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Caveat Emptor: The computable general equilibrium approach to assessing the poverty impact of trade liberalisation

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Abstract

With the widespread interest in the role that international trade can play in achieving the Millennium Development Goals, increasing attention is being given to the poverty impacts of trade liberalisation. The high level of public interest has stimulated renewed research activity aimed at expanding the evidence-base available to trade negotiators and policymakers. Within this context, computable general equilibrium economic modelling tools have been widely employed. This paper provides a critical assessment of the CGE economic modelling approach to assessing the impact of multilateral trade policy reform on poverty. It first summarises the results of recent modelling studies that have been widely quoted during the WTO's Doha Development Agenda negotiations. The paper goes on to argue that although traditional representative agent CGE models tend to be by design ill-suited for poverty analysis, single-country CGE models linked to household micro-simulation modules may provide more relevant insights. Nevertheless, the latter need to be further coupled to other modelling approaches on both the macro and the micro side for a meaningful economic assessment of the trade-poverty nexus. Furthermore, CGE modelling results need to be integrated into a broader cross disciplinary approach, drawing on both quantitative and qualitative methods and evidence.

Keywords: trade, poverty, CGE modelling, impact assessment, inter-disciplinarity.

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1. Introduction

The growth in globalisation and the increased importance of trade liberalisation, particularly as advanced under WTO's Doha agenda, have led to a heightened interest in the relationship between trade and development. At the same time, the international community's commitment to the Millennium Development Goals, and particularly the goal of halving the proportion of the world's population living in poverty by 2015, has focused attention on the reduction of poverty in developing countries. Trade negotiators, developing country governments, international development agencies, NGOs, researchers and civil society at large now have a shared interest in reaching a better understanding of the potential impact on poverty of trade liberalisation and reform of international trade rules.

This high level of public interest has exposed a major lacuna in our knowledge of the causal relationship between trade liberalisation and poverty in poorer countries.[1] Where econometric analysis has been used to detect empirical regularities between trade reform and poverty, the results have been strongly contested.[2] More recently, the focus of empirical investigation has shifted to the use of computable general equilibrium (CGE) analysis to simulate the outcomes of a specified trade liberalisation policy shock ('scenario'). CGE models have typically investigated the economic impacts of trade reforms, analysing, for example, effects on relative prices, resource reallocation, the redistribution of national output across productive sectors, and aggregate economic welfare (Francois et al, 2005, Hertel and Keeney, 2006, Anderson et al, 2006). Constructed using sector level data for the entire economy under investigation, the standard CGE model provides a 'meso' level analysis, combining microeconomic optimisation neoclassical behavioural relationships with typically standard macroeconomic and general equilibrium relationships. For poverty analysis, CGE trade models have been extended by linking the productive sector component of the model to poverty indicators.

The use of CGE models in poverty assessment has gained in popularity partly as a reaction to the limitations of the econometric evidence. But two additional factors have contributed to the recent popularity of this approach. First, CGE models represent powerful economic analytical tools and simulation devices based on solid theoretical underpinnings (depicting representations of national economies) capable of providing quantitative *ex-ante* estimates of a policy shock such as trade liberalisation on poverty indicators, at a global, regional or country level. For this reason, the CGE modelling approach has proved attractive to policy makers, particularly when modelling results can be used to provide the scientific validation for a particular policy agenda or negotiation position.[3] Second, the CGE modelling approach aims to bridge the micro–macro gap that has characterised the trade-poverty literature to date.

[1] As an earlier study noted, 'Tracing the links between trade and poverty is going to be a detailed and frustrating task, for much of what one wishes to know is just unknown.' (Winters, 2000:43)
[2] See, for example, Dollar and Kraay (2004) and Rodríguez and Rodrik (2001).
[3] For example, modelling results have been used by the EU and the United States to support their different views in the WTO debate on the potential impact of agricultural liberalisation on developing countries.

This paper aims to provide a non-technical critical assessment of the CGE modelling approach to evaluating the poverty effects of trade liberalisation. The paper reviews a sample of recent CGE trade modelling studies, many of which have been widely quoted in WTO trade policy fora. We argue that global CGE models are by design ill-suited for poverty analysis and have limited capacity to depict a consistent representation of economic realities. While acknowledging that 'second generation' CGE models that are linked to household micro-simulation modules (typically applied at a country level) do render more useful insights when applied at the country level, we argue that CGE modelling still needs to be 'soft linked' to other quantitative and qualitative assessment methods on both the macro and the micro side for a meaningful assessment of the trade-poverty nexus.

Section 2 introduces the CGE economic modelling approach and reviews a sample of recent CGE models that have assessed the poverty impacts of multilateral trade liberalisation. It summarises the main findings, and identifies a number of common patterns in the results that are reported. Section 3 argues that the theoretical construct of CGE models often gives a bias to the estimates towards a positive causal link between trade liberalisation and poverty reduction. Section 4 concludes and proposes an integrated approach to the assessment of trade-poverty linkages, which augments CGE modelling results with additional quantitative and qualitative evidence on the impact of trade liberalisation on poverty in developing countries.

2. CGE modelling the poverty impacts of trade liberalisation

Computable General Equilibrium (CGE) models represent a relatively recent category of modelling methods that convert Walrasian general equilibrium models from an abstract to a realistic representation of an economy (Shoven and Whalley, 1984). The Walrasian general equilibrium theory states that in an economy where consumers are endowed with factors and demand produced goods, and firms demand factors and produce goods with a fixed coefficients production technology (or more generally, a constant returns to scale production function), both output and factor markets clear, whilst perfect competition assures that producer prices equal the costs of production for every operating activity. CGE models are able to provide a fairly complex representation of the economy, and at the same time render their analytical and theoretical underpinnings relatively tractable (Kehoe and Kehoe, 1994). Though the CGE body of literature has advanced considerably over the last decade to include non-Walrasian elements (e.g. imperfect competition, increasing returns to scale, dynamics, macroeconomic relationships), at its core, it still remains Walrasian in spirit. In short, the CGE theoretical framework draws on a combination of general equilibrium theory, neo-classical micro-economic optimisation behaviour of rational economic agents, and some macro-economic elements that attempt to explain economic, and recently, also social (and environmental) phenomena.

The "G" in the CGE represents a key feature pertaining to this type of model. Through the social accounting matrices they employ,[4] CGE models are capable of providing a "General" representation of an economy, covering all its industries and sectors at various

[4] The Social Accounting Matrix (SAM) is a general equilibrium data system (usually representing one-year data) that links production activities, factor and commodity markets, institutions (companies, households and the government), and other accounts (foreign trade, market for loanable funds), capturing the circular interdependence of any nation-wide economic system (Defourny and Thorbecke, 1984). The SAM numerically illustrates "all the basic accounting identities which must hold for the economy to be in equilibrium" (Hertel, 1999: 3).

levels of aggregation. A further important related advantage is its ability to address the workings of an economy in an integrated manner, and allow for economy-wide inter- and intra-sectoral interactions, macro-economic feedbacks and spill-over effects. Partly for these reasons, CGE modelling is regarded as a powerful, flexible and useful analytical and simulation device for distinguishing between the multiple effects across economies that might be triggered by various policy shocks (FAO, 2003).

In order to grasp how the CGE modelling structure may affect the outcome in terms of poverty impacts, the models have been classified into two categories: standard and augmented CGE models (sometimes referred to in the literature as first generation and second generation models). Standard CGE models (S-CGEs) may be global, regional or national. They are based only on economy-wide input-output tables and social accounting matrices, without any links to micro-level models. S-CGE models exclusively rely on the "representative agent" assumption and, hence, provide aggregate estimates of potential poverty alleviation impacts, often differentiating only between skilled and unskilled labour. In contrast, augmented CGE models (A-CGEs) are typically undertaken at a country level. The augmented CGE model departs from its standard counterpart in that it links the (single-country) CGE model with a micro-simulation model based on household survey data. A-CGEs are thus in a better position to distinguish between poor and non-poor households and more effectively address poverty issues.[5] The liberalisation scenarios assumed in each of the studies are specified in the annex.

A growing number of recent S-CGE models have provided estimates of the impact of multilateral trade liberalisation on poverty levels in developing countries and have been widely quoted in WTO Doha Agenda negotiations (Anderson et al, 2006a; Polaski, 2006). Each model assumes a particular liberalisation scenario, which ranges from partial liberalisation (some reduction in tariff and non tariff barriers in specified sectors) to full liberalisation (removal of all tariff and non-tariff barriers in all sectors). Table 1 provides a summary of the poverty impact estimates in a sample of recent studies.
The main pattern that emerges from these CGE models is that trade liberalisation is positively related to poverty, with the extent to which poverty is reduced being determined by the 'depth' of the liberalisation that is assumed in the scenario. Hertel and Winters (2006:28), for example, conclude that 'to fully realize their potential to stimulate growth and thereby reduce poverty, trade reforms need to be far reaching, addressing barriers to services trade and investment, in addition to merchandise trade, which lie mainly or wholly outside the DDA.'

[5] The caveat here is that this represents a simplified distinction between the various CGE models available in the literature, and has been employed for the purpose of providing a clear line of argument for the paper. Within both S-CGE and A-CGE categories, models may vary considerably, for example they may be static or dynamic, may assume perfect competition and constant returns to scale, or may account for imperfect competition and increasing returns to scale, or may account for varying degree of factor mobility.

Table 1: Trade liberalisation and poverty impacts: results from global CGE models

	Cline (2004)	World Bank (2004)	Anderson et al (2006a)
	+	+	+
Poverty Impacts	Full trade liberalisation: • $2 per day poverty line: 440 million people may be lifted out of poverty • The capital growth effect contributes the most to overall poverty reduction: 184 mln people (42%); followed by the productivity effect: 156 mln people (35%); and the remaining 98 mln people is attributed to the standard CGE model forecast. • Substantial poverty reductions are estimated for Asia (almost 360 mln people), particularly for India (150 mln), Pakistan (70 mln), China (around 60 mln) and Bangladesh (almost 30 mln), whereas more modest estimates are provided for SSA (46 mln).	Partial trade reform: • Substantial global poverty reduction: 61 mln and 144 mln people are lifted above the $1 per day and $2 per day poverty line respectively • Greatest reductions in absolute terms are in Sub-Saharan Africa • The greatest percentage fall is expected in Middle East and North Africa	Full trade liberalisation: • If the poverty line is $2 per day: 3.6% reduction in global poverty (65.6 mln people of whom 20.4 mln in Sub-Saharan Africa and 9.6 mln in South Asia) • If the poverty line is $1 per day: 5% reduction in global poverty (31.9 mln, of whom 21.1 mln in Sub-Saharan Africa and 5.6 mln in South Asia) Partial trade liberalisation (Core Doha scenario): • If the poverty line is $2 per day: 0.3% drop in global poverty (6 mln people of whom 2.3 mln in South Asia and 0.5 mln in SSA) • If the poverty line is $1 per day: 0.4% drop in global poverty (2.5 mln of whom 1.4 mln in South Asia & 0.5 mln in SSA)
	Polaski (2006)	Bouët (2006)	
	+ / − (no quantitative estimates)	+ / − (no quantitative estimates)	
Poverty Impacts	Partial trade liberalisation (Hong Kong scenario): • Poverty is likely to deepen and spread in rural areas in many developing countries, as these experience negative effects from agricultural liberalisation under any plausible Doha agreement, and because most of the poor depend on agricultural income. • The net poverty effect would depend on the details of the outcome of the Doha Round and several country characteristics, such as the relative size of the agricultural and manufacturing sectors, the rates of growth or contraction likely to be experienced by each sector, and their relative productivity levels. • Country examples: under the Hong Kong scenario, China may experience poverty reduction effects, India may witness ambiguous poverty impacts depending on the details of the Doha Round outcome, whereas Bangladesh and several Sub-Saharan African countries are likely to face adverse poverty impacts.	Full trade liberalisation: • Do not use poverty elasticities, and hence do not measure poverty impacts • However, potential positive impacts on unskilled labour and hence on poverty are expected for South America, SACU, Bangladesh, Developing Asia, Tunisia and Rest of Sub-Saharan Africa. • Ambiguous effects on poverty in China, India, Mexico, Rest of Middle East and North Africa. • Negative poverty impacts in Zambia	

Source: Authors' compilation

Notes: "+" trade liberalisation may reduce poverty; "−" trade liberalisation may worsen poverty levels

In all cases, the gains in terms of poverty reduction are smaller under the partial liberalisation scenario as compared to full liberalisation.[6] In other words, S-CGE models tend to take an optimistic view on the nature of the trade-growth-poverty linkages and argue that trade liberalisation is pro-poor (World Bank, 2004, Cline, 2004, Anderson et al, 2006a). This is mostly because "price and quantity changes emerging from the simulation are assumed to modify household income flows in well-determined ways" (Günter et al, 2005: 295). Since real returns to unskilled labour are projected to increase with trade liberalisation relative to real returns to skilled labour, and most of the poor are assumed to be found amongst the unskilled, greater trade reform is expected to contribute to more poverty alleviation.

Furthermore, as noted by other authors, poverty impacts (as in the case of welfare impacts) in more recent S-CGE studies seem to be substantially lower than previous estimates (Ackerman, 2005, Bouët, 2006). For instance, Cline (2004) estimated that 440 million people could be lifted above the $2 per day poverty line with the full liberalisation of merchandise trade, whereas Anderson et al (2006a) reduce this number to around 66 million people. This is partly attributed to the claim that the degree of trade liberalisation that has occurred in recent years has already contributed to increased welfare, and implicitly to poverty reduction, although there is no empirical evidence as yet to confirm this. In other words, there is less world-wide trade protectionism and trade barriers penalising developing countries are less prominent than previously assumed (Bouët, 2006). In addition, differences in the size of the poverty reduction benefits expected in more recent S-CGE studies relative to their predecessors also arise from differences in the trade and poverty elasticities that are assumed to prevail at the moment of liberalisation.[7]

However, there is no clear-cut pattern with regard to the distribution of poverty alleviation impacts across regions and countries. Although at an aggregate level it appears that several S-CGE studies argue that developing countries, particularly from Asia and Sub-Saharan Africa (Cline, 2004, World Bank, 2004, Anderson et al, 2006a) may experience the largest reductions in the number of poor people, other S-CGE studies have argued (without quantification) that the country-level poverty impacts are dependent on a series of country and industry-specific characteristics (Polaski, 2006, Bouët, 2006: see table 1). Polaski (2006) argues, for example, that though China may experience positive poverty impacts under a more realistic liberalisation scenario, labelled the Hong Kong scenario (see table A1 in the appendix), as trade liberalisation induced gains in manufactures outweigh any potential losses in agriculture, India may witness ambiguous impacts, depending on the details of negotiation outcomes (its large agricultural sector likely to be negatively affected), whereas Bangladesh and several Sub-Saharan African countries may face adverse impacts, as their share of both agriculture and manufactures in world exports decline.[8] The ambiguity of the poverty effects of trade liberalisation across

[6] Ackerman (2005) also reviews a number of S-CGE models estimating poverty impacts and derives very small gains of the Doha round for developing countries (less than a cent a day per person).

[7] Bouët (2006) emphasises that recent World Bank assessments are less optimistic in poverty alleviation terms, partly due to the use of lower country-specific poverty elasticities relative to previously higher worldwide poverty elasticities. For example, 2.5 million people are lifted above the $1 per day poverty line under partial trade liberalisation in Anderson et al (2006a) versus 61 million people projected in World Bank (2004).

[8] Polaski (2006) does not provide any quantitative poverty estimates of further trade reforms, but undertakes a discussion on the likely poverty impacts by combining the income gains or losses

countries emphasises the limited ability of S-CGE models to provide meaningful estimates at a more disaggregated country-level of analysis. In other words, net poverty impacts are largely influenced by country characteristics, such as the relative size of agriculture and manufactures, the rates of growth or contraction experienced by each sector, and the corresponding changes in their relative productivity, employment and real wage levels (Polaski, 2006).

Since poverty impacts occur at a highly disaggregated local level and since S-CGE models typically focus on the global level with a high level of country clustering, this further limits their usefulness for trade-poverty analysis. For instance, Cline (2004), World Bank (2004) and Anderson et al (2006a) group all the Sub-Saharan African (SSA) countries under a single region, whereas it is very likely that the poverty impacts will differ across countries within the SSA region. Some SSA countries are net food importers and may suffer under trade liberalisation if world agricultural prices increase, whereas others that are net food exporters may gain provided that they do not already benefit from preferential market access (in which case they may lose from the erosion of these preferences). Special consideration needs to be given to the geographical decomposition of regional aggregates, as poverty effects are at least country-specific if not local-specific. Put differently, S-CGE models with representative household groups simply ignore a large part of microeconomic heterogeneity (Bourguignon and da Silva, 2003).

A recent body of CGE modelling literature has emerged to address this shortcoming in analysing the poverty effects of trade reforms at the country level (Annabi *et al*, 2005, for Senegal; Zhai and Hertel, 2006, for China; Ferreira-Filho and Horridge, 2006, for Brazil; Cororaton et al, 2006, for Philippines; Annabi et al, 2006 for Bangladesh: see table 2). This class of "augmented" CGE models typically focus on one country, linking the economy-wide data to micro-simulation sub-models that draw on detailed household-level survey databases. The higher level of disaggregation of the "representative household" into categories that are relevant for poverty analysis renders these models better equipped for assessing the impact of trade reforms on poverty and equity.

estimated by the CGE (Carnegie) model in a Hong Kong scenario case with the data on the current distribution of poverty in the developing world.

Table 2: Trade liberalisation and poverty impacts: results from country-level A-CGE models

	Annabi et al (2005) – Senegal	Zhai and Hertel (2006) – China	Ferreira-Filho and Horridge (2006) – Brazil
	+/ −	+	+
Poverty Impacts	Unilateral trade liberalisation: Very short run • Small increase in poverty (headcount ratio by 0.17%) and inequality (by 0.85%), associated with a marginal decrease in real GDP (0.02%) and welfare (0.26%) • Rural households are more adversely affected than urban households with a declining agricultural sector • Increase in inequality by 0.77%. Medium to long run: • Substantial decline in poverty (headcount ratio by 2%), associated with a substantial increase in real GDP (2.3%) and welfare (2%) • Urban households benefit to a greater extent than their rural counterparts: the head-count ratio decreases by 7.4% and 1.4% among urban and rural dwellers respectively. • Increase in inequality by 1%	Full trade liberalisation and a Doha scenario: • Positive but relatively modest poverty impacts: decline in national poverty by 2.7% (11.2 mln) and 1.3% (5.4 mln), in the case of full trade liberalisation, and respectively, the Doha scenario ($2 per day poverty line). • Aggregate urban poverty headcount decreases by 2.1 and 1.2%, in the case of full trade liberalisation, and respectively, Doha scenario • Aggregate rural poverty headcount falls by 2.7 and 1.3%, in the case of full trade liberalisation, and respectively, Doha scenario • The biggest poverty reductions occur in China's rural areas (due to higher agricultural prices) • The number of poor people falls even more when rural education reforms are combined with full trade liberalisation, i.e. 55 million people (though there is no interaction between the two)	Full trade liberalisation and a Doha scenario: • Positive but very small effects: decline in national poverty by less than 1 percent • Poverty declines by around 236,000 persons in the Doha scenario and 482,000 persons in the full trade liberalisation scenario • Largest gainers are household relying on low-skill labour, as declines in poverty are fuelled by trade liberalisation induced agricultural growth
	Cororaton et al (2006) – Philippines	Annabi et al (2006) – Bangladesh	
	+/ −	+/ −	
Poverty Impacts	• Slightly negative poverty impacts in the Doha scenario (with a compensatory indirect tax), particularly amongst the rural unemployed, self-employed and low-skilled poor (consumer prices rise more than household incomes). • Full trade liberalisation (with a compensatory indirect tax) generally further increases poverty, particularly in rural areas compared to the Doha agreement (the poverty gap and severity increase significantly, whereas the incidence of poverty is marginally reduced). This is due to lower priced imports and adverse rural impacts. • Poverty increases even more when an income tax replaces the indirect tax that compensates for the lost tariff revenue. • Rest of the world free trade is poverty reducing and favours rural households, who benefit from increasing agricultural demand. • Domestic reforms favour urban households and poverty increasing.	• Minor negative poverty impacts in the Doha scenario, particularly in the short run (consumer, particularly food prices increase more than nominal incomes) • Large farmers emerge as winners from the Doha scenario • Rest of the world trade liberalisation has also negative but slightly larger poverty impacts. Overall poverty increases by 1% in the short run and 0.5% in the long run. • Domestic trade liberalisation: short-term adverse effects on poverty and long-term beneficial poverty impacts. Rises in unskilled wages, with the poorest households reaping most of the gains. • Favourable domestic trade liberalisation poverty effects outweigh rest of the world free trade adverse poverty impacts (large farmers benefit mostly from global trade liberalisation) • Remittances represent a powerful poverty-alleviating tool	

Source: Authors' compilation

Notes: "+" trade liberalisation may reduce poverty; "−" trade liberalisation may worsen poverty levels

Different potential poverty impacts are found in different studies mostly depending on the characteristics of the country under investigation. Positive impacts under varying liberalisation scenarios are expected to occur, for example, in Brazil (Ferreira-Filho and Horridge, 2006), China (Zhai and Hertel, 2006), and Senegal (Annabi *et al*, 2005). The positive but very small poverty impacts in Brazil are largely attributed to the growth in the Brazilian agro-food output and exports predicted to be triggered by Doha scenario trade liberalisation (Ferreira-Filho and Horridge, 2006). This creates a greater demand for unskilled labour, and, assuming operational factor markets, results in a reduction of the number of people below the poverty line. Positive and modest impacts are also found in the case of China in Zhai and Hertel (2006), who estimate that multilateral trade reforms may bring modest poverty alleviation, with the largest reductions in rural areas (as agricultural producer prices rise). The authors also argue that if trade reforms were complemented by investments in education, then the poverty impacts would be greater, though it is questionable to what extent funds will be realistically available, particularly with declining tariff revenues associated with trade liberalisation. A more sizeable reduction in poverty levels, where the benefits accrue mainly to urban households, is predicted to occur in Senegal in the medium to long-term run when trade liberalisation measures are unilaterally implemented. Nonetheless, in the short term, poverty may increase particularly in the rural areas (with a declining agricultural sector).

On the other hand, other A-CGE modelling studies have identified potential negative poverty impacts (i.e. increased poverty) of trade liberalisation, for example in the Philippines (Cororaton et al, 2006) and in Bangladesh (Annabi *et al*, 2006). The Philippines is estimated to experience a slight increase in poverty incidence under a Doha scenario (with a compensatory indirect tax), particularly in rural areas and among the unemployed, self-employed and rural low-educated (Cororaton et al 2006).[9] Under a full trade liberalisation scenario, poverty levels in the Philippines increase even more than under a partial implementation of trade reforms. DDA trade liberalisation also appears to worsen the poverty profile of Bangladesh, particularly in the short run, with large farmers reaping most of the benefits arising from freer trade (Annabi *et al*, 2006).[10] At the same time, the liberalisation of services, particularly improved mobility of service providers (labour) may represent an important poverty alleviation tool through the facilitation of greater remittances.[11] In addition, poverty impacts across countries are likely to be partly influenced by the probability and type of tax used to replace the forgone import tariff revenue. For instance, the negative poverty impact of free trade on the Philippines case is assumed to be exacerbated if a uniform income tax is applied (Cororaton *et al,* 2006). Significant consequences of tax replacement for poverty impacts are also identified in the case of Cameroon, illustrating that tax replacement may

[9] This is attributed to a worsening of the competitiveness of the Philippines agricultural exports (which already enjoy tariff-free access into the EU), a loss of export shares, a reorientation of agro-producers towards domestic markets and of industrial producers towards export markets, and a reallocation of production, worsening the income situation of particular poor households (Cororaton et al, 2006).

[10] In the case of Bangladesh, the rise in poverty in the short run due to trade reforms is mainly attributed to the net agricultural-importing situation of the country combined with the deterioration in the terms of trade, higher trade reform-induced world agricultural prices and the increase in consumer prices at a faster pace than nominal incomes, particularly for the poorest households (Annabi et al, 2006).

[11] Countries that are major suppliers of migrant labour (e.g. Philippines, Bangladesh) are argued to benefit from greater movement of service providers, and are interested therefore in negotiating the services liberalisation agenda, particularly mode 4.

represent a key issue for some countries when evaluating the poverty effects of trade reforms (Emini et al, 2006).
In summary, S-CGE models present an optimistic picture with regard to the *ex-ante* effects of trade liberalisation on poverty. Consequently, these have been often cited, for example, by the developed world during the WTO negotiations of the Doha Round, in support of the argument that trade liberalisation is good for the poor. A-CGE models show, however, that the country-varying effects of trade liberalisation on poverty levels are dependent on a variety of factors, such as factor mobility, the effectiveness of price transmission channels, and the incidence of tax replacement, as well as the extent to which complementary reforms, and mitigating and enhancing measures are implemented (Hertel and Winters, 2006). In other words, though, on balance, trade liberalisation may contribute to poverty alleviation, there is no guarantee that the poor will always stand to benefit. This conclusion is reinforced when the assumptions underpinning CGE models, in general, and in relation to the S-CGE modelling approach in particular, are carefully and critically appraised.

3. A critical appraisal of the CGE modelling approach

CGE models rest on a series of critical assumptions which limit their suitability for trade-poverty analysis. The S-CGE models discussed above, typically undertaken at a global level, are by design not particularly well suited for poverty analysis due to their lack of disaggregated information at the household level and their inability to distinguish between poor and non-poor individual households. Instead they tend to distinguish between various types of "representative agents" or, in other words, categories of households or workers (e.g. unskilled and skilled labour; rural and urban labour). The representative agent assumption plays a key role in the trade-poverty analysis, according to which the behaviour of a socio-economic group is assumed to be adequately represented by each member of the group having the identical characteristics of the average. However, when sufficient data are available to econometrically test the hypothesis, studies have shown that the representative agent assumption does not hold and that conclusions based on the respective assumption are likely to be misleading (Barker and de-Ramon, 2006). This strong assumption has clear limitations for poverty analysis, since it cannot account for the heterogeneous effects of a trade policy reforms on a heterogeneous group, thereby missing out important potential sources of changes in poverty (Bourguignon and da Silva, 2003).

With regard to the logic underlining the computation of poverty estimates, two critical strong simplistic assumptions need highlighting. First, it is assumed that changes in unskilled wages are fully passed through to poor households (e.g. Anderson et al, 2006a). However, unskilled workers may not necessarily be poverty-stricken or may belong to multi-earner households resulting in higher per capita incomes (Ackerman, 2005). Second, the distribution of income is often kept unchanged implying that trade liberalisation is distribution neutral, that is, the poor receive the same increase in real income as the average household in the economy (for example in Cline, 2004, World Bank, 2004, and Anderson et al, 2006a). However, if inequality changes, this will have implications for poverty levels (White and Anderson, 2001, Naschold, 2002). Thus, from a policy design point of view, S-CGE results may be misleading by assuming that trade shocks affect the income of all households within a given group in the same proportion as the "average" (Bourguignon and da Silva, 2003a). In other words, S-CGE trade liberalisation models tend to be inherently pro-poor and positively biased, resulting in misleading predictions that have been often (mis)used and quoted in the WTO's Doha Round debate (Taylor and von Arnim, 2007).

Furthermore, the impact of a full or partial (Doha) trade liberalisation scenario on productivity and growth represents the key factor for poverty reduction (Hertel and Winters, 2006). This tends to depict the trade liberalisation – poverty nexus as a mechanical one, particularly through imposing negative poverty elasticities with respect to changes in real wages of unskilled labour, contributing to the positive bias pertaining to these models. According to this method frequently employed in S-CGE models, "it would be sufficient to liberalise trade for increasing remuneration of unskilled labour in developing countries and reducing automatically (and proportionally) the stock of poor people in the world" (Bouët, 2006: x). However, the empirical evidence on the impact of trade liberalisation on growth and of growth on poverty is mixed and there is no universal pattern in the trade-growth-poverty nexus across countries (White and Anderson, 2001, Rodrik, 2000, Winters *et al*, 2004, Charlton and Stiglitz, 2005). Hence, the data used in global S-CGE models underpinning the linkages between trade, growth, and poverty are highly contested and tend to depend on the region and on the historical period under consideration (Polaski, 2006).

Since poverty impacts occur at a highly disaggregated local level, special consideration needs to be given to the geographical decomposition of regional aggregates. Put differently, S-CGE models with representative household groups simply ignore a large part of microeconomic heterogeneity (Bourguignon and da Silva, 2003). To address some of these limitations, CGE modelling techniques have been further developed and augmented with a micro-simulation sub-model drawing on detailed household survey data. Though this class of augmented CGE models may provide relatively more reliable poverty estimates, it continues to display several limitations in effectively addressing trade-poverty inter-linkages. The dynamics of poverty are poorly captured, and the behavioural parameters of poor households are seldom empirically founded or econometrically estimated.[12] In some studies, labour is assumed to be fully mobile, with aggregate employment often fixed at a national level (Ferreira-Filho *et al,* 2006, Zhai and Hertel, 2006), resulting in the inability of these models to discuss the poverty effects of changes in national unemployment levels. Overall, though it needs to be acknowledged that the literature linking CGE models to micro-simulation household sub-models is still in its infancy and may hold relevant potential, this approach does nevertheless suffer from the major limitations characteristic to the CGE modelling approach in general. These underlining theoretical shortcomings pertaining to both S-CGE and A-CGE models are discussed in the remainder of this section.[13]

First, the assumption that economies are in equilibrium, which is inherent to a CGE model, is fragile and over-simplistic. Equilibrium states of real economies and market-clearing are seldom, if ever achieved, and societies tends to always find themselves in a never-ending process of change and disequilibrium. Since there is no reason to believe that equilibrium is achieved in the real world, the general equilibrium assumption on which CGE models lay their foundations suddenly seems very unstable, as the model fails to explain what may happen out of equilibrium (Grassini, 2004).

[12] For example, Annabi et al 2005, rely on only one year household data.

[13] More in-depth assessments of the limitations pertaining to the underlining theory backing CGE models, the appropriateness of functional forms and closure rules, the implementation of dynamics and other model performance elements is provided in McKitrick (1998), Panagariya and Duttagupta (2001), Ackerman (2002), Grassini (2004), and Ackerman (2005). Inherent dangers of exclusively relying on the CGE modelling approach for the assessment of economic "structural" policies are also discussed in Scrieciu (2007).

Second, the "econometric critique" to CGE modelling represents a further argument undermining the credibility of the CGE modelling approach. The elegance of the theory underlining CGE models and its apparent ability to explain the world relies on a truism, as these models, which are typically based on one year's data, are inherently not falsifiable and fit the data perfectly (Barker, 2004). Crucial parameters are either derived from calibration (i.e. mathematical manipulation) techniques or borrowed from other sources. The CGE model builder tends to be satisfied with the choice of some specific functional forms and closure rules, and modifies the available representation of the real world instead of rejecting the model (Grassini, 2004).

Third, and connected to the econometric critique, is the modelling of dynamics. Though recent developments in CGE modelling allow for the insertion of "dynamic" elements, these are limited in scope and provide an unsatisfactory description of dynamism (compared to the intrinsic dynamism of time series embedded in econometric models, for instance). Several CGE studies on trade-poverty linkages are recursive dynamic (e.g. Anderson et al, 2006a, Annabi et al, 2005, Zhai and Hertel, 2006) meaning that models are done in a sequential recursive set-up of temporary equilibrium linked by some form of asset accumulation (Bouët, 2006, Bourguignon and da Silva, 2003).[14] In other words, CGE models incorporate pseudo-dynamic features that tend to be over-simplistic, within which the usual CGE comparative static snapshots are merely extended to a series of annual snapshots based on artificially perfect macro-economic stability (Ackerman, 2005). The typically associated debatable assumption in this case is that efficiency gains from trade liberalisation trigger productivity and growth over time (Taylor and von Arnim, 2007).

Fourth, CGE estimates of poverty impacts due to trade reforms are also sensitive to closure rules, a further mechanism that is inherent to applied general equilibrium modelling. These reflect the mathematical formulation of the model, wherein the modeller decides upon the endogeneity and exogeneity nature of variables in order to close the system.[15] Macro closure rules, which typically define the direction of causality among the CGE variables (Taylor and von Arnim, 2007), considerably influence the model's ability to analyse events at the macro end (Robinson and Lofgren, 2005).[16] An example with direct implications for poverty analysis is the government closure rule, where government is assumed to follow specified behaviour rules. In some studies, government fiscal balances (government savings) are fixed, implying that the loss of tariff revenue due to trade liberalisation is replaced by higher direct taxes on households. The Anderson et al (2006a) study, for instance, which assumes this type of closure rule, further advocates that an increase in direct taxation will only affect skilled high-income households with no impact on low-skilled poor households. In other words, the authors advance the strong claim that losses in tariff revenues from trade liberalisation are poverty neutral, though governments in poor countries tend to heavily

[14] Dynamics in a CGE model may also be included through the use of optimal growth theory (intertemporal dynamics) where economic agents display a behaviour characterised by perfect foresight. However, it is argued that this represents a too strong assumption, particularly when referring to developing countries (Annabi et al, 2005).

[15] In other words, the Walrasian spirit of the CGE model combined with macroeconomic constraints involves the introduction of additional constraints to achieve equilibrium typically associated with international trade and the current account, the government budget, and the loanable funds market.

[16] It is also argued that CGE models tend to confuse micro-economics and trade theory on the one hand, with open economy macro economics on the other hand, performing poorly with respect to the latter (Taylor and von Arnim, 2006).

rely on tariff income sources.[17] This type of closure rule assumption further adds to the positive bias on the trade-poverty debate that appear to particularly characterise S-CGE models.

The current account closure rule is also important for trade-poverty analysis and crucial to CGE models. Typically, most of these models assume that each country's trade deficit or surplus stays constant after liberalisation (for example through adjustments in real exchange rates as in Cline, 2004). However, in developing countries, which have suffered historically from substantial trade deficits, the assumption that the price system will always fully respond to liberalisation keeping the current account balance constant is highly inadequate to represent macroeconomic realities of poor countries (Taylor and von Arnim, 2006). For example, in their study on trade liberalisation, growth and poverty in Senegal, Annabi et al (2005) assume that any trade-reform led increase in imports is compensated by an increase in exports in order to maintain the current account balance fixed. Equilibrium assumptions would thus force export prices down, automatically suggesting that domestic sectors become competitive with trade liberalisation, which tends to be often at odds with the experience of African countries.

In summary, the CGE modelling approach to providing a meaningful *ex ante* assessment of the poverty impacts of trade liberalisation is presently confronted with a series of crucial limitations which should be explicitly acknowledged, when the results of such models are used in evidence-based policy discourse and decision-making fora.[18]

4. Summary and Conclusions

This paper has highlighted the limitations of CGE models when used for the assessment of trade liberalisation induced poverty impacts. While the current extension of the CGE modelling approach to include micro-economic simulation modules provides a more effective linking of the micro and the macro levels of trade-poverty analysis, the models retain nevertheless the inherent limitations of the overall CGE approach.
CGE modelling does provide, however, a powerful analytical tool based on an internally consistent theoretical representation of the market economy, which can be used to provide quantitative *ex ante* estimates of the impact of trade liberalisation on poverty, particularly if a range of simulation strategies are carried out and several of the highly unrealistic assumptions (e.g. fixed current account and government budget deficits, full or fixed national employment of resources) that dominate the CGE modelling literature are relaxed to provide a more plausible description of economic realities (Taylor and von Arnim, 2007). However, these estimates on their own are unlikely to provide an adequate or reliable evidential foundation for trade negotiators and decision-makers. *Ex ante* analysis of the trade liberalisation – poverty nexus needs to be based on a systematic comparison of evidence arrived at by using different research methods, drawing on the strengths of different approaches, while offsetting the limitations of any single approach.[19]

[17] In addition, higher Armington trade substitution elasticities interact with the fiscal balance to cut back welfare losses or enhance welfare gains (Taylor and von Arnim, 2006), thus mechanically reducing poverty levels.
[18] Ciuriak (2007) makes the same point: '… the CGE model can tell a well-rounded story of the impact of a policy change, such as bilateral trade liberalisation, on an economy. The problem is that, within limits, it can tell almost any story the practitioner wants to tell'.
[19] Hulme (2006) points out that there is an emerging consensus that combined approaches and 'mixed methods' can create knowledge that is more socially useful and can contribute to more effective policy.

There are two ways in which CGE modelling may be married with other methods. First, the insights gained from CGE modelling can be 'soft coupled' to macro-financial models i.e. keep CGE and macro-financial models separate but specify ways through which the models may communicate (Robinson and Lofgren, 2005).[20] Similar soft links can be developed between different econometric studies and the results of CGE modelling.[21] Second, it is generally accepted that an understanding of poverty and development issues requires a cross-disciplinary approach, combining the insights derived from economic analysis with those from other disciplinary perspectives.[22] This is likely to include the use of both quantitative and qualitative evidence, including context specific case studies, participatory methods and expert opinion.[23] The relationship between trade liberalisation and poverty is a complex multidimensional issue that cannot be simply reduced to a standardised economic artefact to fit the theoretical framework of CGE models.

[20] Standard CGE-models only depict the real economy and assume money neutrality, i.e. no interactions between the real and financial dimensions of the economy. It is argued that real-financial modelling frameworks (by hard or soft linking CGE and macro-models) are capable of providing a better treatment of macroeconomic realities, including the loanable funds market, sources of the non-neutrality of money, and real-financial interactions (Robinson and Lofgren, 2005).

[21] For example, Ciuriak (2007) proposes taking account of the non-tariff elements of Free Trade Agreements by integrating the gravity model empirically-based findings of actual FTA impacts into the CGE model assumptions of price elasticities. An insightful experimentation of integrated CGE macro-micro econometric modelling applied to the employment and distributional consequences of the 1999 Brazilian currency crisis has also been recently undertaken in Ferreira et al (2007).

[22] Hulme and Toye (2006). 'Cross disciplinary' is a generic term referring to any analysis or policy recommendation based substantially on analysis and methods of more than one disciple (Kanbur, 2002).

[23] Hulme (2006) discusses the use of quantitative and qualitative (Q squared) methods in the study of poverty. The sustainability impact assessment (SIA) approach to trade policy is an example of this approach, combining quantitative and qualitative evidence to assess the potential developmental impacts of trade liberalisation (George and Kirkpatrick, 2004; Kirkpatrick, George and Scrieciu, 2006).

References

Ackerman, F. (2002), 'Still dead after all these years: interpreting the failure of general equilibrium theory', *Journal of Economic Methodology*, **9** (2), 119-139.

Ackerman, F. (2005), 'The Shrinking Gains from Trade: A Critical Assessment of Doha Round Projections', GDEI Working Paper No.05-01, Global Development and Environment Institute (Medford MA: Tufts University).

Anderson, K., W. Martin and D. van der Mensbrugghe (2006), 'Market and Welfare Implications of Doha Reform Scenarios', Chapter 12 in: K. Anderson and W. Martin (eds.) *Agricultural Trade Reform and the Doha Development Agenda* (Washington D.C., OUP/World Bank).

Anderson, K., W. Martin and D. van der Mensbrugghe (2006a), 'Global impacts of the Doha Scenarios on poverty', Chapter 17 in: T. Hertel and L. A. Winters (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda* (Washington D.C., World Bank).

Annabi, N., F. Cissé, J. Cockburn and B. Decaluwé (2005), 'Trade Liberalisation, Growth and Poverty in Senegal: A Dynamic Microsimulation CGE Model Analysis', CEPII Working Paper No.2005-07, Centre d'Etudes Prospectives and des Informations Internationales (Paris).

Annabi, N., B. Khondker, S. Raihan, J. Cockburn and B. Decaluwé (2006), 'Implications of WTO Agreements and Unilateral Trade Policy Reforms for Poverty in Bangladesh: Short- versus Long-Run Impacts', Chapter 15 in: T. Hertel and L. A. Winters (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda* (Washington DC, World Bank).

Barker, T. (2004), 'The transition to sustainability: a comparison of general-equilibrium and space-time-economics approaches', Tyndall Centre Working Paper No.62, Tyndall Centre for Climate Change Research, University of East Anglia (Norwich).

Barker, T. and S.A. de-Ramon (2006), 'Testing the representative agent assumption: the distribution of parameters in a large-scale model of the EU 1972-1988', *Applied Economics Letters*, vol.**13** (6), 395-398.

Bouët, A. (2006), 'How much will trade liberalisation help the poor? Comparing global trade models', IFPRI Research Brief no.5, International Food Policy Research Institute (Washington, D.C).

Bourguignon, F. and P.L. da Silva (2003), 'Conclusion: Where to Go from Here?', in Bourguignon and da Silva (eds), *The Impact of Economic Policies on Poverty and Income Distribution: Evaluation Techniques and Tools* (New York: Oxford University Press for the World Bank).

Charlton, A.H. and J.E. Stiglitz (2005), 'A Development-friendly Prioritisation of Doha Round Proposals', *The World Economy*, vol. **28** (3), 293-312.

Ciuriak D. (2007), 'Assessing the impacts of FTAs: issues for the small, open and regionally integrated country', paper presented at the Annual Conference of the International Association of Impact Assessment, Seoul, Korea, June 4-8.

Cline, W. R. (2004), *Trade Policy and Global Poverty* (Center for Global Development and Institute for International Economics report, Washington DC).

Cororaton, C.B., J. Cockburn and E. Corong (2006), 'Doha Scenarios, Trade Reform, and Poverty in the Philippines: A CGE Analysis', Chapter 123 in: T. Hertel and L. A. Winters (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda* (Washington DC, World Bank).

Defourny, J. and E. Thorbecke (1984), 'Structural Path Analysis and Multiplier Decomposition within a Social Accounting Matrix Framework', *The Economic Journal* **94** (March), 111-136.

Dollar, D. and A. Kraay (2004), 'Trade, Growth and Poverty', *The Economic Journal*, **114,** F22-F49.

Emini, C.A., J. Cockburn and B. Decaluwé (2006), 'The Poverty Impacts of the Doha Round in Cameroon: The Role of Tax Policy', Chapter 12 in: T. W. Hertel and L. A. Winters (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda* (Washington DC, World Bank).

FAO (2003), *WTO Agreement on Agriculture: The Implementation Experience - Developing Country Case Studies* (Rome: Food and Agriculture Organisation).

Ferreira, F.H.G, P. Leite, L. P. da Silva and P. Picchetti (2007, forthcoming), 'Can the distributional impacts of macroeconomic shocks be predicted? A comparison of the performance of macro-micro models with historical data for Brazil?', in Bourguignon, Bussolo and da Silva (eds.) *The impact of economic policies on poverty and income distribution - Macro-Micro Evaluation Techniques and Tools* (Washington, DC: The World Bank).

Ferreira-Filho, J.B. de Souza and M. Horridge (2006), 'The Doha Round, Poverty, and Regional Inequality in Brazil', Chapter 6 in: T. W. Hertel and L. A. Winters (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda* (Washington DC, World Bank).

Francois, J., H. van Meijl and F. van Tongeren (2005), 'Trade liberalisation in the Doha Development Round', *Economic Policy*, **20** (42), 349-391.

George, C. and C. Kirkpatrick (2004), 'Trade and Development: Assessing the Impact of Trade Liberalisation on Sustainable Development', *Journal of World Trade*, **38** (3), 441-469.

Grassini, M. (2004), 'Rowing along the Computable General Equilibrium Modelling Mainstream', paper presented at EcoMod conference on "Input-Output and General Equilibrium: Data, Modeling, and Policy Analysis", Brussels, September 2-4.

Günter, B.G., L. Taylor and E. Yeldan (2005), 'Analysing Macro-Poverty Linkages of External Liberalisation: Gaps, Achievements and Alternatives', *Development Policy Review*, **23** (3), 285-298.

Hertel, T.W. (1999), 'Applied General Equilibrium Analysis of Agricultural and Resource Policies', GTAP Working Paper no.03, West Lafayette: Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.

Hertel, T.W. and R. Keeney (2006), 'What's at stake: the relative importance of import barriers, export subsidies and domestic support', Chapter 2 in: K. Anderson and W. Martin, *Agricultural Trade Reform and the Doha Development Agenda* (Washington DC, OUP/World Bank).

Hertel, T.W. and L.A. Winters. (2006), 'Poverty Impacts of a WTO Agreement: Synthesis and Overview', Chapter 1 in: Hertel and Winters (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda* (Washington DC, World Bank).

Hulme, D. (2006), 'Integrating quantitative and qualitative research for country case studies of development' Paper prepared for the Global Development Network conference, Delhi, December.

Hulme, D. and J. Toye (2006), 'The case for cross-disciplinary social science research on poverty, inequality and well-being', *Journal of Development Studies*, **42** (7), 1085-1107.

Kanbur, R. (2002), 'Economics, social science and development', *World Development*, **30** (3), 477-86.

Kehoe, P., and T. Kehoe (1994), 'A Primer on Static Applied General Equilibrium Models', *Federal Reserve Bank of Minneapolis Quarterly Review*, **18** (1).

Kirkpatrick, C., C. George and S. Scrieciu (2006), 'Sustainability Impact Assessment of Proposed WTO Negotiations: Final Global Overview Trade SIA of the Doha Development Agenda', Final Report to the European Commission, Impact Assessment Research Centre, Institute for Development Policy and Management, University of Manchester, May.

McKitrick, R.R. (1998), 'The econometric critique of computable general equilibrium modeling: the role of functional forms', *Economic Modelling*, **15**, 543-573.

Naschold, F. (2002), 'Why inequality matters for poverty', ODI Briefing Paper no.2, Overseas Development Institute (London).

Panagariya, A., and R. Duttagupta (2001), 'The 'gains' from preferential trade liberalisation in the CGE models: Where do they come from?', in Lahiri, S. (Ed.) *Regionalism and Globalization: Theory and Practice* (Routledge, London & New York), 39-60.

Polaski, S. (2006), 'Winners and Losers: Impact of the Doha Round on Developing Countries', Carnegie Endowment for International Peace report (Washington, D.C.).

Robinson, S. and H. Lofgren (2005), 'Macro Models and Poverty Analysis: Theoretical Tensions and Empirical Practice', *Development Policy Review* vol. **23** (3), 267-283.

Rodrik, D. (2000), 'Comments on 'Trade, Growth and Poverty' by D. Dollar and A. Kraay', mimeo (October), Harvard University.

Rodríguez, F. and D. Rodrik (2001), 'Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence', Bernanke, B. and K. S. Rogoff (eds.) *Macroeconomics Annual 2000* (MIT Press for NBER, Cambridge, MA).

Scrieciu, S. S. (2007), 'The inherent dangers of using computable general equilibrium models as a single integrated modelling framework for sustainability impact assessment. A critical note on Böhringer and Löschel (2006)', *Ecological Economics* **60** (4), 678-684.

Shoven J., and J. Whalley (1984), 'Applied General Equilibrium Models of Taxation and International Trade: An Introduction and Survey', J*ournal of Economic Literature*, **22** (3), 1007-1051.

Taylor, L. and R. von Arnim (2006), 'Modelling the impact of trade liberalisation: A critique of general equilibrium models', Research Report, Oxfam International (July).

Taylor, L. and R. von Arnim (2007), 'Projected Doha Round benefits hinge on misleading trade models', Schwartz Center for Economic Policy Analysis, The New School Policy Note, March (New York).

Winters, L. A. (2000), 'Trade and poverty: is there a connection?' in D. Ben David, . Nordstrom and L.A. Winters (eds.) *Trade, Income Disparity and Poverty*, Special Study No5. (Geneva: WTO).

Winters, L. A., N. McCulloch and A. McKay (2004), 'Trade liberalisation and poverty: the evidence so far', Journal of Economic Literature, volume **XLII** (March), 72-115.

White, H. and E. Anderson (2001), 'Growth versus Distribution: Does the Pattern of Growth Matter?', *Development Policy Review,* vol. **19** (3), 267-289.

World Bank (2004), *Global Economic Prospects: Realizing the Development Promise of the Doha Agenda* (IBRD / The World Bank).

WTO (2005), 'Ministerial Declaration, Hong Kong 6th Ministerial', WT/MIN(05)/DEC, 22 December 2005, Doha Work Programme, World Trade Organisation.

Zhai, F. and T. Hertel (2006), 'Impacts of the DDA on China: The Role of Labor Markets and Complementary Education Reform', Chapter 10 in: T. W. Hertel and L. A. Winters (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda* (Washington DC, World Bank).

Appendix

Table A1: Trade liberalisation scenarios used in CGE studies

CGE Study	Trade Liberalisation Scenarios
Cline (2004)	• Full merchandise trade liberalisation
World Bank (2004)	• Full merchandise trade liberalisation • Partial trade liberalisation ("pro-poor scenario") o All tariff peaks for developed nations would be cut back to a maximum of 10 percent for agriculture (targeted average 5%), and to 5 percent for manufactures targeted average 1%) o Developing countries would be subject to a maximum agricultural tariff of 15 percent, with a targeted average of 10 percent, and in manufacturing, the peak would be capped at 10 percent (the targeted average would be 5 percent. o Elimination of export subsidies, decoupling of all domestic subsidies, and the elimination of the use of specific tariffs, tariff rate quotas, and antidumping duties and sanctions
Anderson et al (2006a)	• Full merchandise trade liberalisation • Several possible Doha scenarios with a focus on a Core Doha scenario, involving: o Non-agricultural bound tariffs are cut by 50 and 33 percent in developed, and respectively, developing countries; o Agricultural bound tariffs are cut along 3 bands, 45, 70, and 75 percent in developed countries, and along 4 bands, 35, 40, 50, and 60 percent, in developing countries; o Agricultural export subsidies are eliminated; o Agricultural domestic support is cut in 4 economies (by 28% in US, 16% in EU-15, 18% in Norway, and 10% in Australia); o LDCs are excepted
Polaski (2006)	• Poverty effects are only discussed for the Doha scenario case labelled the "Hong Kong scenario": o A modest ambitious market access expansion for both manufactures and agriculture, i.e. a reduction in the applied rates of tariffs and other border protection rates by 36 percent and 24 percent for developed, and respectively, developing countries; o Agricultural domestic support is reduced by one third by all countries, except LDCs; o All agricultural export subsidies are eliminated
Bouët (2006)	• Full merchandise trade liberalisation
Annabi et al (2005)	• Unilateral trade liberalisation of agriculture, manufactures and services
Zhai and Hertel (2006)	• Full merchandise trade liberalisation • Central Doha scenario, same as in Ferreira and Horridge (2006) above
Ferreira-Filho and Horridge (2006)	• Full merchandise trade liberalisation • Central Doha scenario involving a tiered formula with: o Agricultural market access: Inflexion points at 15% and 90% and marginal tariff cuts of 45%, 70% and 75% in developed countries; and inflexion points at 20%, 60% and 120% and marginal tariff cuts of 35, 40, 50 and 60 percent in developing countries o Agricultural market support: marginal rates are cut by 60, and 75 percent for developed countries; for developing countries, 40 percent marginal rate; zero cuts for LDCs o Export subsidies are abolished o NAMA: 50%, 33%, & 0% tariff cuts for developed, developing & LDCs.
Cororaton et al (2006)	• Central Doha scenario, same as in Ferreira and Horridge (2006) above, with indirect tax for tariff revenue replacement • Rest of the world free trade, full domestic liberalisation and indirect tax as replacement tax • Rest of the world free trade, full domestic liberalisation and income tax as replacement tax • Rest of the world free trade, no domestic liberalisation and indirect tax as replacement tax • Full domestic liberalisation, no rest of the world trade reform, and indirect tax as replacement tax
Annabi et al (2006)	• Central Doha scenario, same as in Ferreira and Horridge (2006) above, with indirect tax for tariff revenue replacement • Rest of the World free trade • Unilateral (domestic) trade liberalisation • Full liberalisation of domestic and world trade

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