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Child Labor and International Trade: A Computational Analysis for the Apparel Sector in Asia

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CHILD LABOR AND INTERNATIONAL TRADE: A COMPUTATIONAL ANALYSIS FOR THE APPAREL SECTOR IN ASIA

Abstract

This paper uses a computational equilibrium model of international trade in apparel to investigate the consequences of policies intended to curb child labor in selected Asian countries. The data on input-output structure and income flows of the world economy come from the Global Trade Analysis Project (GTAP) data (Rutherford, 1998) This dataset is based on a multi-regional, multi-sectoral general equilibrium model. The findings of the investigation of this paper are briefly described as follows.

Tariffs applied to reduce child labor may be welfare worsening for working children. Domestic taxes on child labor, if accompanied by lump sum transfers to these children, increase their welfare. Instead, if the parents receive the lump sum transfers the children are worse off. This paper also shows that transfer payments from the developed countries in the form of subsidies to non-market activities of children in these countries may not only reduce child labor but also improve their welfare. Although stemming from a static model, which does not represent education decisions explicitly, the results bear important implications for policy makers in both developing and developed countries. Finally, some sensitivity calculations are carried out. The conclusions are robust with respect to changes in the underlying parameters.

1. Background and Literature Review

This paper studies the economics of child labor standards in the apparel sector in Asian countries and their relationships with international trade. An important issue in assessing the impacts on children's welfare of trade restrictions is that increased tariff or trade sanctions are likely to interact with the amount of child labor in the developing countries in at least two ways. First, while these instruments are likely to reduce child labor in export sectors, they may as well force the unemployed children to seek employment in informal sectors (Panagariya, 2000). Thus there may be no net reduction in the aggregate volume of child labor. Second, wages received in the informal sectors may be lower as well as the working conditions may be worse. Further, the unemployed children may even engage in activities less desired by society (Maskus, 1997).

The purpose of this paper is to investigate the relative importance of these interactive effects using a computable general equilibrium (CGE) model. The analysis is conducted within the framework of a global model of production and trade. For convenience, the model takes the GTAP framework (Hertel, 1997) as a starting point. This model is used to investigate the effects of using various trade and non-trade instruments on child labor, children's welfare, and exports of apparels from selected Asian countries. In order to emphasize the qualitative results, the analysis is confined to achieving a predetermined 25% reduction in child labor, using three different policy instruments: a domestic tax on child labor, a tariff on apparels imported from selected Asian countries, and subsidies from the United States and OECD countries to children's non-market activities, a proxy for education. The relevant points of interest are as follows: 1) *How does each instrument affect the amount of child labor? 2) What are their effects on children's welfare? 3) How does each instrument interact with trade of apparels from selected Asian countries to the United States and the OECD? And 4) Who would gain or lose the most from such policies?*

The linkage between labor standards and international trade was recognized as early as the nineteenth century (Brown, Deardorff, and Stern 1996). It has, however, recently gained prominence in the international policy debate. While NAFTA began originally as a simple free trade arrangement, it ended up much closer to the EC model of integration, with the supplemental

arrangements on environment and labor standards becoming the critical components of the treaty (Anderson 1995). The issue of labor standards is widely debated in the high-wage countries, where growing wage inequality and high levels of structural unemployment are currently quite dominant in economic discourse (Maskus and Holman 1996). Although economists have long argued that varying standards across countries is a natural outcome of an efficient allocation of world's resources, the debate on labor standards persists (Bhagwati and Hudec, 1996).

Absent any strong policy tools, many policy makers and activists believe that the incidence of child labor will not only hurt the future generations of a country, but also may raise another race-to-the-bottom war because it may create artificial comparative advantage for a country. Although highly contentious both theoretically and empirically, debate around the issue of race-to-the bottom dominates the international trade policy dialogues and raises the fears of worldwide downward harmonization of standards around the world. The intensity of such demands for uniform higher standards was exemplified by incidents at the November 1999 WTO meetings in Seattle. These demands for an enlarged scope of trade negotiations have required economic and legal experts to renew their attention on certain issues regarding labor standards. Although the issue of child labor standards ranks highly in international policy debates, there has been relatively little work on the connection between trade and child labor.

The first set of theoretical analyses, presented in Brown, Deardorff, and Stern (1996), focuses on general labor standards and their implications for trade, terms of trade, and welfare. They use a two-factor Heckscher-Ohlin model and show that a removal of a portion of the labor force (for example, by elimination of child labor, or by ensuring workers' rights not to work in hazardous conditions) will lead to an increase in prices of labor-intensive goods. As a result, labor-abundant countries (presumably the less developed countries) would enjoy an improved terms of trade. In this context, the advanced countries should favor limiting the spread of such standards rather than imposing them on others.

In a more recent paper, Brown, Deardorff, and Stern (1999) explore issues of child labor exploitation in developing countries and the variety of trade and other policy options and programs that are available in the United States and other industrialized countries to deter such exploitation.

By developing a static Heckscher-Ohlin model, they show that trade policies may actually hurt the children as well as raise their employment under different scenarios. Finally, although they do not present any empirical evidence on the effectiveness of an education subsidy, their theoretical findings underscore the usefulness of various forms of financial assistance to the developing countries. These transfers can be used to subsidize the education of poor youth and in particular to provide children and their families an incentive to remove them from arduous activities.

Maskus and Holman (1996) present another interesting static model of trade. In their model, child workers are employed in an informal sector of the economy. The informal sector produces an intermediate good that is used in the production of the exportable good. They introduce a market for a minimum-age standard and show that the externalities resulting from the presence of child labor generates a social demand for a minimum age that might be higher or lower than the age determined by the market. They consider several policies to eliminate the inefficiency associated with the externalities and show theoretically that restrictive trade is an inefficient means of accomplishing a social goal of reducing child labor or increasing minimum-age standard. Although they allude to the significance of child education, they do not formally model it.

In another theoretical paper, Brown (1999) analyzes the economic mechanics and consequences of product labeling. When product labeling is applied to child labor, he finds that even in the optimistic case in which consumers pay a labeling premium that exceeds the additional cost of adult-only technology, there is no net reduction in the labor force participation of children. Children are better off only when the fund (that is, a transfer from the North to the children in South) is used for their benefit.

Agarwal (1995) conducts a descriptive study on the linkages between labor standards and trade and finds no support for labor standards in developing countries unduly influencing trade flows. Rodrik (1995) studies econometrically the connection between labor standards and international trade and finds that the results are statistically insignificant enough and cannot be used to support the claim that low labor standards or the presence of child labor can create comparative advantage. Rodrik (1995) uses dummy variables to investigate the effects of child labor. His paper is a pioneering empirical work in the area of child labor and international trade. He, however, stops

short of examining quantitatively how a reduction in child labor may affect trade flows or how different trade or non-trade instruments can influence the incidence of child labor. Among other econometric papers, Grootaert (1998), Psacharopoulas (1997), and Ravallion and Wondon (1999) primarily focus on the linkage between child labor and schooling in a closed economy.

Hussain (1999) and Ranjan (1999) develop dynamic models of child labor and human capital and investigate econometrically the linkages between child labor, economic growth, and income inequality. While these two papers are significant because their hypotheses are generated from coherent economic theories, they still do not address the interface between trade and child labor. This paper adds to the literature on child labor and international trade in a number of ways. Here economic theory is used to investigate the employment, welfare, and trade consequences of using various trade or non-trade instruments to reduce child labor in selected Asian countries.

The rest of the paper is organized as follows. Section 4.3 outlines the basic methodology that is used to build a multi-regional and multi-sector model of child labor and trade. Data related issues and comments on calibration are discussed in detail in section 4.4. Section 4.5 presents the primary results and a series of sensitivity analyses. Section 4.6 concludes the paper and discusses briefly the possibilities for future extensions.

2. Methodology

Quantitatively, the two ways one can investigate the questions that were raised in the introduction are: i) econometric estimation of different parameters, which can be used to analyze welfare implications of different policy tools; and ii) computable general equilibrium (CGE) analysis. This paper uses CGE analysis to examine the following questions: 1) *How does each instrument affect the amount of child labor? 2) What are their effects on children's welfare? 3) How does each instrument interact with trade of apparels from selected Asian countries to the United States and the OECD? And 4) Who would gain or lose the most from such policies?*

Balistreri and Rutherford (undated) point out there are at least three advantages of using CGE models. First, CGE models have relatively transparent theoretic structures that capture the entire economy. CGE models, as opposed to partial equilibrium or reduced form models, can

capture the inter-market relationships and recognize important macroeconomic impacts. Econometric models mostly relate prices and quantities to historically important drivers, rather than explicitly representing supply, demand, and prices. Even the power of a simultaneous equations model is reduced when there are too many endogenous variables and the relationships are mostly nonlinear.

Second, CGE models are able to analyze effects of unprecedented changes in the economy. Point estimates outside the range of historical data have a large variance and thus may be less reliable in predicting certain effects. CGE model can analyze large, discrete policy changes. Finally, CGE models are calibrated to actual input-output data. This feature ensures that the relative size of a market is recognized when tracing the impacts of various policy changes through the economy. Purely theoretical arguments can sometimes emphasize negligible impacts. The scaling of markets and sectors in CGE models, which are founded in data, often reveals that other effects dominate these impacts.

The analysis in this paper is conducted within the framework of a global model of production and trade. For convenience, the model takes the GTAP framework (Hertel, 1997) as a starting point. This model is used to investigate the effects of using various trade and non-trade instruments on child labor, children's welfare, and exports of apparels from selected Asian countries. Below the general model structure and empirical implementaion are briefly discussed.[1]

[1] Please see Rutherford (1998) for a detailed discussion of GTAP data set and static model that are extensively used in computational analysis.

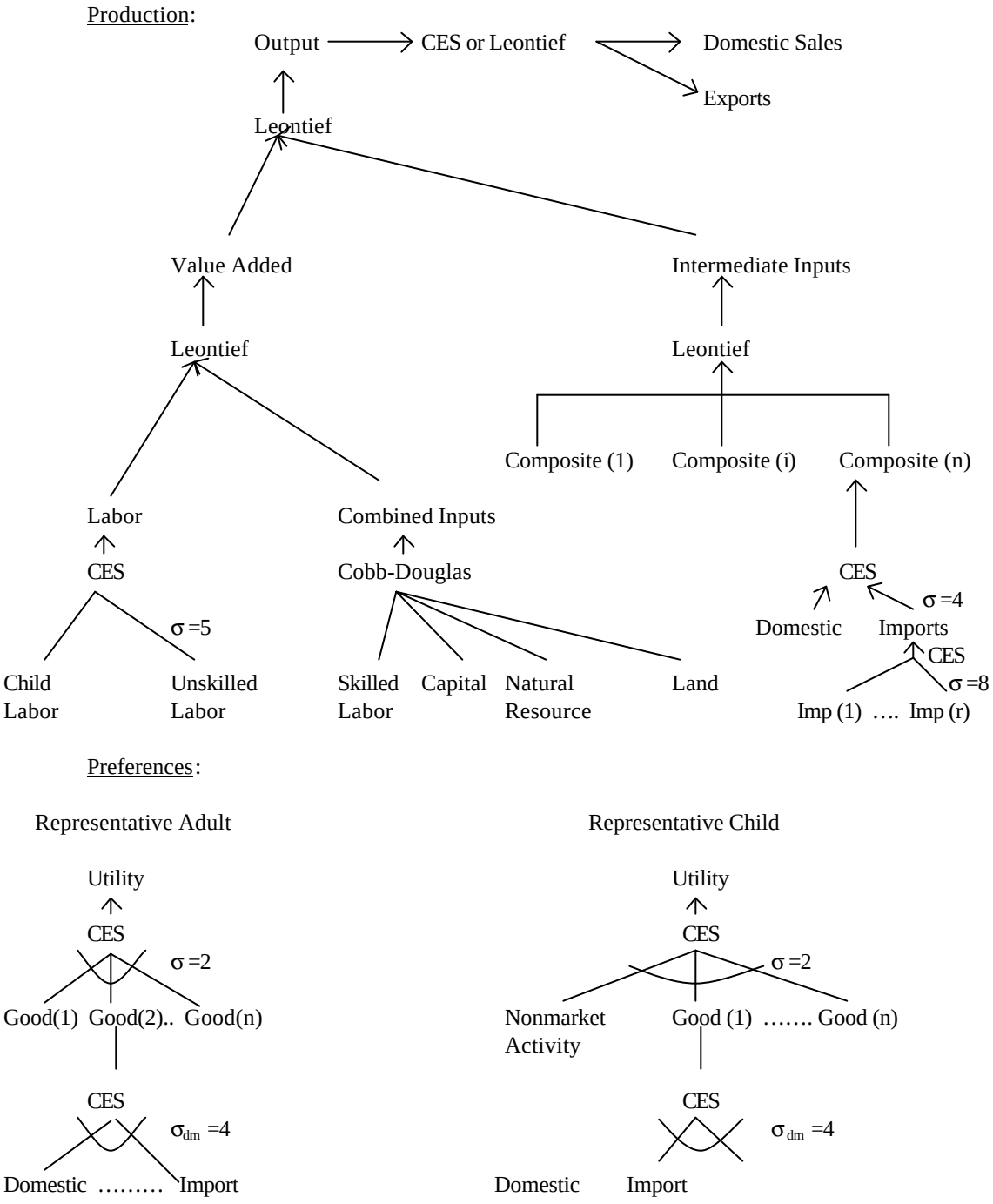
2.1 General Model Structure

There are three production sectors: wearing apparel, other goods, and composite investment sector.[2] In order to focus on the problem of child labor in Asia, in particular, the number of regions was limited to seven. They are the United States, OECD countries, India, Sri Lanka, Rest of South Asia (RAS), Rest of Asia (ASI), and Rest of the World (ROW). The three goods are produced by a total of six factors: land, natural resources, capital, skilled labor, unskilled labor, and child labor. Of these factors, child labor and unskilled labor constitute the total amount of unskilled labor in a region.

An Armington constant elasticity of substitution (CES) allows for substitution in goods produced for domestic and foreign markets. Here, the elasticity is assumed to be infinity. That is, produced goods can be transferred freely between domestic consumption and exports. Firms produce goods by combining value added and intermediate inputs. Intermediate inputs are aggregated by means of standard fixed coefficients from each economy's input-output structure. Each intermediate input is an aggregate of supply sources from the domestic and foreign markets. An Armington constant elasticity of substitution (CES) function is applied in defining the intermediate composite goods.

Final output is a CES function of inputs from intermediate composite goods, capital, land, resources, skilled labor, unskilled labor and child labor. Capital, land, resources, and skilled labor are combined by use of a Cobb-Douglas (CD) technology. Unskilled and child labor are combined in a CES nest to produce a composite amount of unskilled labor. Capital owners are assumed to receive any current-account imbalances in the benchmark. Since this is a static model, there is no requirement that current-account imbalances be paid for ultimately, as there would be in a dynamic model. In this model a deficit on current account acts as gift to capital owners. The complete model is sketched in the flow chart in Figure 1. This sketch is primarily based on the flow chart presented in Maskus, Rutherford, and Selby (1995).

Figure 1. Technology and Preference Structure



[2] Various sectors may be aggregated to produce more compact datasets, as it was done in this analysis. The composite investment sector, however, must appear as a distinct sector in any aggregation (Rutherford 1998).

There are two representative consumers in this model: an adult and a child. The lower half of Figure 1 depicts the structure of their utilities. A CES utility function captures their preferences. The representative adult derives utility from n consumption goods from r regions. The representative adult allocates her income to consumption goods in two steps. First, he allocates consumption across types of goods via a CES preference structure. In the second step, each commodity consumed is decomposed into consumption of domestic goods and imports.

These goods are aggregated in an Armington CES function, allowing for less-than-perfect substitution between them. In this paper, domestic and import goods are assumed to be highly substitutable in consumption (elasticity = 4). The preference structure of the representative child is identical to that of the adult except he has an extra source of utility, namely non-market activity. This extra utility is a proxy for education.

There are certain market-clearing conditions that must be satisfied. Incomes must be balanced with expenditures in a series of budget constraints. Representative adults derive income from their endowments of each factor of production. Representative children derive income only from their labor supply. Additionally, they receive fixed endowments of consumption goods from the representative adults (i.e. parents). Capital is assumed to be mobile between sectors and immobile between regions. The "real exchange rate" (the shadow price of foreign exchange) in order to keep the current account fixed at current world prices. Finally, market clearing conditions are imposed on all goods and factor markets by requiring that the quantity supplied equals the quantity demanded in each market.

The numeraire commodity is the aggregate consumption basket, which carries an aggregate price index, which is used to calculate changes in real magnitudes. Welfare is measured in terms of changes in real consumption of the representative adult and child. Welfare comparisons are reported in percentage terms in comparison to utility levels in the benchmark case. Accordingly, the utility

indexes are measures of Hicksian equivalent variation for both agents.[3] The model equations are presented in Appendix A.

[3] Equivalent Variation=$\mu(p^o;p',m')-\mu(p^o;p^o,m^o)$. It uses the current prices as the base and measures how much additional money is needed at the benchmark prices to make the consumer as well off as he would be facing the current prices. (Varian 1992)

2.2 Empirical Implementation

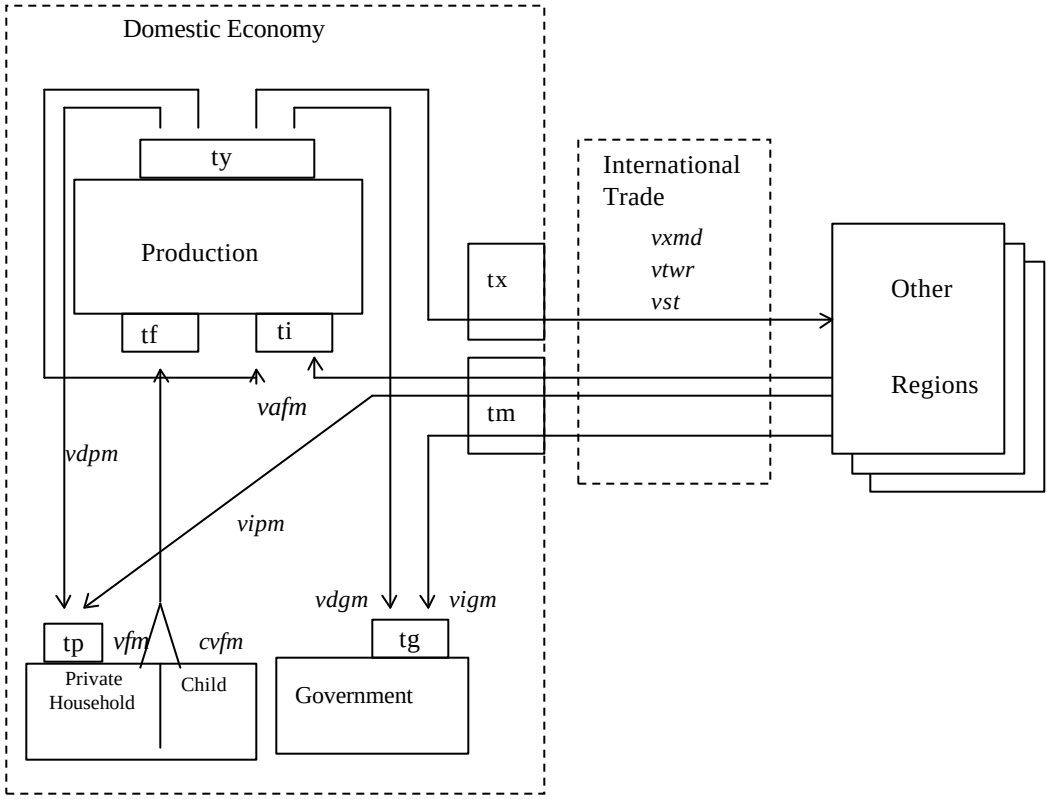
The CGE model described above is constructed for computational purposes with the Mathematical Programming System for General Equilibrium analysis (MPSGE, Rutherford 1999) in the Generalized Algebraic Modeling System (GAMS). GAMS is a computer language which was originally developed to assist economists at the World Bank in the quantitative analysis of economic policy questions.

The data on input-out structure and income flows of the world economy come from the Global Trade Analysis Project (GTAP) database (Rutherford, 1998). This dataset is based on a multi-regional, multi-sectoral general equilibrium model. All GTAP datasets are defined in terms of three primary sets: r – the set of countries and regions, i – the set of sectors and produced commodities, and f – the set of primary factors. It provides self-consistent production, consumption, and bilateral trade statistics for 45 regions and 50 goods. For the purpose of focusing exclusively on the apparel sector, 48 sectors were aggregated into one "others" sector. Also, the current analysis aggregates the 45 regions into 7 regions to focus on primary trade patterns.

Figure 2 presents the GTAP flows explicitly represented in the dataset. The parameters that begin with a "t" refer to taxes and other parameters in the figure refer to value of goods flow among sectors. A complete description of the parameters is given in Appendix B. Additionally, the GAMS representation of the GTAP dataset and the complete MPSGE formulation are presented in Appendix C.

The data that are used to proxy for children's participation in the labor market merit discussion at this point. In the CGE analysis, a factor's value share in production reflects its participation. The same convention is followed to capture children's participation in the apparel sector. Precise data on the monetary contribution of children to their household incomes do not exist. Therefore, different sources are used to extract the approximate value share of children from the share of unskilled labor in the apparel sector.

Figure 2. GTAP flows explicitly represented in the dataset.



Anker and Melkas (1996) indicate that each working child's contribution to household income ranges from 10 to 25 percent. Bailey-Wiebecke and Rahman (1996) state that child workers account for approximately 20% of the total labor force in the Bangladeshi apparel sector and their average monthly income is approximately 50% of that of an average adult worker. According to another study (Chaudhury and Majumder, 1991), 13% of the workers in the apparel sector were found to be child laborers. Based on these numbers and the fact that child labor is usually underreported, a conservative estimate of 10% of the unskilled laborers' income in the apparel sector is assigned to children's value share in the apparel sectors in India, Sri Lanka and rest of South Asia. For other Asian countries and the rest of the World child labor is assumed to be

lower, at 5% and 2% respectively. In order to calculate children's total endowment it is assumed that in the benchmark equilibrium the children spend 50% of their time working.[4]

3. Simulation Results

3.1 Main Results

The objective utilized in the CGE model is a 25% reduction in child labor in the apparel sector in selected Asian countries. This value is chosen arbitrarily for ease of exposition. Four counterfactual exercises are undertaken in the model. They are:

1. Import tariff: The US and OECD impose tariffs on imports of apparel products from the countries that use child labor in the production of apparel products.
2. a. Domestic Taxes: Governments in countries where child labor exists impose proportional taxes on the use of child labor in the apparel sector and then transfer the tax revenues to the representative child. Although this may be an unlikely option in reality, the results from this exercise are expected to offer valuable insights for policy makers.

   b. Domestic Taxes: Governments in countries where child labor exists impose proportional taxes on the use of child labor in the apparel sector and then transfer the tax revenues to the representative adult.
3. Subsidy: The US and OECD subsidize non-market activities of the representative child in countries where child labor exist.

In the first set of results we assume the existence of child labor only in the apparel sector. Since the employment of children in the apparel sector in poor countries has drawn most criticisms in the US, it is informative to examine first the likely effects of different policy instruments on child labor under the assumption that these children are unable to get employment in any other sector.

[4] In the absence of any concrete data on children's non-market activities, this division between work and non-market activities is arbitrarily assumed in the benchmark equilibrium. On the basis of anecdotal evidence, it is probably safe to assume that on average children work 50% of their available time. It is also worth mentioning here that the division between market and non-market activities is endogenous. Once the policy instruments are introduce the division between labor and non-market activities will be determined.

Later, this assumption is relaxed and sensitivity analyses are conducted under the assumption that children can be employed in other sectors too.

We assume a high substitutability between child labor and adult unskilled labor. Specifically, we assume that the elasticity of substitution is 5 between child labor and unskilled adult labor. The support for a high elasticity is abundant in the literature. Among others, see Silvers (1996), Basu and Van (1998), and Rahman (1997). Silver (1996) argues that employers substitute unskilled workers with child labor in order to maintain a low cost of production. Basu and Van (1998) use this substitutability as the main basis of their model to generate multiple equilibria. While investigating the child labor situation in Bangladesh, Rahman (1997) identifies the substitutability between adult and child workers to be high. This substitutability works as a strong "pull" factor for the incidence of child labor.

Given the assumptions of the model, the first set of results is presented in a series of tables below. The detailed results of sensitivity analyses will be confined to the Appendix D. Table 1 shows the amount of child labor (value share of children in the apparel sector) in the apparel sector by regions in 5 different scenarios.

Table 1: Children's Value Share in Apparel Production by Scenario
(Millions of US dollars)

	Benchmark Equilibrium	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
India	75	65	57	57	57
Sri Lanka	16	12	12	12	12
Rest of South Asia	42	32	32	32	32
Other Asian countries	435	348	326	326	326
Rest of the World	296	272	222	222	222

A brief note on the benchmark value is in order. As discussed earlier, approximately 20% of the apparel sector labor force is accounted for by child labor. Children receive approximately 50% of the adult wage. Based on these estimates, the benchmark value share of children is calculated and presented in the first column of Table 1. In order to achieve the predetermined target

of 75% of benchmark child labor, the rates for the tariff, taxes, and subsidy were endogenously determined in the model. However, to achieve the target we allowed these instruments vary only between 0 and 2000%. That is, for example, if 2000% tariff or tax failed to reduce child labor by 25%, we didn't raise them any further because any further increase is unlikely in reality. Therefore, in the next four columns of Table 1 children's value shares are endogenously determined to reach the targeted level of 75% after the introduction of tariff, domestic taxes, and subsidy respectively.

Table 2 summarizes the magnitudes of these policy instruments. Interestingly, in spite of a 2000% tariff, children's value share does not fall by 25% (second column of Table 1) in India, the rest of Asia, or the rest of the world. For example, a 2000% tariff on apparel imports from India reduces child labor in that sector only by 14% (from US$75mill to US$65mill). While many experts and politicians advocate the use of tariff to curb child labor or seek to ban products made with child labor, the results show that even a prohibitively high tariff cannot achieve even a modest target in countries where the incidence of child labor is relatively high. On the other hand, domestic taxes and subsidies from the developed countries appear effective in achieving the target, at modest rates of 19-23%.

Table 2: Tariff, Tax, and Subsidy Rates by Scenarios and Subsidy Amounts

	Tariff	Tax (Revenue Transferred to children)	Tax (Revenue Transferred to adults)	Subsidy	Subsidy Amount (millions of US$)
India	2000	21	23	19	18
Sri Lanka	38	21	23	19	4
Rest of South Asia	54	21	23	19	10
Other Asian countries	2000	21	23	19	101
Rest of the world	2000	21	23	19	69

The last column of table 2 is of particular interest to policy makers in the US and the OECD. It translates the subsidy rates into absolute U.S. dollar amounts needed to induce children that are employed in the apparel sector to withdraw from work and participate in non-market

activity.[5] The number in the row for India is 18. It implies that the United States and OECD countries need to make a transfer payment of US$ 18 million, each paying 50% of this amount, to Indian children to encourage them to reduce their work effort by 25% and utilize the time saved in acquiring education. Only then will child labor fall to 75% of the benchmark level.

The United States and OECD countries, on a regular basis, transfer funds to different programs of the ILO for improving labor standards. If the US and the OECD countries desire to reduce the worldwide child labor in the apparel sector by 25%, they will need to earmark approximately US$202 million (table 2 column 5 total) for the countries where children work in the apparel sector.[6] Given the static nature of the analysis it should be noted that in a dynamic context this amount is expected to go higher. Therefore, this amount can be considered the estimated annual transfer amount that is required to go from the developed to the developing countries. In a related paper, Brown, Deardorff, and Stern (1999) conjectured that the amount of money needed to subsidize education of poor youth is minuscule compared to what the United States alone contributes to many domestic and even international initiatives. The figures presented here seem supportive to their conjecture.

The estimates of subsidies can further be compared with some figures derived from different ILO sources. A relevant question is whether the estimates of the subsidy amount, derived from the CGE analysis, make sense. To investigate this we need information on child labor in the apparel sector in a specific country or a region. Since figures on children employment in the apparel sector by country or region are not available, we will use estimates of child labor in the apparel sector of Bangladesh. The question we investigate is: how much should the subsidies be to reduce child labor in the apparel sector of Bangladesh by 25%?

Anker and Melkas (1996) document information on economic incentives intended to reduce child labor. Their 18-country survey was conducted in collaboration with the International Save the Children Alliance, the International Group on Child Labour, and the UNICEF International Child

[5] For simplicity, this paper assumes away any possibility of children being displaced and forced into activities less desired than working in a factory, for example, prostitution.

Development Centre. They find that different NGOs were using a variety of income replacement or subsidy programs to attack the problem of child labor. 31 NGOs out of 34 reported that such programs were successful in reducing child labor. The payments in-kind were the most common form of benefit and their average cost per child per year was US$75. Rahman (1997) reports that approximately 200,000 children are employed in the apparel sector in Bangladesh. Based on the information provided by these two sources, the approximate subsidy required to reduce child labor by 25% from the Bangladeshi apparel sector is approximately US$4 million. According to the figures presented in Table 2, the United States and OECD need to pay US$10 million to reduce child labor by 25% in the apparel sector in the South Asia which is comprised of Bangladesh, Pakistan and Nepal in the disaggregated GTAP dataset. The estimates from the CGE model appear to be quite reasonable.

Table 3 summarizes the effects of the different instruments on apparel exports. The exporting countries are organized in rows and the importing countries in columns. The figures on the diagonal are total consumption of domestic apparel. As a result of 2000% tariff, apparel exports from Sri Lanka and the rest of South Asia to the US and the OECD countries fall by 64% and 84% respectively. A 2000% tariff by the United States and OECD reduces India's export volume of apparel from US$3 billion to zero, which is equivalent to a complete ban on apparel imports from India. A ban (or a prohibitive tariff) could potentially evaporate the trade of apparel between India and the US. Such a trade restriction, however, does not reduce child labor in the Indian apparel sector by a 25%.

This failure of a prohibitive tariff can be explained by the large domestic consumption of its own apparel products by India. This large domestic demand for its own apparel products, as indicated by the figures on the diagonal of each sub-table in table 3, explains why such a prohibitive tariff cannot achieve the objective. Indian consumers spend more than its combined exports volume to the US and the OECD countries in the benchmark. The apparel sectors in all countries, however, shrink unambiguously.

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[6] The issues of implementation and monitoring are ignored here because they fall outside the scope of this paper.

Table 3: Apparel Trade Volumes under different scenarios (millions of US$)

	India	Sri Lanka	Rest of South Asia	Asia	USA	OECD	Rest of the World
3.1 Benchmark Apparel Trade:							
India	4,765	0	3	92	981	2,417	370
Sri Lanka	0	93	0	3	906	618	8
Rest of South Asia	0	5	1,534	15	1,792	2,100	111
Other Asian countries	5	14	52	28,853	13,648	29,441	5,455
US	2	2	0	139	98,766	3,644	2,878
OECD	5	8	13	1,714	7,113	205,766	4,888
Rest of the World	0	5	0	114	9,757	20,395	77,713
3.2 Post Tariff:							
India	4,658	0	3	95	0	0	388
Sri Lanka	0	87	0	4	398	153	9
Rest of South Asia	0	3	1,445	16	396	246	128
Other Asian countries	5	7	46	27,363	0	0	5,494
US	2	1	0	117	112,929	6,289	2,523
OECD	5	4	11	1,535	21,033	227,149	4,529
Rest of the World	0	2	0	109	0	0	77,062
3.3 Post Input Tax (Tax Revenue Transferred to the Representative Child):							
India	4,762	0	3	92	978	2,410	369
Sri Lanka	0	93	0	3	903	616	8
Rest of South Asia	0	5	1,533	15	1,789	2,095	111
Other Asian countries	5	14	52	28,834	13,631	29,396	5,447
US	2	2	0	139	98,781	3,646	2,880
OECD	5	8	13	1,716	7120	205,791	4,892
Rest of the World	0	5	0	114	9,756	20,386	77,690
3.4 Post Input Tax (Tax Revenue Transferred to the Representative Adult):							
India	4,762	0	3	92	978	2,410	369
Sri Lanka	0	93	0	3	903	616	8
Rest of South Asia	0	5	1,533	15	1,789	2,095	111
Other Asian countries	5	14	52	28,834	13,631	29,396	5,447
US	2	2	0	139	98,781	3,646	2,880
OECD	5	8	13	1,716	7,120	205,791	4,892
Rest of the World	0	5	0	114	9756	20,386	77,690
3.5 Post- Subsidy:							
India	4,762	0	3	92	978	2,409	369
Sri Lanka	0	93	0	3	903	616	8
Rest of South Asia	0	5	1,533	15	1,788	2,094	111
Other Asian countries	5	14	52	28,836	13,630	29,394	5,447
US	2	2	0	139	98,781	3,646	2,880
OECD	5	8	13	1,716	7,120	205,791	4,893
Rest of the World	0	5	0	114	9,755	20,385	77,691

These results refute the popular belief, advocated and made popular by Senator Tom Harkin in 1992, among various activist groups that a complete ban on products made with child labor can force developing countries to eliminate child labor. Note that we have not yet assumed child in other sectors. As we have already found that a pre-existing, large amount of child labor is hard to eliminate. Therefore, it is intuitive that if such a prohibitive tariff cannot reduce child labor in a relatively small sector, it is likely fail to reduce child labor in other sectors.

On the other hand, the apparel sectors in the United States and OECD expand unambiguously. The value of consumption of domestic apparel products by the United States increases from a benchmark amount of US$99 billion to US$113 billion. Also, the apparel exports from the United States rise from US$6.7 billion to almost US$9 billion. This partial equilibrium picture is exactly what the popular media and protectionist groups rely on to conjecture that a tariff by the United States may not only reduce child labor in developing countries but also improve the production of the apparel sector in the United States. This partial improvement in the performance of the United States apparel sector is misleading because they ignore the of general equilibrium effects.

Such contractions or expansion of apparel sectors may have important welfare consequences for both the children and the adults in all countries. For example, the expansion of the apparel sector in the US has to occur at the cost of resources withdrawn from other sources.[7] A tariff essentially causes a redistribution of wealth in every country. Unless the positive terms of trade effects more than offset the negative volume of trade effects, the United States cannot benefit from tariffs. Therefore, without examining the overall welfare implications of such a shift, we cannot conclude that a unilateral tariff is beneficial for the United States.

Table 3 also shows that although domestic taxes or subsidies reduce child labor by exactly 25% in apparel sector, they do not alter export performances of these countries significantly; nor do they alter a country's own consumption in any significant way. The reason is that while increased

[7] See Markusen et. al (1995), chapter 15.2 for a discussion of the welfare loss from tariffs.

tariffs by the US and the OECD significantly alter the terms of trade and the volume of trade, domestic taxes or subsidies do not. The ineffectiveness of domestic taxes and subsidies to alter terms of trade and thus trade volumes in any significant way can be explained by the relatively small sizes of these exporting economies.

Before examining the welfare impacts of these instruments, we will briefly investigate the their impacts on adult labor in these countries. Table 4 summarizes the changes in value shares of skilled and unskilled adult workers in the production apparel and products. Not surprisingly, the effects of a tariff on the adults workers in developed are opposite compared with those on adult workers in the developing countries. On the one hand, the employment (represented by the value shares) of both types of workers in the US and the OECD apparel sectors rise. On the other hand, the employment of these two types of workers shrinks in the apparel sectors of India, Sri Lanka, the rest of South Asia, other Asian countries, and the rest of the world.

The employment effects of a tariff on the "other" sectors are exactly opposite. The employment of workers in the other sectors in the US and the OECD falls whereas the employment in the other sectors in all other countries rises. While Table 1 shows that a tariff needs to be prohibitively high to reduce child labor in some countries, table 4 shows that same tariff has the largest general equilibrium effects on the overall employments of adults in all countries. Since tariff affects unemployment via affecting demand for the apparel products, the employment of adults in both sectors and children in the apparel sector is affected significantly.

Table 4 also shows that domestic taxes and subsidies do not affect adult employment significantly. The reason is that child workers account for only between 2 and 10% of total employment in the countries that employ children. Therefore, a direct instrument that is capable of reducing child labor by 25% need not be strong enough to affect the employment of adults.

Table 4: Adults' Value Shares by Sectors under different scenarios (Millions of US$)

	Benchmark Equilibrium	Post Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
4.1 Skilled Adults' Value Share in Apparel Production					
India	102	60	102	102	102
Sri Lanka	22	8	22	22	22
Rest of South Asia	56	22	56	56	56
Other Asian countries	1,660	768	1,660	1,660	1,660
OECD	10,738	13,511	10,740	10,740	10,740
US	6,099	7,054	6,100	6,100	6,100
Rest of the World	2,252	1,618	2,253	2,253	2,253
4.2 Unskilled Adults' Value Share in Apparel Production					
India	679	387	695	695	694
Sri Lanka	143	52	146	146	146
Rest of South Asia	379	139	387	387	387
Other Asian countries	8,261	3,729	8,349	8,349	8,349
US	22,417	25,904	22,421	22,421	22,421
OECD	50,991	64,061	51,004	51,004	51,004
Rest of the World	14,513	10,401	14,574	14,574	14,574
4.3 Skilled Adults' Value Share in the Production of Other Goods					
India	25,705	25,746	25,705	25,705	25,705
Sri Lanka	1,193	1,207	1,193	1,193	1,193
Rest of South Asia	6,405	6,439	6,405	6,405	6,405
Other Asian countries	169,978	170,870	169,978	169,978	169,978
US	1,693,422	1,692,467	1,693,422	1,693,422	1,693,422
OECD	3,328,921	3,326,148	3,328,921	3,328,921	3,328,921
Rest of the World	430,329	430,964	430,329	430,329	430,329
4.4 Unskilled Adults' Value Share in the Production of Other Goods					
India	111,995	112,288	111,980	111,980	111980
Sri Lanka	4,094	4,185	4,091	4,091	4,091
Rest of South Asia	26,970	27,209	26,961	26,961	26,961
Other Asian countries	462,296	466,828	462,208	462,208	462,208
US	2,486,905	2,483,418	2,486,901	2,486,901	2,486,901
OECD	5,502,399	5,489,330	5,502,387	5,502,387	5,502,387
Rest of the World	1,082,358	1,086,470	1,082,296	1,082,296	1,082,296

The welfare impacts of these instruments on children's welfare are summarized in Table 5. These impacts should be of interests to those who are concerned about the plight of children in poor countries. A prohibitive tariff or banning importation of apparel products from small regions, such as, the rest of South Asia unambiguously reduces the production of apparels and child labor in those

sectors. Such a drop in child labor is, however, accompanied by a worsening of children's welfare in those countries.

Table 5: Summary Report on Child Welfare
(% Changes in Hicksian Equivalent Variation)

	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
India	-1	1	-2	4
Sri Lanka	-2	1	-2	4
Rest of South Asia	-2	1	-2	4
Other Asian countries	-1	1	-2	4
Rest of the World	-1	0	-2	4

The figures in the "Post-Tariff" column in table 5 confirm that tariffs imposed by developed countries are detrimental to children's welfare in developing countries. Whereas if the government in developing countries imposes proportional taxes on child labor with the concomitant tax revenues being passed on to children in a lump-sum fashion, children's welfare rises (see the second column of the above table). The intuition behind such an improvement is that while increased taxes reduce the demand for child labor, the resultant transfer more than offsets the loss in wage. Absent any information and implementation problem, such a mechanism, although quite unlikely, seems far superior instrument to a tariff imposed by developed countries.

If the tax revenues, however, are transferred to adults, children are unambiguously worse off. Taxes simply engender a drop in children's wage by reducing the marginal product of child labor. In the absence of any direct transfer, the children bear the brunt of lower participation in the labor force. The last column of table 5 shows that subsidies from developed countries to the children in poor countries improve children's welfare. That is, the most effective means to curb child labor as well as to improve children's wellbeing seems to be a subsidy to children's non-market activities from developed countries. In addition to Brown, Deardorff, and Stern (1999), Maskus and Holman (1996) and Maskus (1997) unequivocally draw attention to the need for such subsidies. Srinivasan (1996) also underscores this point by stating "indeed a test of the depth of

their [*developed countries*] humanitarian concern is the price that citizens are willing to pay for translating the concern into actual increase in welfare of workers in poor countries." According to table 5, children's welfare in these countries rises by 4% because such subsidies, by producing a wealth effect, is like to facilitate children's leisure and education. At this stage, it may not be unfair to conjecture that such large static gains have the potential to become even larger dynamic gains in the sense that these children will become adults with higher stock of human capital in the future. The static scope of this model does not allow for quantification of such gains.

Finally, Table 6 shows how these instruments affect the representative adults' welfare in both developing and developed countries. Under the tariff regime, the adults' welfare in India, Sri Lanka, the rest of South Asia, and other Asian countries falls significantly while the fall in welfare in the rest of the world, the US and the OECD is almost negiligible (not reported in the table). For the other instruments, the welfare effects in all the regions except Sri Lanka is negligible. To sum up the findings, a tariff appears to be the welfare worsening for all. The policy implications appear straightforward. Since developed countries can maintain almost the same level of welfare regardless of which instrument is used, it seems efficient to allow subsidization of children's non-market activities.

Table 6: Summary Report on Representative Agents' Welfare
(% Changes in Hicksian Equivalent Variation)

	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
India	-1	0	0	0
Sri Lanka	-3	-1	-1	-1
Rest of South Asia	-3	0	0	0
Other Asian countries	-1	0	0	0
US	0	0	0	0
OECD	0	0	0	0
Rest of the World	0	0	0	0

3.2 Sensitivity Analysis

To better understand the influence of the parametric framework, brief discussions based the results from a number of sensitivity calculations are presented in this part. The tables pertaining to the discussion below are in Appendix D. It is found that the conclusions are robust with respect to changes in the underlying parameters and benchmark data. Only one individual change is considered at a time.

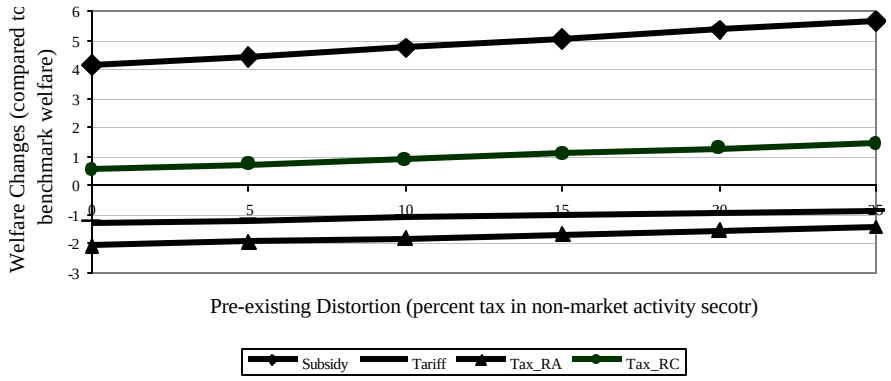
Case 1: Pre-existing Distortions

It is well documented in the literature that child labor exists primarily because a variety of market failures or distortions prevent children, or their parents, who make decisions on children's behalf, from allocating children's time efficiently between work and education or leisure. As a result, in the competitive equilibrium children's perticipation in the labor market is excessively high. In the static model of this study, we may introduce a pre-existing tax in the non-market activity of children to account for such an exogenous distortion. After introduction of this distortionary tax, although children are working 50% of the time, their labor supply is now inefficient unless the distortion is removed. That is, in the absence of the distortion, children would be enjoying more leisure or education and less work. Additionally, we know from the theory of the second best that introducing a second distortion (trade barriers or other forms of taxes or subsidies) in the presence of an existing distortion (taxes and subsidies) might make an agent better off (Markusen et al 1995).

We reinvestigate the effects of these instruments in the presence of the pre-exiting distortion in the non-market sector for the children. The above theory implies that introducing these instruments may actually improve children's welfare. The tables in Case 1 of Appendix D are produced under the assumption that a 25% pre-existing tax exists in the non-market sector of the children. A distortionary force causes excessive amount of child labor. Therefore, the tariff, taxes, and subsidy rates need to be higher, compared to those in the original case, to achieve the desired reduction in child labor. The trade, adult employment, and adult welfare do not change in any significant way. The relationships between different rates of distortionary tax and changes in welfare

resulting from the introduction of policy tools in all countries with child labor are similar. Therefore, figure 3 uses numbers from India and shows the relationships between the pre-existing distortionary tax and changes in welfare resulting from these four instruments.

Figure 3: Pre-existing Distortion in Children's Non-market Activity Sector and Welfare Effects of Different Instruments: India



The points on the left vertical axis comes directly from the first row of table 5, which shows the changes in welfare of Indian children resulting from these instruments. We also observe that while the higher the distortion, the more favorable are the effects of these instruments. However, even in the presence of distortionary tax in children's non-market sector a tariff or a domestic tax with transfers to the adults cannot improve children's welfare above its benchmark level. The lines for "Tariff" and "Tax_RA" never cross the horizontal axis. Both quantitatively and qualitatively, these results are almost identical to those with no pre-existing distortion.

Case2: Low Substitutability Between Children and Unskilled Adult Workers.

The analysis in section 4.3.1 was based on the assumption that children and adult unskilled workers are highly substitutable. Now it is assumed the all the parameters values from the original model except that the elasticity of substitution between child labor and adult unskilled labor remain constant. The elasticity is now 1 instead of 5. The rationale behind such an alternative experiment, however, comes from the literature on child labor. Both Anker and Melkas (1996) and Quddus

(1999) find that an entrepreneur employs underage workers to retain adult workers, especially mothers. The children come with their mothers and sometimes with other family members since there are no day-care facilities available. Many garment workers are single mothers, usually because their husbands have deserted the family. Managers faced with pleas usually relent and allow the mothers to bring their children to the job to work with them. In this sense, we would expect to see very low substitutability between adult unskilled and child laborers in the apparel industry.

Under the new assumption on elasticity between unskilled adult labor and child labor, the employment scenario for all countries, and export or production performances of the apparel sector in the United States and the OECD do not vary significantly. Hence for reasons of brevity, the export performances for only India, Sri Lanka, rest of South Asia, and other Asian countries are presented in Appendix D. Despite some quantitative differences, the implications of the results derived here remain the same as above.

In this case, the tariff does not have to be prohibitive as was in the previous case. The welfare impacts of the tariff, however, are almost identical. The reason for a smaller tariff in this case can be explained as follows. A tariff shifts down the demand for foreign apparel products in developed countries, which in effect reduces demand for inputs in the apparel sector in Asia. Since in the original case adult unskilled workers are easily substitutable with the child workers, a reduction in their employment is likely to be easily replaced by child workers. This high substitutability renders it difficult for employers to reduce child labor by 25%. Thus only a prohibitive tariff can achieve the desired reduction in the original case. In the present case, children and adult unskilled workers are close to complements so whenever the demand for an adult unskilled worker decreases, the demand for child workers decreases as well. Therefore, a relatively modest tariff can achieve the target. Once the demand for apparel products falls, the demand for both types of workers fall simultaneously.

On the other hand, the domestic taxes and subsidy rates have to be higher to achieve the same reduction. Here a domestic tax directly reduces demand for child workers. Since they are not as substitutable as before, the tax rate needs to be higher to achieve the desired reduction in child labor. However, when children receive the transfers, a domestic tax produces larger welfare gains

for children. In the base case, welfare rises by a meager 1%, here children's welfare rises by 4%. The intuition is that although the children will have to pay a higher tax, they also receive higher transfers in return that can be utilized to receive a more education or more leisure.

The positive welfare effect of a subsidy is also much higher, as is expected from a higher subsidy rate and amount. The effects on trade are much less pronounced. One political economy implication of such low substitutability is that there is a need for a new system to empower the children. Thus, the children will benefit most when their labor is taxed with transfers coming back to them in a lumpsum fashion.

Case 3: Difference in children's value share.

In this exercise we examine how the children's value share and the effectiveness of each instrument are related. How do the results vary if children's value shares in these countries are actually twice as much as that assumed in section 3? Once again both the qualitative and quantitative results are identical except for children's value shares (which in the benchmark by assumption are not the same) and the subsidy amount. The reason for the required subsidy being twice as much is that the desired reduction in child labor is twice as much as before in absolute terms. Since including a set identical tables do not add any value to this discussion, only the table containing rates of tariff, taxes, and subsidies and the the subsidy amounts is in Appendix D.

Case 4: When children do not receive any transfer from the adults

As mentioned earlier that children receive from the adults a fixed amount of the composite consumption good. Here it is assumed that children do not receive any transfer from the adults. The reason conducting this experiment is the unanimous theoretical and empirical finding that the poverty of the parents remains the important factor that contributes to excessive child labor. Therefore, it is instructive to examine how the results are influenced if we assume the children to receive no endowment from their parents. Only relevant tables are presented in Appendix D. These tables pertain to the magnitudes of instruments, children's value share in production (i.e. employment), welfare of children and adults are in Appendix D.

The most important result is the ineffectiveness of tariff. Even a 2000% tariff fails to reduce child labor by 25% in most of the countries. Therefore, instead letting the tariff rate be endogenously determined we fix it at 2000% and examine its effects. Only in the case of Sri Lanka is this prohibitive tariff effective in reducing child labor. A 2000% tariff reduces child labor in Sri Lanka by approximately 32%. In other regions the reduction in child labor ranges between 2 and 15%. For example, in the original case, a 2000% tariff reduced child labor is India by 14%, where the children's value share fell from US$75 million to US$65 million. The same rate of tariff reduces children's value share to only US$72 million. In percentage terms, it is only a 4% reduction. As expected the welfare effects are more pronounced in this case. In general, a 2000% tariff in this case has worse effects on children's welfare than a 2000% tariff in the original case. For example, in the original case the welfare of Indian children worsens by 1%, while in this case their welfare worsens by 5%. The negative welfare effects of a tariff on children in other regions are more pronounce, as can be seen from column 1 of table D.4.1 in Appendix D.

Additionally, the effectiveness of other instruments is also subdued in this case. To achieve the desired reduction in child labor, domestic taxes with transfer to the children have to be at least 50% higher than those in the original case. For example, in the presence of transfer from the adults, a 21% input tax can lower child labor in India by 25%, whereas, here the tax needs to be 33% to achieve the same target. The welfare effects, however, is identical to those in the original case. The results vary significantly for domestic taxes with transfers to the adults. The tax rate has to be 77% to reduce child labor by 25%, as opposed to 23% in the original case. The welfare effects are also huge. Such a domestic tax on child reduces children's welfare by 20% in all countries.

On the contrary, subsidy rates remain the same as those in the original model. When the children, instead being penalized for working, receive subsidies for their non-market activities, the subsidies are not required to be any higher than the original case. The reason is that the subsidies directly shift the children's budget constraint up. Therefore the children can afford a little more of both the consumption good and leisure without having to work for them. The implication from this experiment is important for policy makers. The damages caused by a tariff or taxes are magnified for the poorest of the poor children. By the same token, even small subsidies may improve their

welfare substantially although subsidies do not completely remove the children from work.

Case 5: When children are employed in other sectors as well

Finally, we investigate the most intriguing case where children are employed in all sectors in these countries. The fact that exports sector in developing countries employs only a small fraction of child workers is undisputed in the literature. For example, in Bangladesh 200,000 children are employed in the garments sector whereas the Bangladesh Bureau of Statistics suggest that approximately 5 million children are working in the agriculture sector (Rahman 1997).[8] Therefore, this section extends the original case by only adding child labor in other sectors. This addition of child labor facilitates a fresh investigation into the effectiveness and consequences of each instrument. Based on the evidence presented in the previous section regarding the value share of children in the apparel sector we make a conservative assumption about children percent contribution in other sectors. Table 7 summarizes this information. The tables containing detailed results are in Appendix D.

Table 7: Children's Value Percent Share by Sectors by Regions

	India	Sri Lanka	Rest of South Asia	Rest of Asia	Rest of the World
Apparel Sector	10	10	10	5	2
"Other" Sector	5	5	5	3	1

Since in this case child labor is substantially higher than in the original case, an indirect instrument such as a tariff cannot affect the child labor significantly. Given the assumptions, all the instruments except tariff are able to achieve the desired reduction in child labor. Therefore, we have fixed tariff at 2000% to examine its impact on children. Even after a 2000% tariff the child labor falls by a huge amounts in the apparel sector. Since most of other sectors categorized as informal and non-traded sectors, child labor in other sectors falls very little. In general, it is almost impossible for

[8] See, among many sources, ILO (1996a), Grootaert and Kanbur (1995), Ravallion and Wondon (1999), Panagariya (2000) and Maskus (1997).

a tariff to reduce substantially the employment in the informal sectors. Table 8 summarizes the effects of a tariff on the employment of children in two sectors.

Table 8: Change in Child Labor from a Tariff (as Percentage of Benchmark) by Sectors

	Apparel	Other	Overall
India	-41	-1.87	-2
Sri Lanka	-94	0.00	-7
Rest of South Asia	-74	-3.30	-5
Other Asian countries	-58	-7.78	-9
Rest of the world	30	-4.03	-5

Domestic taxes, and subsidies, assuming they are enforceable, are able to reduce child labor by 25% because they are attacking the child labor directly. In this case, however, subsidies required to induce children to withdraw from labor market are substantially higher. Essentially, the results in this section are only quantitatively different than those of the original model. For example, to reduce child labor in India by 25% the US and OECD need to share approximately US$1.4 billion of transfer fund to India (See Table D.5.2 in Appendix D). In the original case, in which child labor exists only in the apparel sector, a transfer of mere US$18 million can successfully achieve a 25% reduction in child labor. Thus, the results in section of sensitivity analysis deserve special attention from the policy makers because reducing child labor, let alone eliminating it, may be a very complex task.

Since a tariff directly reduces the demand for apparel products from developing countries, the employment of adults in the apparel sector cannot escape the impact of such a prohibitive tariff. Table 9 shows that a 2000% tariff reduces the adult employment in the apparel sectors of developing countries in the same way as it affect the child labor. As expected, the same tariff raises the employment of adult workers in the US and the OECD. These results are qualitatively similar to those derived from the original model. The zeros in Table 9, however, do not imply “no-change” in adult employment for the respective countries but that a the changes are insignificant. The employment of adults remains virtually unaffected after domestic taxes or subsidies (See table D.5.3 in Appendix D). Such reductions in employment in the apparel sector have implication for its production level. Tables presented in Appendix D show that the production of apparels and other

goods (the sum of row figures in tables D.5.4 and D.5.5) and their trade fall drastically after a 2000% tariff imposed by the US and the OECD.

Table 9: Change in Adult Labor from a Tariff (as Percentage of Benchmark) by Sectors

	Unskilled Labor		Skilled Labor	
	Apparel	Other	Apparel	Other
India	-40	0	-40	0
Sri Lanka	-94	3	-94	2
Rest of South Asia	-72	1	-73	1
Other Asian countries	-54	1	-54	1
US	12	0	12	0
OECD	23	0	24	0
Rest of the world	-27	0	-27	0

Table 10 Summary Report on Welfare (% Changes in Hicksian Equivalent Variation)

	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
Children's Welfare				
India	0	1	-2	4
Sri Lanka	-1	1	-2	4
Rest of South Asia	-1	1	-2	4
Other Asian countries	-1	1	-2	4
Rest of the World	0	0	-2	4
Representative Agents' Welfare				
India	-17	-11	-10	-11
Sri Lanka	-21	-10	-9	-10
Rest of South Asia	-19	-8	-8	-8
Other Asian countries	-23	-6	-6	-6
USA	-3	0	0	0
OECD	-1	0	0	0
Rest of the World	-9	-2	-2	-2

It is no surprise that negative welfare consequences of a tariff on developing countries would be enormous. The welfare effects are shown in Table 10. It is worth noting at this point that the current CGE analysis did not consider asset specificity. However, we can safely infer that under an alternative assumption of specific (immobile) capital the negative welfare consequences would be substantially more conspicuous. This calls for extreme caution in the choice of instrument to curb child labor.

4. Summary

This paper uses a computational equilibrium model of international trade in apparel to investigate the consequences of policies intended to curb child labor in selected Asian countries. Tariffs applied to reduce child labor may be welfare worsening for working children. Domestic taxes on child labor, if accompanied by lump sum transfers to these children, increase their welfare. Instead, if the parents receive the lump sum transfers the children are worse off. This paper also shows that transfer payments from the developed countries in the form of subsidies to non-market activities of children in these countries may not only reduce child labor but also improve their welfare. Although stemming from a static model, which does not represent education decisions explicitly, the results bear important implications for policy makers in both developing and developed countries.

Further, some sensitivity analyses are carried out. The results from the sensitivity analyses can be summarized as follows. First, as the pre-existing distortions in children's non-market activity increases the trade or non-trade tools are required to be higher to achieve a 25% reduction in child labor in selected Asian countries. However, as is seen in the original case, only subsidies or domestic taxes with transfers can reduce child labor as well as improve the welfare of the children. Second, there is a positive relation between the elasticity of substitution between unskilled adult workers and child workers and the tariff. That is, when this elasticity is low, a modest tariff can reduce child labor by 25%. However, in this case, domestic instruments are not as effective. These instruments need to be more severe to achieve the target reduction in child labor.

Third, the larger the benchmark amount of child labor, the lower is effectiveness of all these instruments, especially tariff. Fourth, the poorer the children, the harder it is to remove them from work. For if children are too poor, even a 2000% tariff cannot reduce child labor by 25%. The taxes need to be higher too in this case. Subsidies, however, do not have to be raised in order to attract the working children to education or non-market activities. Finally, If children are employed in other sectors, which are not only significantly larger than the apparel sector but also beyond the direct influence of tariff it is impossible to reduce child labor with any trade restrictions. In this case,

domestic instruments can only achieve the desired reduction in child labor. However, subsidies, as seen in the original case, still remain the optimum choice to achieve the targeted reduction in child labor without worsening children's welfare.

These sensitivity analyses show that the qualitative conclusions of the original case are robust with respect to changes in the underlying parameters. It is worth reiterating that only a small portion of child laborers works in export industries. Thus the computed subsidy amounts from the original case should be viewed in combination with those calculated in case 5 and be considered as a partial guide to the solution of the child labor problem in poor countries. Any measure that exclusively targets export industries will have moderate effects on the total extent of child labor in developing countries (Melchoir, 1996).

Although stemming from a static model, which does not represent the education decision explicitly, the results bear important implications for policy makers in both developing and developed countries. A fruitful extension of this work would be the explicit inclusion of the education decision in this model to analyze the impact of these trade and non-trade instruments in a dynamic setup. The anticipation of a new computational journey that will explicitly conduct a dynamic analysis of child labor standrads, international trade, human capital, and economic development seems a fitting place to conclude this static analysis.

Bibliography (Complete bibliography of my dissertation)

Abel, Andrew (1985), "Precautionary Saving and Accidental Bequests," *American Economic Review*, Vol. 75, No. 4.

Agarwal, Mita (1995), "International Trade, Labor Standards, and labor Market Conditions: An Evaluation of the Linkages," U. S. International Trade Commission, Office of Economics Working Paper No. 95-06. Washington D.C.

Amemiya, Takeshi (1967), "A Note on the Estimation of Balestra-Nerlove Models," Technical Report No. 4, Institute for Mathematical Studies in Social Sciences, Stanford University.

Anderson. Kym (1995), *"The Entwining of Trade Policy with Environmental and Labour Standards,"* presented at the Uruguay Round and the Developing Economies, the World Bank.

Anker, Richard and Helinä Melkas (1996), *Economic Incentives for Children and Families to Eliminate or Reduce Child Labour*, International Labour Organization Documentation, May (Website: www-ilo-mirror.who.or.jp/public/english/child/documentation/…/index.htm).

Armington, P. (1969), "A Theory of Demand for Products Dinstinguished by Place of Production," IMF Staff Papers, 16, pp. 159-178.

Ashagrie, Kebebew (1998), "Statistics on Working Children and Hazardous Child Labour in Brief," ILO (from www.ilo.org/public/english/child/documentation/trends/stats.htm).

Asian Development Bank (1998), *Key Indicators of Developing Asian and Pacific Countries*, Vol. XXXIX, Oxford University Press.

Bailey-Wiebecke, I. And Wahidur Rahman (1996), "Bangladesh: Taking an Innovative Step Towards Eliminating Child Labour," *Human Rights Forum* 5(2).

Baland, Jean-Marie and James A. Robinson (2000), "Is Child Labor Inefficient?" *Journal of Political Economy*, Vol. 108, No. 4.

Balistreri, Edward J. and Thomas F. Rutherford (undated), "The Impacts on Colorado of the Kyoto Agreement to Stabilize Carbon Emissions," (available at nash.Colorado.edu/tomruth/ colorado/html/Colo_pap4.html).

Barro, Robert and Jong-Wha Lee (1997), "Schooling Quality in a Cross Section of Countries," *NBER Working Paper 6198*.

Barro, Robert and Xavier Sala-I-Martin (1995), *Economic Growth*, McGraw-Hill, Inc.

Barro, Robert and Jong-Wha Lee (1994), "Sources of Economic Growth," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 40, June.

Barro, Robert and Jong-Wha Lee (1993), "International Comparisons of Educational Attainment," *Journal of Monetary Economics*, 32, pp. 363-394.

Barro, Robert (1991), "Economic Growth in a Cross Section of Countries," *The Quarterly Journal of Economics*, May.

Basu, Kaushik (2000), "The Intriguing Relation Between Adult Minimum Wage and Child Labour," *The Economic Journal*, Vol. 110, No. 462.

Basu, Kaushik (1999), "Child Labor: Causes, Consequence, and Cure, with Remarks on International Labor Standards," *Journal of Economic Literature*, vol. XXXVII, no. 3.

Basu, Kaushik, and Pham Hoang Van (1998), "The Economics of Child Labor," *American Economic Review*, vol. 88, no. 3.

Beauchemin, Kenneth (2000a), "Stagnation or Growth? The Role of Public Education," *Journal of Development Economics, forthcoming*.

Beauchemin, Kenneth (2000b), "W(h)ither Public Capital?" working paper in progress, State University of New York at Albany, Department of Economics.

Becker, Gary S., Kevin Murphy, and Robert Tamura (1990); "Human Capital, Fertility, and Economic Growth," *JPE*, vol. 98, no. 5, pp. S12-S37.

Becker, Gary S. (1991), "The Demand for Children," chapter 5 in *A Treatise on the Family*, Cambridge MA, Harvard University Press.

Bernheim, B. Douglas, Andrei Shleifer, and Lawrence H. Summers (1985), "The Strategic Bequest Motive," *Journal of Political Economy*, Vol. 93, No. 6.

Bhagwati, Jagdish and Robert Hudec ed. (1996), *Fair Trade and Harmonization: Prerequisite for Free Trade: Volume 1, Economic Analysis*, MIT Press.

Bhagwati, Jagdish and Robert Hudec ed. (1996), *Fair Trade and Harmonization: Prerequisite for Free Trade: Volume 2, Legal Analysis*, MIT Press.

Blanchard, Olivier J. and Stanley Fischer (1989), *Lectures on Macroeconomics*, Cambridge MA, The MIT Press.

Bonnet, M. (1993), "Child Labor in Africa," *International Labour Review*, 132 (3).

Bowcott, Owen (1997), "When Work is the Lesser of Two Evils," *Guardian Weekly*, October 26.

Brown, Drusilla (1999), "Can Consumer Product Labels Deter Foreign Child Labor Exploitation?" Tufts University, *Department of Economics Working Paper*, No. 99-19.

Brown, Drusilla, Alan Deardorff, and Robert Stern (1999), "U.S. Trade and Other Policy Options and Programs to Deter Foreign Exploitation of Child Labor," paper prepared for presentation at National Bureau of Economic Research Conference, New York.

Brown, Drusilla (1998), "A Transactions Cost Politics Analysis of International Child Labor Standards," Tufts University, *Department of Economics Working Paper*, No. 98-19.

Brown, Drusilla, Alan Deardorff, and Robert Stern (1996); " International Labor Standards and Trade : A Theoretical Analysis," in Jagdish Bhagwati and Robert Hudec Ed. *Fair Trade and Harmonization : Prerequisites for Free Trade? Volume 1*; MIT Press.

Chaudhury, S. and Pratima Paul Majumder (1991), "The Conditions of Garment Workers in Bangladesh – An Appraisal," Bangladesh Institute of Development Studies, Dhaka.

Fallon, Peter and Zafiris Tzannatos (1998), "Child Labor: Issues and Directions for the World Bank," The World Bank, Washington, DC.

Glomm, Gerhard and B. Ravikumar (1992), "Public versus Private Investment in Human Capital: Endogenous growth and Income Inequality," *Journal of Political Economy*, 100, 4, 818-834.

Goldin, Claudia (1979), "Household and Market Production of Families in a Late Nineteenth Century America City," *Explorations in Economic History*, 16, 111-131.

Griliches, Zvi (1997), "Education, Human Capital, and Growth: A Personal Perspective," *Journal of Labor Economics*, vol. 15, no. 1, pp. s330-s344.

Grootaert, Christiaan (1998), "*Child Labor in Côte d'Ivoire: Incidence and Determinants*," The World Bank.

Grootaert, Christiaan and Ravi Kanbur, (1995) "Child Labour: An Economic Perspective." *International Labour Review*, pp. 187-203.

Greene, William H. (1997), *Econometric Analysis*, 3rd edition, Prentice-Hall Inc.

Hall, Robert and Charles Jones (1999), "Why do Some Countries Produce So Much More Output per Worker than Others?" *The Quarterly Journal of Economics*, February.

Hertel, T. W. ed. (1997), *Global Trade Analysis: Modeling and Applications*, Cambridge University Press, Cambridge and New York.

Hoffman, L. W. (1988), "Cross-Cultural Differences in Child-Bearing Goals," in R. A. LeVine, P. M. Miller, and M. M. West (Eds.) *Parental Behavior in Diverse Societies: New Directions for Child Development*, San Francisco: Jossey-Bass.

Horrell, Sara and Jane Humphries (1995), "The Exploitation of Little Children: Child Labor and the Family Economy in the Industrial Revolution," *Explorations in Economic History*, 32, 485-516.

Hussain, Mahmood (1999), "Child Labor Standards and Economic Growth: An Econometric Analysis," *University of Colorado Department of Economics Working Paper*, No. 21.

International Labour Organisation (1992), *World Development Report 1992*, Geneva.

International Labour Organisation (1996a), *Child Labour - Targeting the Intolerable*.

International Labour Office (1996b), *STAT Working papers: Economically Active Population 1950-2010*, Volumes 1-5.

International Programme on the Elimination of Child Labour (1996), *Child Labour in Bangladesh: An Overview and A Proposed Plan of Action*, International Labour Office, Dhaka.

Islam, Nazrul (1995); "Growth Empirics: A Panel data Approach," *The Quarterly Journal of Economics*, November.

Kruse, Douglas and Douglas Mahony (1998); " Illegal Child Labor in the United States : Prevalence and Characteristics," *NBER Working Paper 6479*, March 1998.

Lindert, P. (1976), "Child Costs and Economic Development," in R. A. Easterlin, ed., *Population and Economic Change in Developing Countries*, Chicago: The University of Chicago Press.

Lloyd, C. B. (1994), "Investing in the Next Generation: The Implication of High Fertility at the Level of the Family," New York Population Council, *Research Division Working Paper*, No. 63.

Maddala, G.S. (1992), *Introduction to Econometrics*, 2nd edition, Prentice-Hall Inc.

Mankiw, Gregory, David Romer, and David Weil (1992); "A Contribution to the Empirics of Economic Growth," *The Quarterly Journal of Economics*, May.

Markusen, James R., James Melvin, William H. Kaempfer, and Keith E. Maskus (1995), *International Trade: Theory and Evidence*, International Edition, McGraw-Hill, Inc.

Maskus, Keith E. (1997), "Should Core Labor Standards Be Imposed Through International Trade Policy?," The World Bank Policy Research Working Paper 1817.

Maskus, Keith E. and Jill Holman (1996); "*The Economics of Child Labor Standards*," Working Paper # 96-10, Department of Economics, University of Colorado.

Maskus, Keith E., Thomas F. Rutherford, and Steven Selby (1995), "Implications of Chnages in Labor Srandards: A Computational Analysis for Mexico," *North American Journal of Economics and Finance*, 6(2): 171-188.

Melchoir, Arne (1996), "Child Labour and Trade Policy," in Bjorne Grimsrud and Arne Melchoir ed. *Child Labour and International Trade Policy*, Norwegian Institute of International Affairs and Institute for Applied Social Science, Oslo Norway.

Nerlove, Marc and Lakshmi Raut (1997), "Growth Models with Endogenous Population: A General Framework," *Handbook of Population and Family Economics*, Chapter 20, pp. 1117-1173.

Panagariya, Arvind (2000), "Trade-Labor Link: A Post-Seattle Analysis," Department of Economics, University of Maryland at College Park.

Paxson, Christina, and Nobert Schady (1999), "Do School Facilities Matter? The case of the Peruvian Social Fund (FONCODES)", *The World Bank Policy Research Working Paper*, No. 2229.

Psacharopoulos, G. (1994), "Returns to Investment in Education: A Global Update", *World Development*, 22 (9).

Psacharopoulas, George (1997), "Child Labor versus Educational Attainment: Some Evidence from Latin America," *Journal of Population Economics*, 10, pp. 377-386.

Quddus, Munir (1999), "Child Labor and Global Business: Lessons from the Apparel Industry in Bangladesh," University of Southern Indiana Department of Economics Working Paper.

Rahman, Wahidur (1997), *Child Labour Situation in Bangladesh: A Rapid Assessment*, ILO, Dhaka.

Ranjan, Priya (1999), "An Economic Analysis of Child Labor," *Economics Letters*, vol. 64, pp. 99-105.

Ranjan, Priya (1998), Credit Constraints and the Phenomenon of Child Labor, University of California, Irvine Economics Paper # 98-99-12.

Ravallion, Martin and Quentin Wondon (1999), "*Does Child Labor Displace Schooling? Evidence on Behavioral Responses to an Enrollment Subsidy*," Working Paper No. 2116, The World Bank.

Rodrik, Dani (1995), "Labor Standards and International Trade: Moving Beyond the Rhetoric," unpublished paper, prepared for the Overseas Development Council, Columbia University.

Rutherford, Thomas F. (1999), "Applied General Equilibrium Modeling with MPSGE as a GAMS Subsystem: An Overview of the Modeling Framework and Syntax," Computational Economics, Vol. 14, Nos. 1-2.

Rutherford, Thomas F. (1998), "GTAPin GAMS: The Dataset and Static Model," Working Paper, University of Colorado Department of Economics.

Silvers, Jonathan (1996), "Child Labor in Pakistan," *The Atlantic Monthly*, February 1996.

Srinivasan, T. N. (1996), "Trade and Human Rights," Yale University Economic Growth Center Discussion Paper No. 765.

Syed, K. A. A. Mirza, R. Sultana, and I. Rana (1991), "Child Labour: Socioeconomic Consequences," *Pakistan and Gulf Economist*, 10, pp. 36-39.

Tienda, M. (1979), "Economic Activity of Children in Peru: Labor Force Behavior in Rural and Urban Contexts," *Rural Sociology*, 44, pp. 370-391.

Turnovsky, Stephen J., (2000), *Methods of macroeconomic Dynamics*, MIT Press.

UN (1998), *Statistical Charts and Indicators on the Situation of Youth 1980-1995*.

UNICEF (1999), *The State of the World's Children 1999: Education*.

UNESCO (1960-1990), *Statistical Yearbooks*, various volumes.

Varian, Hal (1992), *Microeconomic Analysis*, 3rd edition, W. W. Norton and Company, New York.

Wiebecke, I. Bailey, and Wahidur Rahman (1996), "Bangladesh: Taking an Innovative Step Towards Eliminating Child Labor," *Human Rights Forum*, Vol. V, No. 2.

World Bank (1993), *The East Asian Miracle: Economic growth and Public Policy*, Oxford University Press, Oxford.

Appendix A: Model Equations used in GAMS/MPSGE Codes in Chapter 4

This appendix draws heavily on Rutherford (1998). In addition, to the equation given in Rutherford (1998) some equations are added to describe the specific model used in the current analysis.

Production

In the GTAP model there are two types of produced commodities, goods produced for domestic markets and goods produced for export. Specifically, if D_{ir} is domestic output and X_{ir} is export, then

$$Y_{ir} = \left[\alpha_{ir}^{Y} D_{ir}^{1+1/\eta} + \beta_{ir}^{Y} X_{ir}^{1+1/\eta}\right]^{1/(1+1/\eta)}$$

where Y_{ir} is the activity level for good i in region r. Producers are competitive, implying that given a value of Y_{ir}, supplies to the domestic and export markets are given by:

$$D_{ir} = Y_{ir} a_{ir}^{D}\left(p_{ir}^{D}, p_{ir}^{X}\right)$$

and

$$X_{ir} = Y_{ir} a_{ir}^{X}\left(p_{ir}^{D}, p_{ir}^{X}\right).$$

In the current analysis, D_{ir} and X_{ir} are assumed to be perfect substitutes (that is ?=∝). Then $Y_{ir} = \alpha_{ir} D_{ir} + \beta_{ir} X_{ir}$.

Inputs to production include primary factors and intermediate inputs. Intermediate demands are proportional to the level of activity, so that total intermediate demand for i in region r is:

$$ID_{ir} = \sum_{j} Y_{jr} a_{ijr}.$$

Following Armington (1969) intermediate demand is represented as the composite of imported and domestic goods as imperfect substitute. Thus, we have:

$$ID_{ir} = \left[\alpha_{ir}^{I} DI_{ir}^{\rho} + \beta_{ir}^{I} MI_{ir}^{\rho}\right]^{1/\rho}$$

in which DI_{ir} is domestic intermediate and is MI_{ir} imported intermediate demand.

A Cobb-Douglas production function relates activity level and factor inputs. Producers minimize unit cost given factor prices and applicable taxes. The factor demand solves:

$$\min \sum_{f} p_{fr}^{F}\left(1+t_{fir}^{F}\right) FD_{fir} \qquad \text{s.t.} \quad \varphi_{ir} \prod_{f} FD_{fir}^{\theta_{fir}} = Y_{ir}$$

taking Y_{ir} as given. Linear homogeneity of the production function implies that factor demands may be expressed as the product of an activity and compensated demand function depending on factor prices and factor taxes:

$$FD_{ir} = Y_{ir} a_{ir}^{F}\left(p_{ir}^{F}, t_{ir}^{F}\right).$$

Among the five primary factors into production, unskilled labor is represented as a composite of unskilled adult and child labor. Thus, we have

$$UL_{ir} = \left[\alpha_{ir}^{UL} L_{ir}^{\gamma} + \beta_{ir}^{UL} CL_{ir}^{\gamma}\right]^{1/\gamma}.$$

In the current model we made two assumptions regarding substitutability between unskilled adult labor and child labor. In the original case we assume an elasticity of substitution of 5 (i.e. γ=0.2) and in case 1 we assume an elasticity of substitution of 1 (i.e. γ=0).

Public and Private Demand

Public sector output is assumed to represent a Cobb-Douglas aggregation of market commodities:

$$G_r = \Gamma_r \prod_i GD_{ir}^{\theta_{ir}^{G}}.$$

As is the case for intermediate demand, an Armington aggregation of domestic and imported inputs defines public sector demand:

$$GD_{ir} = \left[\alpha_{ir}^{G} DG_{ir}^{\rho} + \beta_{ir}^{G} MG_{ir}^{\rho}\right]^{1/\rho}.$$

Public sector output is exogenous. The composition of public sector inputs, however, responds to relative prices, gross of applicable tax, implying that given a value of GD_{ir}, demand for public sector inputs is given by:

$$GD_{ir} = \overline{G}_r a_{ir}^{G}\left(p_{ir}^{D}, p_{ir}^{M}, t_{ir}^{G}\right).$$

The utility function of the representative adult is CES:

$$U_r^{RA} = \left[\sum_i \alpha_{ir}^{RA} CD_{ir}^{\rho}\right]^{1/\rho}.$$

As is the case for intermediate and public demand, an Armington aggregation of domestic and imported inputs defines each commodity:

$$CD_{ir}^{RA} = \left[\alpha_{ir}^{RA} DC_{ir}^{\rho} + \beta_{ir}^{RA} MC_{ir}^{\rho}\right]^{1/\rho}.$$

Aggregate final demand is then defined by regional expenditure and the unit price of aggregate of domestic and imported goods, gross of applicable tax:

$$CD_{ir}^{RA} = \frac{\theta_{ir}^{C} M_{r}^{RA}}{p_{ir}^{C}\left(1+t_{ir}^{C}\right)}.$$

Regional expenditure by a representative adult $\left(M_r^{RA}\right)$ includes factor income, net capital flows and tax revenue, net of cost of investment and public expenditure.

The utility function of a representative child includes consumption of composite commodity and non-market activities. Then

$$U_{r}^{RC} = \left[\alpha_{ir}^{RC} CD^{RC}{}_{ir}^{\delta} + \beta_{ir}^{RC} CLE_{ir}^{\delta}\right]^{1/\delta}.$$

A representative child's expenditure $\left(M_r^{RC}\right)$ includes his labor income and a fixed endowment that he receives from the representative adult.

Bilateral Trade

There are three types of imports in the model: imports to intermediate demand (MI_{ir}), imports to public sector demand (MG_{ir}), and imports to consumption goods demand (MC_{ir}).

$$MI_{ir} + MG_{ir} + MC_{ir} = \left[\sum_{s} \alpha_{ir}^{M} M_{isr}^{\rho}\right]^{1/\rho}$$

where M_{isr} refers to the import of commodity i from region to s to region r.

Two tax margins and a transportation cost apply on bilateral trade in the model. Real transport costs are proportional to trade:

$$T_{irs} = \tau_{irs} M_{irs}$$

and these inputs are defined by a Cobb-Douglas aggregate of international transport inputs supplied by different countries:

$$\sum_{irs} T_{irs} = \varphi_T \prod_{i,r} TD_{ir}^{\theta_{ir}^T}$$

Bilateral trade flows are determined by cost-minimizing choice, given the fob export price from region r, p_{ir}^X, the export tax rate, t_{ir}^X, and the import tariff rate, t_{ir}^M. The model formulation assumes that the export tax applies on the *fob* price (net of transport margin), while the import tariff applies on the *cif* price, gross of export tax and transport margin. We may then write the demand for bilateral imports as:

$$M_{irs} = M_{is} a_{irs}^X \left(p_{ir'}^X, t_{ir's}^X, p^T, t_{ir's}^M \right)$$

Income and Expenditure

Consumer expenditures for a representative adult are the sum of factor earnings and tax revenue, net the cost of investment, public sector output and net capital outflows:

$$\begin{aligned}
M_r^{RA} = & \sum\nolimits_f p_{fr}^F F_{fr} && \text{Factor income} \\
& + \sum\nolimits_i t_{ir}^Y \left(p_{ir}^D D_{ir} + p_{ir}^X X_{ir} \right) && \text{Indirect taxes} \\
& + \sum\nolimits_{ij} t_{ifr}^{ID} p_{ir}^{ID} Y_{jr} a_{ijr} && \text{Taxes on intermediate goods} \\
& + \sum\nolimits_{fi} t_{fir}^F p_{fr}^F FD_{fir} && \text{Factor tax revenue} \\
& + \sum\nolimits_i t_{ir}^G p_{ir}^{GD} GD_{ir} && \text{Public tax revenue} \\
& + \sum\nolimits_i t_{ir}^C p_{ir}^{CD} CD_{ir} && \text{Consumption tax revenue} \\
& + \sum\nolimits_{is} t_{irs}^X p_{ir}^X M_{irs} && \text{Export tax revenue} \\
& + \sum\nolimits_{is} t_{irs}^M \left(p_{is}^X M_{isr} \left(1 + t_{irs}^X \right) + p^T T_{isr} \right) && \text{Tariff revenue} \\
& - \sum\nolimits_i p_{ir}^D I_{ir} && \text{Investment demand} \\
& - \sum\nolimits_i p_{ir}^G \left(1 + t_{ir}^G \right) GD_{ir}^G && \text{Public sector demand} \\
& - p_n^C B_r && \text{Current account balance}
\end{aligned}$$

Capital flows in the base year are represented by B_r in this expression, and in a counterfactual equilibrium these are held fixed and denominated in terms of the numeraire price index, the consumer price level in region *n* (USA).

Consumer expenditures for a representative child are the sum of labor earnings and endowment of consumption goods received from the representative adult.

$$M_r^{RC} = p_r^{CL} CL_r + E_c^{RC}$$

Market Clearance

$$D_{ir} = DI_{ir} + DG_{ir} + DC_{ir} + I_{ir} \qquad \text{Domestic Output}$$

$$M_{ir} = MI_{ir} + MG_{ir} + MC_{ir}$$ Imports

$$X_{ir} = \sum_s M_{irs} + TD_{ir}$$ Exports

$$F_{ir} = \sum_i Y_{ir} a^F_{fir}$$ Primary factors

Zero profit

Production. Competitive producers operating constant-returns technology earn zero profit in equilibrium. For the GTAP producer, the value of output to the firm equals the value of sales in the domestic and export markets net of applicable taxes. Costs of production include factors inputs (taxed at rate t^F) and intermediate inputs (taxed at rate t^{ID}):

$$\left(p^D_{ir} a^D_{ir} + p^X_{ir} a^X_{ir}\right)\left(1 - t^Y_{ir}\right) = \sum_f a^F_{fir} p^F_{fr} \left(1 + t^F_{fir}\right) + \sum_f a^{ID}_{jir} p^{ID}_{jr} \left(1 + t^{ID}_{jir}\right)$$

Imports. Zero profit conditions apply to trade activities as well as production. In equilibrium, the value of imports at the domestic *cif* price therefore equals the *fob* price gross of export tax, the transportation margin and the applicable tariff.

$$p^M_{ir} = \sum_s a^M_{irs} \left[p^X_{is} \left(1 + t^X_{isr}\right) + \tau_{irs} p^T\right]\left(1 + t^M_{isr}\right)$$

Investment, public, and private demand. Armington aggregation functions transform domestic and imported goods into composite goods for investment demand, public sector demand, and private demand. Zero profit for these activities provide the following equilibrium identities:

$$p^I_{ir} = c\left(p^D_{ir}, p^M_{ir}, \alpha^I_{ir}, \beta^I_{ir}\right)$$
$$p^G_{ir} = c\left(p^D_{ir}, p^M_{ir}, \alpha^G_{ir}, \beta^G_{ir}\right)$$
$$p^C_{ir} = c\left(p^D_{ir}, p^M_{ir}, \alpha^C_{ir}, \beta^C_{ir}\right)$$

in which

$$c\left(p^D, p^M, a, ß\right) \equiv \min_{D,M} \; p^D D + p^M M \;\; \left(a D^{?} + ß M^{?}\right)^{1/?}$$
$$= \left(a^{\sigma} p_D^{1-\sigma} + ß^{\sigma} p_M^{1-\sigma}\right)^{1/1-\sigma}$$

is the unit cost function defined by the constant-elaticity-of-substitution aggregate of domestic and imported inputs.

Appendix B: GAMS Parameters Explicitly Represented

Symbols	Parameters	Description
Parameters in Figure 2:		
t_{ir}^{Y}	ty(i,r)	Output tax
t_{ir}^{ID}	ti(j,i,r)	Intermediate Input tax
t_{ir}^{F}	tf(f,I,r)	Factor tax
t_{isr}^{X}	tx(i,s,r)	Export tax
t_{isr}^{M}	tm(i,s,r)	Import tariff
t_{ir}^{G}	tg(i,r)	Tax rates on government demand
t_{ir}^{C}	tp(i,r)	Tax rates on private demand
$Y_{ir}a_{jir}$	vafm(j,i,r)	Aggregate intermediate inputs
FD_{fir}	vfm(f,i,r)	Value of factor inputs (net of tax)
M_{irs}	vxmd(i,r,s)	Value of commodity trade (fob – net of export tax)
T_{irs}	vtwr(i,r,s)	Transport services
TD_{ir}	vst(i,r)	Value of international transport sales
DG_{ir}	vdgm(i,r)	Government demand (domestic)
MG_{ir}	vigm(i,r)	Government demand (imported)
DC_{ir}	vdpm(i,r)	Aggregate private demand (domestic)
MC_{ir}	vipm(i,r)	Aggregate private demand (imported)
CL_{ir}	cvfm(i,r)	Children's value share in production
Other Parameters:		
M_{ir}	vim(i,r)	Total value of imports (gross tariff)
X_{ir}	vxm(i,r)	Value of exports (gross excise tax)
D_{ir}	vdm(i,r)	Value of domestic output (net excise tax)
DI_{ir}	vdfm(i,r)	Aggregate intermediate demand (domestic)
MI_{ir}	vifm(i,r)	Aggregate intermediate demand (imported)
CD_{ir}	vpm(i,r)	Private Expenditure
GD_{ir}	vgm(i,r)	Public Expenditure
MI_{dir}	vm(d,i,r)	Armington supply
DI_{dir}	vd(d,i,r)	Domestic supply
B_{r}	b(r)	Current account balance

Notes on subscripts:

i, j = Commodities (Apparel, other commodities, and investment composite goods)
r,s = Regions (USA, OECD, India, Sri Lanka, Rest of South Asia, Rest of Asia, and the Rest of the world)
f = Factors (Land, Capital, Natural Resources, Skilled, Unskilled, and Child)
d = Sectors (Private, Public, and Investment)

Appendix C: GAMS Representation of the GTAP dataset and MPSGE Formulation

```
$TITLE  GTAPinGAMS -- Static Multiregional Child Labor Model in MPSGE Syntax

*       Note:
*               This is the model implemented in MPSGE.
*               This implementation accomodates both constant-elasticity of
*               transformation between production for domestic and export
*               markets (eta < +INF), and perfect substitution between
*               those markets (eta=+INF).
*               Variables, equations and GAMS keywords are in UPPER case.
*               Sets and parameters are in lower case.
*       Read the dataset using the standard routine:

$LIBINCLUDE mrtdata CL

Table clshr(i,r) children's share in production value

        ind     lka     ras     asi     usa     oec     row
wap     0.1     0.1     0.1     0.05                    0.02
oth     0.05    0.05    0.05    0.03                    0.01;

parameter clshar Children's Value percent share in production;
clshar(i,r)=clshr(i,r)*100;

parameter distax   Preexisting distortionary tax in children's nomarket sector;

Parameter TCLE0(R) PREEX TAX DRIVES A WEDGE BTWN PRI AND SOCIAL VALUE OF LEISURE;
TCLE0(R)=0.25;
distax(r,"Pretax")=tcle0(r)*100;

parameter cvfm(i,r) children value share in production,
          pcl0(i,r)  reference price for child input,
          tcl(i,r) faxtor tax on child,
          cle(r)   non market activityies of child,
          nvfm(f,i,r) new value of factor inputs,
          clend(r)   Children's time endowment;

scalar endtfr   arbitrary endowment value received from adult  /2/;
parameter  tfr transfer from adutls;

tfr(r,"Tfr")=endtfr;
nvfm(f,i,r)=vfm(f,i,r);
cvfm(i,r)=clshr(i,r)*(nvfm("lab",i,r));
vfm("lab",i,r)=((1-clshr(i,r))*(nvfm("lab",i,r)));
tcl(i,r)=tf("lab",i,r);
pcl0(i,r)=1+tcl(i,r);
evoa("lab",r)=(evoa("lab",r)-sum(i,cvfm(i,r)));
cle(r)=sum(i,cvfm(i,r));
vipm(i,r)=(vipm(i,r)-cvfm(i,r));
clend(r)=cle(r)+sum(i,cvfm(i,r));
```

```
SCALAR
        eta     Elasticity of transformation - domestic vs. exports     / +inf /,
        esubdm  Elasticity of substitution - domestic vs. imports    / 4 /,
        esubmm  Elasticity of substitution - imports                    / 8 /;

parameter elasdm Elasticity of substitution between imports;
elasdm(r,"Esubdm")=esubdm;

set     tmcl(i,s,r)     Identifies trade flows subject to tax,
        tlcl(s)         Identifies regions with tax on child labor
        scl(r)          Subsidy on child leisure;

scalar  cltax   Flag for tax paid to children /0/;

tmcl(i,s,r) = no;
tlcl(s) = no;
scl(r) = no;

PARAMETER   CLTARGET(R);  CLTARGET(R) = 1.1;

parameter waptrade Initial Apparel Trade;
waptrade(s,r) = vxmd("wap",s,r)*10000;
waptrade(s,s) = sum(d, vd(d,"wap",s))*10000;
waptrade(s,"tot_ex")=sum(r,vxmd("wap",s,r))*10000;
waptrade(s,"tot_prd")=(waptrade(s,"tot_ex")+waptrade(s,s));

parameter othtrade Initial Other Trade;
othtrade(s,r) = vxmd("oth",s,r)*10000;
othtrade(s,s) = sum(d, vd(d,"oth",s))*10000;
othtrade(s,"tot_ex")=sum(r,vxmd("oth",s,r))*10000;
othtrade(s,"tot_prd")=(othtrade(s,"tot_ex")+othtrade(s,s));

set     unsk(f) /lab/;

$ONTEXT

$MODEL:child

$SECTORS:
    C(r)                                ! Private consumption
    G(r)                                ! Public provision
    Y(i,r)$vom(i,r)                     ! Output
    M(i,r)$vim(i,r)                     ! Import aggregation
    A(d,i,r)$va(d,i,r)                  ! Armington aggregation of domestic and imports
   Cl(r)$cle(r)                         ! Child labor supply
   CLS(R)$cle(r)
   YT                                   ! Transport

$COMMODITIES:
   PC(r)                                ! Private demand
   PG(r)                                ! Public provision
   PY(i,r)$(vom(i,r) and (1/eta=0))  ! Output price
```

```
    PD(i,r)$(vdm(i,r) and 1/ETA)          ! Domestic price
    PX(i,r)$(vxm(i,r) and 1/ETA)          ! Export price
    PM(i,r)$vim(i,r)                      ! Import price
    PA(d,i,r)$va(d,i,r)                   ! Armington composite price
    PF(f,r)$evoa(f,r)                     ! Factor price
    PT                                    ! Transport services
    PCL(r)$cle(r)                 ! Child's Wage
    PCLS(r)$cle(r)                        ! Child's Wage
    PCLAB(r)$cle(r)                       ! Child's labor

$CONSUMERS:
    RA(r)                                 ! Representative agent
    RC(r)$cle(r)                          ! Representative Child

$AUXILIARY:
    TAU(s)$cle(s)                         ! Tariff/tax/ subsidy  rates

*    Production:
*        I have added the last line in this block
*        assumed CES in other inputs and child labor

$CONSTRAINT:TAU(r)$cle(r)
        CLTARGET(r) =E= CL(r);

$PROD:Y(i,r)$(vom(i,r)>0 and 1/eta>0)  S:0  T:eta  va:1 lab(va):5
    O:PD(i,r)      Q:vdm(i,r)    A:RA(r) T:ty(i,r)
    O:PX(i,r)      Q:vxm(i,r)    A:RA(r) T:ty(i,r)
    I:PA("i",j,r)  Q:vafm(J,i,r) A:RA(r) T:ti(j,i,r)
    I:PF(f,r)      Q:vfm(f,i,r)  P:pf0(f,i,r)
+                                    A:RA(r) T:tf(f,i,r) va:$(not unsk(f)) lab:$unsk(f)
    I:PCLAB(r)     Q:cvfm(i,r)   P:pcl0(i,r)
+                                    A:RC(r)$cltax A:RA(R)$(not cltax) T:tcl(i,r) N:TAU(r)$TLCL(r) lab:

*        I have added the last line in this block
*        assumed CES in other inputs and child labor

$PROD:Y(i,r)$(vom(i,r)>0 and 1/eta=0)  S:0  va:1   lab(va):5
    O:PY(i,r)      Q:vom(i,r)    A:RA(r) T:ty(i,r)
    I:PA("i",j,r)  Q:vafm(J,i,r) A:RA(r) T:ti(j,i,r)
    I:PF(f,r)      Q:vfm(f,i,r)  P:pf0(f,i,r)
+                                    A:RA(r)  T:tf(f,i,r) va:$(not unsk(f)) lab:$unsk(f)
    I:PCLAB(r)     Q:cvfm(i,r)   P:pcl0(i,r)
+                                    A:RC(r)$cltax A:RA(R)$(not cltax) T:tcl(i,r)  N:TAU(r)$TLCL(r) lab:

*    Armington aggregation over domestic versus imports:

$PROD:A(d,i,r)$va(d,i,r)  S:esubdm
    O:PA(d,i,r)            Q:va(d,i,r)
    I:PD(i,r)$(1/eta>0)    Q:vd(d,i,r)
    I:PY(i,r)$(1/eta=0)    Q:vd(d,i,r)
    I:PM(i,r)              Q:vm(d,i,r)

*    Armington aggregation across imports from different countries:
```

```
$PROD:M(i,r)$(vim(i,r)>0 and 1/eta>0)   S:esubmm   s.TL:0
      O:PM(i,r)      Q:vim(i,r)
      I:PX(i,s)      Q:vxmd(i,s,r)  P:pmx0(i,s,r)     s.TL:
+                A:RA(S) T:TX(i,s,r) A:RA(r) T:(tm(i,s,r)*(1+tx(i,s,r)))
      I:PT#(s)       Q:vtwr(i,s,r)  P:pmt0(i,s,r)     s.TL:
+                              A:RA(r) T:tm(i,s,r)

$PROD:M(i,r)$(vim(i,r)>0 and 1/eta=0)   S:esubmm   s.TL:0
      O:PM(i,r)      Q:vim(i,r)
      I:PY(i,s)      Q:vxmd(i,s,r)  P:pmx0(i,s,r)     s.TL:
+                A:RA(S) T:TX(i,s,r) A:RA(r) T:(tm(i,s,r)*(1+tx(i,s,r)))
+                              A:RA(r)  N:tau(s)$TMCL(i,s,r)
      I:PT#(s)       Q:vtwr(i,s,r)  P:pmt0(i,s,r)     s.TL:
+                              A:RA(r) T:tm(i,s,r)

*      Demand for public output:

$PROD:G(r)  S:1
      O:PG(r)        Q:vg(r)
      I:PA("g",i,r)   Q:vgm(i,r)  P:pg0(i,r)  A:RA(r) T:tg(i,r)

*      Private consumption:

$PROD:C(r)  S:2
      O:PC(r)        Q:vp(r)
      I:PA("c",i,r)   Q:vpm(i,r)  P:pc0(i,r)  A:RA(r) T:tp(i,r)

*      Inter-national transport services (Cobb-Douglas):

$PROD:YT  S:1
      O:PT                              Q:vt
      I:PX(i,r)$(1/eta>0)       Q:vst(i,r)
      I:PY(i,r)$(1/eta=0)       Q:vst(i,r)

*      Final demand over consumption, savings and government
*      services :

$DEMAND:RA(r)
      E:PF(f,r)                 Q:evoa(f,r)
      E:PC(num)                 Q:vb(r)
      E:PD(cgd,r)$(1/eta>0)  Q:-vi(r)
          E:PY(cgd,r)$(1/eta=0)       Q:-vi(r)
      E:PG(r)                           Q:-vg(r)
      D:PC(r)                           Q:(vp(r)-sum(i,cvfm(i,r)))
          E:PC(R)                       Q:((-endtfr)*clend(r))

*          Final demand over consumption and nonmarket activities by the child


$PROD:CL(R)$cle(r)
          O:PCLAB(R)       Q:(clend(r)-cle(r))
          I:PCL(R) Q:(clend(r)-cle(r))
```

```
$PROD:CLS(R)$CLE(R)
          O:PCLS(R)      Q:CLE(R)       A:RA("USA")     N:TAU(r)$SCL(r)  M:(-0.5)$scl(r)
+                        A:RA("OEC")     N:TAU(r)$SCL(r)  M:(-0.5)$scl(r)
          I:PCL(R)       Q:(CLE(R)/(1+TCLE0(R)))  P:(1+TCLE0(R))  A:RC(R)  T:TCLE0(R)


$DEMAND:RC(r)$cle(r)  s:2
          E:PCL(R)       Q:(clend(r)-(TCLE0(r))*(CLE(R)/(1+TCLE0(R))))
          E:PC(R)        Q:(endtfr*clend(r))
          D:PCLS(R)      Q:cle(r)
          D:PC(R)        Q:(sum(i,cvfm(i,r))+endtfr*clend(r))


$REPORT:
          V:CLEI(r)$cle(r)    O:PCLS(r)           PROD:CLS(r)
          V:WELFARE(r)$cle(r)        w:rc(r)
          V:WELRA(r)        w:ra(r)
     V:FDCL(i,r)$cle(r)    I:PCLAB(r)      PROD:Y(i,r)

     V:FDSKL(i,r)       I:PF("skl",r)    PROD:Y(i,r)
     V:FDLAB(i,r)       I:PF("lab",r)    PROD:Y(i,r)

     V:PRD(i,r)    O:PY(i,r)      PROD:Y(i,r)
     V:TOTCON(i,r)    O:PM(i,r)      PROD:M(i,r)
     V:GEXP(i,s,r)    I:PY(i,s)      PROD:M(i,r)
     V:YD(i,r)$(1/eta>0) O:PD(i,r)      PROD:Y(i,r)
     V:YX(i,r)$(1/eta>0) O:PX(i,r)      PROD:Y(i,r)
          V:DCNM(r)         I:PCLS(r)           PROD:CLS(r)



$OFFTEXT
$SYSINCLUDE mpsgeset child


*         Check the benchmark:

child.ITERLIM = 0;
$INCLUDE child.GEN
SOLVE child USING MCP;



*         Fix a numeraire to permit comparison with MCP:

RA.FX(num) = RA.L(num);

*         Do a cleanup calculation:

child.ITERLIM = 8000;
$INCLUDE child.GEN
```

```
SOLVE child USING MCP;

parameter          clrep      Child's Value Share in Apparel Production;
parameter          clrep2     Child's Value Share in Other Production;
parameter      skapp   Skilled Adult's Value Share in Apparel Production;
parameter      unskapp   Unskilled Adult's Value Share in Apparel Production;
parameter      skoth   Skilled Adult's Value Share in Other Sector;
parameter      unskoth   Unskilled Adult's Value Share in Other Sector;

clrep(r,"initial")$cle(r)=fdcl.l("wap",r)*10000;
clrep2(r,"initial")$cle(r)=fdcl.l("oth",r)*10000;
skapp(r,"initial")=fdskl.l("wap",r)*10000;
unskapp(r,"initial")=fdlab.l("wap",r)*10000;
skoth(r,"initial")=fdskl.l("oth",r)*10000;
unskoth(r,"initial")=fdlab.l("oth",r)*10000;

parameter clrep3 Child's Total Value Share;
clrep3(r,"initial")=clrep(r,"initial")+clrep2(r,"initial");

parameter chgcl Percent Change in Total Child Labor;
chgcl(r,"initial")$cle(r)=100*((clrep3(r,"initial")-clrep3(r,"initial"))/clrep3(r,"initial"));

parameter chgunsk Percent Change in Total Unskilled Labor In Apparel Sector;
parameter chgunsko  Percent Change in Total Unskilled Labor In Other Sector;
parameter chgska Percent Change in Total Skilled Labor In Apparel Sector;
parameter chgsko Percent Change in Total Skilled Labor In Other Sector;

chgunsk(r,"initial")=100*((unskapp(r,"initial")-unskapp(r,"initial"))/unskapp(r,"initial"));
chgunsko(r,"initial")=100*((unskoth(r,"initial")-unskoth(r,"initial"))/unskoth(r,"initial"));
chgska(r,"initial")=100*((skapp(r,"initial")-skapp(r,"initial"))/skapp(r,"initial"));
chgsko(r,"initial")=100*((skoth(r,"initial")-skoth(r,"initial"))/skoth(r,"initial"));

*          First consider the tariff instrument:

tmcl(i,s,"usa")$clshr(i,s) = yes;
tmcl(i,s,"oec")$clshr(i,s) = yes;

* Here we are setting target child labor

cltarget(r)$cle(r) = 0.75;
tau.lo(r)$cle(r) = 0;
* tau.up(r)$cle(r) = 5;
tau.fx(r)$cle(r) = 2;
* tau.fx("ind") =20;
* tau.fx("asi") =20;
* tau.fx("row") =20;

$INCLUDE child.GEN
SOLVE child USING MCP;

parameter          report     Summary Report on Child Welfare;
parameter          report2   Tariff Tax Subsidy Rates in Different Scenario;
parameter          report1   Summary Report on Representative Agents;
```

```
report2(r,"Tariff")$cle(r) = 100 * tau.l(r);
report(r,"Tariff")$cle(r) = 100 * (welfare.l(r)-1);
clrep(r,"Tariff")$cle(r)=fdcl.l("wap",r)*10000;
clrep2(r,"Tariff")$cle(r)=fdcl.l("oth",r)*10000;
skapp(r,"Tariff")=fdskl.l("wap",r)*10000;
unskapp(r,"Tariff")=fdlab.l("wap",r)*10000;
skoth(r,"Tariff")=fdskl.l("oth",r)*10000;
unskoth(r,"Tariff")=fdlab.l("oth",r)*10000;
clrep3(r,"tariff")=clrep(r,"tariff")+clrep2(r,"tariff");
chgcl(r,"tariff")$cle(r)=100*((clrep3(r,"tariff")-clrep3(r,"initial"))/clrep3(r,"initial"));

chgunsk(r,"tariff")=100*((unskapp(r,"tariff")-unskapp(r,"initial"))/unskapp(r,"initial"));
chgunsko(r,"tariff")=100*((unskoth(r,"tariff")-unskoth(r,"initial"))/unskoth(r,"initial"));
chgska(r,"tariff")=100*((skapp(r,"tariff")-skapp(r,"initial"))/skapp(r,"initial"));
chgsko(r,"tariff")=100*((skoth(r,"tariff")-skoth(r,"initial"))/skoth(r,"initial"));

report1(r,"Tariff") = 100 * (welra.l(r)-1);

parameter waptrd1 Apparel Trade after Import Tariff;
waptrd1(s,r) = gexp.l("wap",s,r)*10000;
waptrd1(s,s) = (prd.l("wap",s)-sum(r,gexp.l("wap",s,r)))*10000;
waptrd1(s,"tot_ex")=sum(r,gexp.l("wap",s,r))*10000;
waptrd1(s,"tot_prd")=prd.l("wap",s)*10000;


parameter othtrd1 Other Trade after Tariff;
othtrd1(s,r) = gexp.l("oth",s,r)*10000;
othtrd1(s,s) = (prd.l("oth",s)-sum(r,gexp.l("oth",s,r)))*10000;
othtrd1(s,"tot_ex")=sum(r,gexp.l("oth",s,r))*10000;
othtrd1(s,"tot_prd")=prd.l("oth",s)*10000;

* cltarget(r)$cle(r) = 0.75;
* tau.lo(r)$cle(r) = 0;
* tau.up(r)$cle(r) = 20;


*           Next, consider the wage tax:

CLTAX = 1;
tau.l(r) = 0;
tmcl(i,s,r) = no;
tlcl(s)$cle(s) = yes;
$INCLUDE child.GEN
SOLVE child USING MCP;

report2(r,"Tax_RC")$cle(r) = 100 * tau.l(r);
report(r,"Tax_rc")$cle(r) = 100 * (welfare.l(r)-1);
report1(r,"tax_rc") = 100 * (welra.l(r)-1);
clrep(r,"tax_rc")$cle(r)=fdcl.l("wap",r)*10000;
clrep2(r,"tax_rc")$cle(r)=fdcl.l("oth",r)*10000;
skapp(r,"Tax_rc")=fdskl.l("wap",r)*10000;
unskapp(r,"Tax_rc")=fdlab.l("wap",r)*10000;
```

```
skoth(r,"Tax_rc")=fdskl.l("oth",r)*10000;
unskoth(r,"Tax_rc")=fdlab.l("oth",r)*10000;
clrep3(r,"tax_rc")=clrep(r,"tax_rc")+clrep2(r,"tax_rc");
chgcl(r,"tax_rc")$cle(r)=100*((clrep3(r,"tax_rc")-clrep3(r,"initial"))/clrep3(r,"initial"));
chgunsk(r,"tax_rc")=100*((unskapp(r,"tax_rc")-unskapp(r,"initial"))/unskapp(r,"initial"));
chgunsko(r,"tax_rc")=100*((unskoth(r,"tax_rc")-unskoth(r,"initial"))/unskoth(r,"initial"));
chgska(r,"tax_rc")=100*((skapp(r,"tax_rc")-skapp(r,"initial"))/skapp(r,"initial"));
chgsko(r,"tax_rc")=100*((skoth(r,"tax_rc")-skoth(r,"initial"))/skoth(r,"initial"));

parameter waptrd2 Apparel Trade after Input Tax on Child Labor (RC);
waptrd2(s,r) = gexp.l("wap",s,r)*10000;
waptrd2(s,s) = (prd.l("wap",s)-sum(r,gexp.l("wap",s,r)))*10000;
waptrd2(s,"tot_ex")=sum(r,gexp.l("wap",s,r))*10000;
waptrd2(s,"tot_prd")=prd.l("wap",s)*10000;

parameter othtrd2 Other Trade after Input Tax on Child Labor (RC);
othtrd2(s,r) = gexp.l("oth",s,r)*10000;
othtrd2(s,s) = (prd.l("oth",s)-sum(r,gexp.l("oth",s,r)))*10000;
othtrd2(s,"tot_ex")=sum(r,gexp.l("oth",s,r))*10000;
othtrd2(s,"tot_prd")=prd.l("oth",s)*10000;



CLTAX = 0;
$INCLUDE child.GEN
SOLVE child USING MCP;

report2(r,"Tax_RA")$cle(r) = 100 * tau.l(r);
report(r,"tax_ra")$cle(r) = 100 * (welfare.l(r)-1);
report1(r,"tax_ra") = 100 * (welra.l(r)-1);
clrep(r,"tax_ra")$cle(r)=fdcl.l("wap",r)*10000;
clrep2(r,"tax_ra")$cle(r)=fdcl.l("oth",r)*10000;
skapp(r,"Tax_ra")=fdskl.l("wap",r)*10000;
unskapp(r,"Tax_ra")=fdlab.l("wap",r)*10000;
skoth(r,"Tax_ra")=fdskl.l("oth",r)*10000;
unskoth(r,"Tax_ra")=fdlab.l("oth",r)*10000;
clrep3(r,"tax_ra")=clrep(r,"tax_ra")+clrep2(r,"tax_ra");
chgcl(r,"tax_ra")$cle(r)=100*((clrep3(r,"tax_ra")-clrep3(r,"initial"))/clrep3(r,"initial"));
chgunsk(r,"tax_ra")=100*((unskapp(r,"tax_ra")-unskapp(r,"initial"))/unskapp(r,"initial"));
chgunsko(r,"tax_ra")=100*((unskoth(r,"tax_ra")-unskoth(r,"initial"))/unskoth(r,"initial"));
chgska(r,"tax_ra")=100*((skapp(r,"tax_ra")-skapp(r,"initial"))/skapp(r,"initial"));
chgsko(r,"tax_ra")=100*((skoth(r,"tax_ra")-skoth(r,"initial"))/skoth(r,"initial"));

parameter waptrd3 Apparel Trade after Input Tax on Child Labor (RA);
waptrd3(s,r) = gexp.l("wap",s,r)*10000;
waptrd3(s,s) = (prd.l("wap",s)-sum(r,gexp.l("wap",s,r)))*10000;
waptrd3(s,"tot_ex")=sum(r,gexp.l("wap",s,r))*10000;
waptrd3(s,"tot_prd")=prd.l("wap",s)*10000;

parameter othtrd3 Other Trade after Input Tax on Child Labor (RA);
othtrd3(s,r) = gexp.l("oth",s,r)*10000;
othtrd3(s,s) = (prd.l("oth",s)-sum(r,gexp.l("oth",s,r)))*10000;
othtrd3(s,"tot_ex")=sum(r,gexp.l("oth",s,r))*10000;
```

```
othtrd3(s,"tot_prd")=prd.l("oth",s)*10000;


tlcl(s)$cle(s) = no;
scl(s)$cle(s) = yes;
$INCLUDE child.GEN
SOLVE child USING MCP;

report2(r,"Subsidy")$cle(r) = 100 * tau.l(r);
report(r,"subsidy")$cle(r) = 100 * (welfare.l(r)-1);
report1(r,"subsidy") = 100 * (welra.l(r)-1);
clrep(r,"subsidy")$cle(r)=fdcl.l("wap",r)*10000;
clrep2(r,"subsidy")$cle(r)=fdcl.l("oth",r)*10000;
skapp(r,"subsidy")=fdskl.l("wap",r)*10000;
unskapp(r,"subsidy")=fdlab.l("wap",r)*10000;
skoth(r,"subsidy")=fdskl.l("oth",r)*10000;
unskoth(r,"subsidy")=fdlab.l("oth",r)*10000;
clrep3(r,"subsidy")=clrep(r,"subsidy")+clrep2(r,"subsidy");
chgcl(r,"subsidy")$cle(r)=100*((clrep3(r,"subsidy")-clrep3(r,"initial"))/clrep3(r,"initial"));
chgunsk(r,"subsidy")=100*((unskapp(r,"subsidy")-unskapp(r,"initial"))/unskapp(r,"initial"));
chgunsko(r,"subsidy")=100*((unskoth(r,"subsidy")-unskoth(r,"initial"))/unskoth(r,"initial"));
chgska(r,"subsidy")=100*((skapp(r,"subsidy")-skapp(r,"initial"))/skapp(r,"initial"));
chgsko(r,"subsidy")=100*((skoth(r,"subsidy")-skoth(r,"initial"))/skoth(r,"initial"));

parameter waptrd4 Apparel Trade after Subsidy;
waptrd4(s,r) = gexp.l("wap",s,r)*10000;
waptrd4(s,s) = (prd.l("wap",s)-sum(r,gexp.l("wap",s,r)))*10000;
waptrd4(s,"tot_ex")=sum(r,gexp.l("wap",s,r))*10000;
waptrd4(s,"tot_prd")=prd.l("wap",s)*10000;

parameter othtrd4 Other Trade after Subsidy;
othtrd4(s,r) = gexp.l("oth",s,r)*10000;
othtrd4(s,s) = (prd.l("oth",s)-sum(r,gexp.l("oth",s,r)))*10000;
othtrd4(s,"tot_ex")=sum(r,gexp.l("oth",s,r))*10000;
othtrd4(s,"tot_prd")=prd.l("oth",s)*10000;

report2(r,"S_(mill)")=tau.l(r)*clei.l(r)*10000;


file out/clapp.txt/; put out;

out.nd=0;
out.nw=9;

$libinclude gams2tbl clshar
$libinclude gams2tbl tfr
$libinclude gams2tbl elasdm
$libinclude gams2tbl distax
$libinclude gams2tbl report2

$libinclude gams2tbl chgcl
$libinclude gams2tbl clrep
$libinclude gams2tbl clrep2
```

```
$libinclude gams2tbl clrep3
$libinclude gams2tbl chgunsk

$libinclude gams2tbl chgunsko
$libinclude gams2tbl chgska
$libinclude gams2tbl chgsko
$libinclude gams2tbl skapp
$libinclude gams2tbl unskapp

$libinclude gams2tbl skoth
$libinclude gams2tbl unskoth
$libinclude gams2tbl report
$libinclude gams2tbl report1
$libinclude gams2tbl waptrade

$libinclude gams2tbl waptrd1
$libinclude gams2tbl waptrd2
$libinclude gams2tbl waptrd3
$libinclude gams2tbl waptrd4
$libinclude gams2tbl othtrade

$libinclude gams2tbl othtrd1
$libinclude gams2tbl othtrd2
$libinclude gams2tbl othtrd3
$libinclude gams2tbl othtrd4
```

Appendix D: Results of Sensitivity Analysis

Case 1: results produced under the assumption that the pre-exiting distortionary tax in children's non-market sector is 25%

Table D.1.1: Children's Value Share in Apparel Production (Millions of US dollars)

	Benchmark Equilibrium	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
India	75	67	57	57	57
Sri Lanka	16	12	12	12	12
Rest of South Asia	42	32	32	32	32
Other Asian countries	435	359	326	326	326
Rest of the World	296	276	222	222	222

Table D.1.2: Tariff, Tax, Subsidy Rates and Subsidy Amounts by Scenarios

	Tariff	Tax (Revenue Transferred to children)	Tax (Revenue Transferred to adults)	Subsidy	Subsidy Amount (millions of US$)
India	2000	24	27	21	21
Sri Lanka	41	24	27	21	4
Rest of South Asia	64	24	27	21	12
Other Asian countries	2000	24	26	21	121
Rest of the world	2000	24	26	21	82

Table D.1.3: Apparel Trade Volumes by Scenarios (millions of US$)

	India	Sri Lanka	Rest of South Asia	Asia	USA	OECD	Rest of the World
D.1.3.1 Post Tariff:							
India	4,658	0	3	93	0	0	388
Sri Lanka	0	87	0	4	351	133	9
Rest of South Asia	0	3	1,439	16	258	156	129
Other Asian countries	5	7	46	27,366	0	0	5,495
United States	2	1	0	117	113,010	6,296	2,521
OECD	5	4	11	1,534	21,191	227,200	4,528
Rest of the World	0	2	0	109	0	0	77,063
D.1.3.2 Post Input Tax (Tax Revenue Transferred to the Representative Child):							
India	4,762	0	3	92	978	2,410	369
Sri Lanka	0	93	0	3	903	616	8
Rest of South Asia	0	5	1,533	15	1,789	2,095	111
Other Asian countries	5	14	52	28,834	13,631	29,396	5,447
United States	2	2	0	139	98,781	3,646	2,880
OECD	5	8	13	1,716	7120	205,791	4,892
Rest of the World	0	5	0	114	9,756	20,386	77,690

Table D.1.3 (Continued): Apparel Trade Volumes by Scenarios (millions of US$)

	India	Sri Lanka	Rest of South Asia	Asia	USA	OECD	Rest of the World
D.1.3.3 Post Input Tax (Tax Revenue Transferred to the Representative Adult):							
India	4,762	0	3	92	978	2,410	369
Sri Lanka	0	93	0	3	903	616	8
Rest of South Asia	0	5	1,533	15	1,789	2,095	111
Other Asian countries	5	14	52	28,834	13,631	29,396	5,447
United States	2	2	0	139	98,781	3,646	2,880
OECD	5	8	13	1,716	7,120	205,791	4,892
Rest of the World	0	5	0	114	9756	20,386	77,690
D.1.3.4 Post- Subsidy:							
India	4,762	0	3	92	978	2,409	369
Sri Lanka	0	93	0	3	903	616	8
Rest of South Asia	0	5	1,533	15	1,788	2,094	111
Other Asian countries	5	14	52	28,836	13,630	29,394	5,447
United States	2	2	0	139	98,781	3,646	2,880
OECD	5	8	13	1,716	7,120	205,791	4,892
Rest of the World	0	5	0	114	9,755	20,385	77,692

Table D.1.4: Adults' Value Shares by Sectors by Scenarios (millions of US$)

	Benchmark Equilibrium	Post Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
D.1.4.1 Skilled Adults' Value Share in Apparel Production					
India	102	60	102	102	102
Sri Lanka	22	8	22	22	22
Rest of South Asia	56	22	56	56	56
Other Asian countries	1,660	768	1,660	1,660	1,660
Rest of the World	2,252	1,617	2,253	2,253	2,253
US	6,099	7,054	6,100	6,100	6,100
OECD	10,738	13,511	10,740	10,740	10,740
D.1.4.2 Unskilled Adults' Value Share in Apparel Production					
India	679	386	695	695	694
Sri Lanka	143	52	146	146	146
Rest of South Asia	379	139	387	387	387
Other Asian countries	8,261	3,729	8,349	8,349	8,349
Rest of the World	14,513	10,398	14,574	14,574	14,574
US	22,417	25,922	22,421	22,421	22,421
OECD	50,991	64,120	51,004	51,004	51,004

Table D.1.4 (Continued) : Adults' Value Shares by Sectors by Scenarios (millions of US$)

	Benchmark Equilibrium	Post Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
D.1.4.3 Skilled Adults' Value Share in the Production of Other Goods					
India	25,705	25,746	25,705	25,705	25,705
Sri Lanka	1,193	1,208	1,193	1,193	1,193
Rest of South Asia	6,405	6,442	6,405	6,405	6,405
Other Asian countries	169,978	170,870	169,978	169,978	169,978
Rest of the World	430,329	430,964	430,329	430,329	430,329
US	1,693,422	1,692,462	1,693,421	1,693,421	1,693,421
OECD	3,328,921	3,326,135	3,328,918	3,328,918	3,328,918
D.1.4.4 Unskilled Adults' Value Share in the Production of Other Goods					
India	106,396	112,288	111,980	111,980	111,980
Sri Lanka	3,889	4,192	4,091	4,091	4,091
Rest of South Asia	25,621	27,226	26,961	26,961	26,961
Other Asian countries	448,427	466,836	462,208	462,208	462,208
Rest of the World	1,071,534	1,086,472	1,082,296	1,082,296	1,082,296
US	2,486,905	2,483,399	2,486,901	2,486,901	2,486,901
OECD	5,502,399	5,489,270	5,502,387	5,502,387	5,502,387

Table D.1.5: Summary Report on Welfare (% Changes in Hicksian Equivalent Variation)

	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
D.1.5.1: Children's Welfare				
India	-1	1	-1	6
Sri Lanka	-1	1	-1	6
Rest of South Asia	-1	1	-1	6
Other Asian countries	-1	1	-1	6
Rest of the World	-1	1	-1	6
D.1.5.2: Representative Agents' Welfare				
India	-1	0	0	0
Sri Lanka	-3	-1	-1	-1
Rest of South Asia	-3	0	0	0
Other Asian countries	-1	0	0	0
USA	0	0	0	0
OECD	0	0	0	0
Rest of the World	0	0	0	0

Case 2: Results under the alternative assumption of low substitutability between unskilled adult and child labor (the elasticity of substitution =1)

Table D.2.1: Children's Value Share in Apparel Production

	Benchmark Equilibrium	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
India	75	57	57	57	57
Sri Lanka	16	12	12	12	12
Rest of South Asia	42	32	32	32	32
Other Asian countries	435	326	326	326	326
Rest of the World	296	239	222	222	222

Table D.2.2: Tariff, Tax, Subsidy Rates and Subsidy Amounts by Scenarios

	Tariff	Tax (Revenue Transferred to children)	Tax (Revenue Transferred to adults)	Subsidy	Subsidy Amount (millions of US$)
India	55	49	55	42	40
Sri Lanka	20	48	54	41	8
Rest of South Asia	24	49	55	42	22
Other Asian countries	29	49	55	42	230
Rest of the World	2000	49	55	42	156

Table D.2.3: Apparel Trade Volumes by Scenarios (millions of US$)

	India	Sri Lanka	Rest of South Asia	Asia	USA	OECD	Rest of the World
D.2.3.1 Post Tariff:							
India	4,676	0	3	95	211	252	384
Sri Lanka	0	90	0	4	645	325	8
Rest of South Asia	0	4	1,483	15	1,096	923	119
Other Asian countries	5	10	49	27,897	6,443	8,524	5,403
US	2	1	0	123	108,788	5,676	2,580
OECD	5	6	12	1,587	14,778	222,958	4,558
Rest of the World	0	3	0	112	0	0	77,095
D.2.3.2 Post Input Tax (Tax Revenue Transferred to the Representative Child):							
India	4,747	0	3	91	967	2,379	365
Sri Lanka	0	93	0	3	894	609	8
Rest of South Asia	0	4	1,528	14	1,773	2,075	110
Other Asian countries	5	14	52	28,765	13,561	29,207	5,416
US	2	2	0	140	98,844	3,656	2,890
OECD	5	8	13	1,726	7,150	205,898	4,558
Rest of the World	0	5	0	115	9,749	20,346	77,595

Table D.2.3 (Continued): Apparel Trade Volumes by Scenarios (millions of US$)

	India	Sri Lanka	Rest of South Asia	Asia	USA	OECD	Rest of the World
D.2.3.3 Post Input Tax (Tax Revenue Transferred to the Representative Adult):							
India	4,747	0	3	91	967	2,379	365
Sri Lanka	0	93	0	3	894	609	8
Rest of South Asia	0	4	1,528	14	1,773	2,075	110
Other Asian countries	5	14	52	28,765	13,561	29,207	5,416
US	2	2	0	140	98,844	3,656	2,890
OECD	5	8	13	1,726	7,150	205,898	4,911
Rest of the World	0	5	0	115	9,749	20,346	77,595
D.2.3.4 Post- Subsidy:							
India	4,748	0	3	91	967	2,378	365
Sri Lanka	0	93	0	3	893	608	8
Rest of South Asia	0	4	1,529	14	1,772	2,073	110
Other Asian countries	5	14	52	28,770	13,558	29,203	5,416
US	2	2	0	140	98,843	3,656	2,891
OECD	5	8	13	1,727	7,150	205,897	4,911
Rest of the World	0	5	0	115	9,748	20,344	77,599

Table D.2.4: Summary Report on Welfare (% Changes in Hicksian Equivalent Variation)

	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
D.2.4.1: Children's Welfare				
India	-2	4	-2	12
Sri Lanka	-2	4	-2	12
Rest of South Asia	-2	4	-2	12
Other Asian countries	-2	4	-2	12
Rest of the World	-2	4	-2	12
D.2.4.2: Representative Agents' Welfare				
India	-1	0	0	0
Sri Lanka	-2	-1	-1	-1
Rest of South Asia	-2	0	0	0
Other Asian countries	-1	0	0	0
USA	0	0	0	0
OECD	0	0	0	0
Rest of the World	0	0	0	0

Case 3: Children's value share is twice as much as that assumed in the original case

Table D.3.1: Tariff, Tax, Subsidy Rates and Subsidy Amounts by Scenarios

	Tariff	Tax (Revenue Transferred to children)	Tax (Revenue Transferred to adults)	Subsidy	Subsidy Amount (millions of US$)
India	2000	22	24	19	37
Sri Lanka	36	22	24	19	8
Rest of South Asia	49	22	24	19	20
Other Asian countries	2000	21	24	19	205

Case 4: When children do not receive any transfer from the adults

Table D.4.1: Children's Value Share in Apparel Production

	Benchmark Equilibrium	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
India	75	72	57	57	57
Sri Lanka	16	11	12	12	12
Rest of South Asia	42	36	32	32	32
Other Asian countries	435	296	326	326	326
Rest of the World	296	287	222	222	222

Table D.4.2: Tariff, Tax, Subsidy Rates and Subsidy Amounts by Scenarios

	Tariff	Tax (Revenue Transferred to children)	Tax (Revenue Transferred to adults)	Subsidy	Subsidy Amount (millions of US$)
India	2000	33	77	19	18
Sri Lanka	2000	33	77	19	4
Rest of South Asia	2000	33	77	19	10
Other Asian countries	2000	33	77	19	101
Rest of the World	2000	33	77	19	68

Table D.4.3: Summary Report on Welfare (% Changes in Hicksian Equivalent Variation)

	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
D.4.3.1: Children's Welfare				
India	-5	1	-20	12
Sri Lanka	-24	1	-20	12
Rest of South Asia	-12	1	-20	12
Other Asian countries	-7	1	-20	12
Rest of the World	-3	1	-20	12
D.4.3.2: Representative Agents' Welfare				
India	-1	0	0	0
Sri Lanka	-4	0	0	0
Rest of South Asia	-2	0	0	0
Other Asian countries	-1	0	0	0
USA	0	0	0	0
OECD	0	0	0	0
Rest of the World	0	0	0	0

Case 5: When children are employed in other sectors as well

Table D.5.1: Children's Value Share (Millions of US dollars)

	Benchmark Equilibrium	Post-Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
D.5.1.1: Apparel Production					
India	75	44	57	57	57
Sri Lanka	16	1	12	12	12
Rest of South Asia	42	11	32	32	32
Other Asian countries	435	183	327	327	327
Rest of the World	296	206	223	223	223
D.5.1.2: Other Sectors					
India	5,600	5,495	4,199	4,199	4,200
Sri Lanka	205	205	153	153	153
Rest of South Asia	1,348	1,304	1,011	1,011	1,011
Other Asian countries	13,869	12,790	10,400	10,400	10,400
Rest of the World	10,824	10,388	8,117	8,117	8,117

Table D.5.2: Tariff, Tax, Subsidy Rates and Subsidy Amounts by Scenarios

	Tariff	Tax (Revenue Transferred to children)	Tax (Revenue Transferred to adults)	Subsidy	Subsidy Amount (millions of US$)
India	2000	22	23	19	1,346
Sri Lanka	2000	22	24	19	52
Rest of South Asia	2000	22	24	19	331
Other Asian countries	2000	21	23	19	3,362
Rest of the world	2000	21	23	19	2,578

Table D.5.3: Adults' Value Shares by Sectors by Scenarios (Millions of US$)

	Benchmark Equilibrium	Post Tariff	Post-Tax (Revenue Transferred to children)	Post-Tax (Revenue Transferred to adults)	Post Subsidy
D.5.3.1 Skilled Adults' Value Share in Apparel Production					
India	102	60	102	102	101
Sri Lanka	22	1	22	22	22
Rest of South Asia	56	16	56	56	56
Other Asian countries	1,660	762	1,660	1,660	1,660
US	6,099	6,829	6,101	6,101	6,101
OECD	10,738	13,272	10,741	10,741	10,744
Rest of the World	2,252	1,634	2,252	2,252	2,253
D.5.3.2 Unskilled Adults' Value Share in Apparel Production					
India	679	405	687	687	687
Sri Lanka	143	8	145	145	145
Rest of South Asia	379	105	383	383	380
Other Asian countries	8,261	3,816	8,296	8,296	8,295
US	22,417	25,084	22,423	22,423	22,425
OECD	50,991	62,935	51,009	51,009	51,021
Rest of the World	14,513	10,554	14,543	14,543	14,545
D.5.3.3 Skilled Adults' Value Share in the Production of Other Goods					
India	25,705	25,746	25,705	25,705	25,705
Sri Lanka	1,193	1,214	1,193	1,193	1,194
Rest of South Asia	6,405	6,446	6,405	6,405	6,406
Other Asian countries	169,978	170,875	169,978	169,978	169,978
US	1,693,422	1,692,692	1,693,421	1,693,421	1,693,420
OECD	3,328,921	3,326,387	3,328,917	3,328,917	3,328,915
Rest of the World	430,329	430,948	430,329	430,329	430,329
D.5.3.4 Unskilled Adults' Value Share in the Production of Other Goods					
India	106,396	106,670	106,388	106,388	106,393
Sri Lanka	3,889	4,024	3,887	3,887	3,888
Rest of South Asia	25,621	25,895	25,617	25,617	25,620
Other Asian countries	448,427	452,872	448,392	448,392	448,393
US	2,486,905	2,484,238	2,486,899	2,486,899	2,486,896
OECD	5,502,399	5,490,455	5,502,382	5,502,382	5,502,370
Rest of the World	1,071,534	1,075,493	1,071,503	1,071,503	1,071,501

Table D.5.4: Apparel Trade Volumes by Scenario (millions of US$)

	India	Sri Lanka	Rest of South Asia	Asia	USA	OECD	Rest of the World
D.5.4.1 Post Tariff:							
India	4,497	0	3	90	0	0	564
Sri Lanka	0	79	0	4	0	0	15
Rest of South Asia	0	2	1,366	14	0	0	167
Other Asian countries	7	5	47	25,191	0	0	7,616
US	0	0	2	111,044	6,900	49	
OECD	0	0	0	19	21,227	225,507	81
Rest of the World	0	2	0	99	0	0	76,900
D.5.4.2 Post Input Tax (Tax Revenue Transferred to the Representative Child):							
India	4,736	0	3	92	980	2,414	370
Sri Lanka	0	93	0	3	905	617	8
Rest of South Asia	0	5	1,526	14	1,788	2,094	111
Other Asian countries	5	14	52	28,720	13,612	29,349	5,434
US	2	2	0	138	98,789	3,646	2,878
OECD	5	8	13	1,712	7,124	205,803	4,890
Rest of the World	0	5	0	114	9,757	20,385	77,601
D.5.4.3 Post Input Tax (Tax Revenue Transferred to the Representative Adult):							
India	4,736	0	3	92	980	2,414	370
Sri Lanka	0	93	0	3	905	617	8
Rest of South Asia	0	5	1,526	14	1,788	2,094	111
Other Asian countries	5	14	52	28,720	13,612	29,349	5,434
US	2	2	0	138	98,789	3,646	2,878
OECD	5	8	13	1,712	7,124	205,803	4,890
Rest of the World	0	5	0	114	9,757	20,385	77,601
D.5.4.4 Post- Subsidy:							
India	4,754	0	3	91	960	2,364	363
Sri Lanka	0	93	0	3	898	613	8
Rest of South Asia	0	4	1,530	14	1,766	2,068	110
Other Asian countries	5	14	53	28,793	13,580	29,283	5,432
US	2	2	0	140	98,779	3,657	2,892
OECD	5	8	13	1,722	7,132	205,782	4,906
Rest of the World	0	5	0	114	9,738	20,347	77,673

Table D.5.4: Trade Volumes of Other Goods by Scenario (millions of US$)

	India	Sri Lanka	Rest of South Asia	Asia	USA	OECD	Rest of the World
D.5.4.1 Benchmark:							
India	522,725	310	1,203	5,822	5,156	14,951	6,463
Sri Lanka	28	13,452	78	291	369	1,293	549
Rest of South Asia	175	73	135,005	1,806	1,038	4,890	2,004
Other Asian countries	6,070	1,477	4,836	3,048,752	146,741	284,277	61,783
US	3,552	403	1,632	95,587	11,373,766	493,082	100,291
OECD	19,645	2,362	8,360	366,798	566,305	26,361,106	432,626
Rest of the World	9,319	738	4,161	61,881	87,703	366,489	5,940,451
D.5.4.2 Post Tariff:							
India	534,427	409	1,495	10,037	0	0	12,544
Sri Lanka	56	14,529	141	710	0	0	1,588
Rest of South Asia	278	111	139,599	3,198	0	0	3,932
Other Asian countries	9,410	2,029	6,389	3,309,121	0	0	127,769
US	67	7	27	1,940	11,466,736	622,220	2,348
OECD	341	36	130	6,961	695,536	27,765,333	9,436
Rest of the World	14,975	982	5,236	98,243	0	0	6,278,569
D.5.4.3 Post Input Tax (Tax Revenue Transferred to the Representative Child):							
India	520,471	308	1,196	5,792	5,138	14,898	6,437
Sri Lanka	28	13,557	78	289	367	1,286	546
Rest of South Asia	174	72	134,518	1,793	1,033	4,863	1,992
Other Asian countries	6,043	1,472	4,818	3,068,185	146,526	283,828	61,654
US	3,542	403	1,629	95,445	11,408,589	493,116	100,247
OECD	19,592	2,358	8,344	366,286	566,459	26,492,846	432,474
Rest of the World	9,287	736	4,150	61,749	87,664	366,282	5,968,745
D.5.4.4 Post Input Tax (Tax Revenue Transferred to the Representative Adult):							
India	520,471	308	1,196	5,792	5,138	14,898	6,437
Sri Lanka	28	13,557	78	289	367	1,286	546
Rest of South Asia	174	72	134,518	1,793	1,033	4,863	1,992
Other Asian countries	6,043	1,472	4,818	3,068,185	146,526	283,828	61,654
US	3,542	403	1,629	95,445	11,408,589	493,116	100,247
OECD	19,592	2,358	8,344	366,286	566,459	26,492,846	432,474
Rest of the World	9,287	736	4,150	61,749	87,664	366,282	5,968,745
D.5.4.5 Post- Subsidy:							
India	521,253	303	1,180	5,673	5,014	14,551	6,302
Sri Lanka	28	13,587	77	287	363	1,273	541
Rest of South Asia	173	71	134,681	1,771	1,017	4,791	1,967
Other Asian countries	6,099	1,476	4,847	3,069,976	145,919	282,817	61,564
US	3,594	406	1,646	95,887	11,406,732	494,045	100,650
OECD	19,848	2,373	8,425	367,383	566,273	26,490,038	433,505
Rest of the World	9,376	738	4,177	61,731	87,349	365,171	5,970,197