepub	1.27	3.38	0.53	1.81	1.15
RoSoAsia	1.42	1.10	1.11	1.79	0.98
RoAsia	1.22	2.28	0.57	1.86	0.98
OECDAmerica	1.21	2.02	0.79	1.79	0.97
RoAmericas	1.27	1.81	0.66	1.78	0.98
OECEurope	1.19	1.82	0.70	1.78	0.96
NorthAfrica	1.32	2.81	0.48	1.78	0.98
Nigeria	1.04	2.24	0.89	1.80	0.98
Senegal	1.18	1.51	0.77	1.75	0.97
RoWAfrica	1.07	1.68	0.90	1.84	0.97
CntrlAfrica	1.22	1.54	1.02	1.78	0.96
SCntrlAfrica	1.16	1.44	1.10	1.85	0.97
Ethiopia	1.10	1.05	1.10	1.83	0.97
Malawi	1.08	1.14	0.99	1.73	0.97
Mozambique	1.18	1.05	1.05	1.76	0.99
Tanzania	1.15	1.11	0.92	1.78	0.97
Uganda	1.03	1.17	1.07	1.77	0.96
Zambia	1.20	1.46	0.85	1.78	1.00
Zimbabwe	1.15	1.15	0.48	1.77	1.05
RoEAfrica	1.21	1.53	1.09	1.77	0.97
SouthAfrica	1.15	1.67	0.94	1.73	0.97
RoSACU	1.19	1.09	0.90	1.74	0.96
RoW	1.35	3.08	0.67	1.78	1.02

**Table A.2: Elasticity of Substitution between Imports by Origin:
Main Scenarios**

	cAgFood	cFuels	cOPrimary	cNfManuf	cServices
OECDAsia	2.48	5.75	1.12	3.79	1.90
Cambodia	1.80	4.29	1.07	3.63	1.92
Vietnam	2.40	2.10	1.68	3.66	1.90
Myanmar	2.63	2.10	0.99	3.64	1.90
Indonesia	2.76	3.26	1.06	3.67	1.90
Bangladesh	2.79	3.04	1.45	3.68	1.90
India	2.78	4.82	1.02	3.81	1.90
Pakistan	2.95	3.73	1.32	3.65	1.90
China	2.68	4.24	1.12	3.85	1.90
KyrgyzRepub	2.34	7.38	0.94	3.62	1.91
RoSoAsia	2.45	2.13	1.07	3.56	1.92
RoAsia	2.42	4.58	0.98	3.81	1.91
OECDAmerica	2.27	5.49	1.09	3.65	1.91
RoAmericas	2.62	4.37	0.97	3.65	1.94
OECEurope	2.44	6.12	1.10	3.61	1.92
NorthAfrica	2.99	3.96	1.04	3.60	1.91
Nigeria	2.76	2.10	1.05	3.70	1.90
Senegal	2.73	3.91	0.97	3.53	1.90
RoWAfrica	2.66	2.96	1.00	3.71	1.93
CntrlAfrica	2.67	2.16	1.23	3.64	1.91
SCntrlAfrica	2.43	2.12	0.99	3.82	1.90
Ethiopia	2.96	2.10	1.17	3.69	1.90
Malawi	2.72	2.11	0.96	3.49	1.91
Mozambique	2.83	2.10	1.18	3.56	2.14
Tanzania	2.99	2.10	1.12	3.62	1.91
Uganda	2.84	2.12	0.92	3.56	1.91
Zambia	2.53	4.50	0.93	3.59	1.90
Zimbabwe	2.47	2.11	0.95	3.66	2.23
RoEAfrica	2.73	2.64	1.36	3.57	1.91
SouthAfrica	2.66	4.96	0.95	3.59	1.97
RoSACU	2.32	2.11	1.11	3.52	1.95
RoW	2.57	9.24	0.97	3.61	1.96

**Table A.3: Elasticities of Substitution between Primary Factors:
Main Scenarios**

	aAgFood	aFuels	aOPrimary	aNfManuf	aServices
OECDAsia	0.25	0.17	0.10	0.42	0.46
Cambodia	0.10	0.11	0.10	0.42	0.49
Vietnam	0.16	0.08	0.10	0.42	0.45
Myanmar	0.08	0.10	0.10	0.42	0.45
Indonesia	0.17	0.10	0.10	0.42	0.47
Bangladesh	0.14	0.09	0.10	0.42	0.51
India	0.16	0.11	0.10	0.42	0.48
Pakistan	0.13	0.12	0.10	0.42	0.48
China	0.13	0.10	0.10	0.42	0.48
KyrgyzRepub	0.10	0.10	0.10	0.42	0.45
RoSoAsia	0.14	0.07	0.10	0.42	0.50
RoAsia	0.17	0.08	0.10	0.42	0.47
OECDAmerica	0.26	0.09	0.10	0.42	0.45
RoAmericas	0.18	0.12	0.10	0.42	0.46
OECEurope	0.25	0.11	0.10	0.42	0.46
NorthAfrica	0.16	0.10	0.10	0.42	0.48
Nigeria	0.09	0.10	0.10	0.42	0.48
Senegal	0.16	0.41	0.10	0.42	0.47
RoWAfrica	0.10	0.10	0.10	0.42	0.49
CntrlAfrica	0.15	0.10	0.10	0.42	0.49
SCntrlAfrica	0.15	0.10	0.10	0.42	0.48
Ethiopia	0.10	0.38	0.10	0.42	0.47
Malawi	0.14	0.10	0.10	0.42	0.50
Mozambique	0.11	0.28	0.10	0.42	0.50
Tanzania	0.13	0.12	0.10	0.42	0.50
Uganda	0.09	0.10	0.10	0.42	0.49
Zambia	0.14	0.33	0.10	0.42	0.48
Zimbabwe	0.20	0.13	0.10	0.42	0.45
RoEAfrica	0.15	0.10	0.10	0.42	0.48
SouthAfrica	0.24	0.10	0.10	0.42	0.45
RoSACU	0.23	0.10	0.10	0.42	0.46
RoW	0.16	0.10	0.10	0.42	0.48

References

Athukorala, P. and N. Yamashita (2006) Production Fragmentation and Trade Integration: East Asia in a Global Context. *North American Journal of Economics and Finance* 17(2), 233–256.

IMF (2008) *World Economic Outlook*. IMF: Washington, DC (November).

IMF (2009) *The Implications of the Global Financial Crisis for Low-Income Countries*. IMF: Washington, DC (March).

Dimaranan, B.V., R.A. McDougall and T.W. Hertel (2006) Behavioral Parameters. In B.V. Dimaranan (ed) *Global Trade, Assistance, and Production: The GTAP 6 Data Base*. Center for Global Trade Analysis, Purdue University: West Lafayette, Ch.20.

Hertel, T.W., D. Hummels, M. Ivanic, and R. Keeney. (2007) How Confident Can We Be in CGE Based Assessments of Free Trade Agreements? *Economic Modelling* 24(4), 611-35.

Liu, J., C. Arndt and T.W. Hertel (2004) Parameter Estimation and Measures of Fit in a General Equilibrium Model. *Journal of Economic Integration* 19(3), 626-49.

McDonald, S., K. Thierfelder and S. Robinson (2007) Globe: A SAM Based Global CGE Model using GTAP Data. *USNA Working Paper* No.14. US Naval Academy: Annapolis.

McDonald, S., S. Robinson and K. Thierfelder (2008) Asian Growth and Trade Poles: India, China, and East and Southeast Asia. *World Development* 36(2), 210-34

McDonald, S. and D. Willenbockel (2008) India, Brazil, South Africa and China: Is the South Big Enough? In A. Bayar (ed) *Proceedings International Conference on Policy Modeling, Berlin 2008 – ECOMOD 2008*. EcoMod Press: Florence, MA.

Narayanan, B. and T. L. Walmsley (eds) (2008) *Global Trade, Assistance, and Production: The GTAP 7 Data Base*. Center for Global Trade Analysis, Purdue University: West Lafayette.

Ng, F. and A. Yeats (2003) Major Trade Trends in East Asia: What are their Implications for Regional Cooperation and Growth? *World Bank Policy Research Working Paper* No. 3084. World Bank: Washington, DC.

Noland, M., S. Robinson, L. Liu and Z. Wang (1998). *Global Economic Effects of the Asian Currency Devaluations*, Washington DC: Peterson Institute for International Economics.

OECD (2008) *OECD Economic Outlook*. OECD: Paris (November).

USDA-ERS (2009) *USDA Economic Research Service International Macroeconomic Data Set*. US Department of Agriculture (www.ers.usda.gov – accessed January 2009).

World Bank (2009) *Global Economic Prospects: Commodities at the Crossroads*. World Bank: Washington, DC (January).