Free Trade in the Americas from a North-South Perspective

John Gilbert
Assistant Professor
Department of Economics
Utah State University
e-mail: jgilbert@econ.usu.edu

Abstract:

Much of the original CGE literature arose from the need to analyze developing economy issues. In recent years, CGE models have been widely used to analyze trade policy issues in developed and developing economies alike. For a variety of reasons, there has been a gradual convergence towards what might be called a 'standard' CGE trade model. It can be argued that this standard model is best suited to the analysis of developed market economies. In this paper we focus on three developing economy issues that have not been widely explored in recent literature. The first is the effect of dual economic structures – in our case taking the neoclassical Harris-Todaro approach. The second is the effect of imperfect labor mobility (introduced with endogenous migration costs). The third is the necessity of tax revenue replacement policies. Our application is to trade liberalization in the Americas. By simulating reform under both standard and developing economy assumptions, we obtain a different perspective on North-South benefits from trade reform. In particular, developing American economies are shown to be the most substantial beneficiaries of liberalization in net welfare terms – a consequence of under-exploited labor and the structure of protection.

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F13 - Commercial Policy; Protection; Promotion; Trade Negotiations
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1. Introduction

Computable general equilibrium (CGE) models are simply numerical implementations general equilibrium (GE) theory, having the fundamental objective of turning the abstract models of theory into a practical tool for policy analysis. They are multi-sectoral, and in many cases multi-regional, and the behavior of economic agents is modeled explicitly through utility and profit maximizing assumptions. In addition, economy-wide constraints are rigorously enforced within the models. Since distortions in an economic system will often have repercussions beyond the sector in which they occur, by linking markets, CGE techniques can at capture relevant feedback and flow-through effects. For these reasons, CGE techniques have become perhaps the most widely used method of the analyzing trade policy issues.

Most of the CGE models currently in wide use (publicly available models like GTAP - Hertel, 1997 - and GTAP-Dyn, the Michigan model, and the multitude of independently developed models) are based on what might be called a 'standard' neoclassical paradigm. By this we mean that the micro-economic closure generally involves perfectly mobile endowments of productive factors, with endogenous factor returns and full employment. The macro-economic closure often does not incorporate a government budget constraint (spending is independent of revenue). Where extensions to the standard framework are made, they are most often in the form of introducing imperfect competition and economies of scale, or dynamic structures (as in the Michigan Model and various extensions to GTAP). This observation is not a criticism of the models. They introduce valuable and consistent information to the policy debate on trade liberalization. Moreover, there are good reasons for adopting this standard structure, in particular in terms of stability and predictability of results. However, it can be argued that most CGE models are essentially HOS derivatives (and derivatives of the new trade theory in the case of imperfect competition). These underlying theoretical models are typically regarded as simplified representations of developed market economies. Other features are emphasized in the theoretical GE literature on developing economies, but these have not been widely adopted in recent CGE literature.[1]

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[1] A recent survey of some 30 CGE studies of liberalization in APEC did not reveal any specifications outside of the standard paradigm (Scollay and Gilbert, 2000), despite the much emphasized North-South dimension of this forum. Another survey of 30 CGE studies of trade reform in China (Gilbert and Wahl, 2001) revealed only one study (Xu, 1994) with a developing economy specification (Lewis rural surplus labor), and one study that considered tax replacement (Wang and Zhai, 1998). We are also aware of a study by of Indonesia by Azis (1997), that introduces developing economy features. The literature on South America reform is thinner, but we

Many of the original CGE models were developed with the objective of highlighting developing economy issues. Much early work of Shoven and Whalley, and the World Bank was undertaken for the purpose of developing economy analysis.[2] The excellent survey by Decaluwé and Martens (1988) details over 70 such studies. The survey by Bandara (1991) also highlights many developing economy models. In our view, two issues of particular importance when analyzing trade policy in a developing economy are not addressed in the standard framework. On the micro side, the theoretical GE literature relating to developing economies emphasizes dual economic structures – the contrast between rural and urban facets of the economy. Typical modifications to the neoclassical framework are the addition of rural surplus labor (Lewis, 1955), or the addition of wait unemployment in the urban area with rural-urban migration (Harris and Todaro, 1970). Moreover, it can be argued that with labor markets in developing economies are less flexible than those in developed economies, and that labor is not able to move freely between alternative economic activities. Hence HOS-type abstractions may not be reasonable in many developing economies.

On the macro side, it is frequently argued that tariffs are important in developing economies for revenue purposes. If this is accepted, then simply modeling the removal of those tariffs, on a preferential, multilateral or unilateral basis, is unsatisfactory. The estimated benefits of the policy are overstated by the failure to accommodate compensating rises in other taxation. This may be an unimportant issue in the context of developed economies where trade taxes are not a significant source of government revenue, and thus the standard model again seems best suited to a developed economy paradigm.[3]

Both of these issues (which are essentially ones of closure) have important implications when analyzing the effect of trade reform. Trade reform in the Americas makes a particularly interesting case study because it involves a number of economies that would generally be classified as developing, with two economies (Canada and the United States) that clearly fall into the developed category. This paper explores some of the issues that might be considered when tailoring a model to a developing economy, and how the model results can

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are not aware of any studies that adopt non-standard specifications in the sense used in this paper. However, the tide is turning, we note with enthusiasm that the Fifth Annual Conference on Global Trade Analysis is to be centered on the topic of modeling sustainable development in a CGE context.

[2] Other early work was of course concerned with developed economies, notably the ORANI project. The Michigan model was originally developed with the analysis of US policy in mind.

[3] A more cynical view of the tendency not to link government expenditure directly to revenue may be the need to bolster the arguments for trade liberalization, as net welfare effects are generally small in the typical static model.

vary from what would be obtained in a 'standard' model. We emphasize that the way that we characterize a developing economy as distinct from a developed economy in this paper is only one possible approach. We begin by reviewing the theoretical foundations of our study. When then consider the effect of reform using general equilibrium models of a selection of American economies, taking into account the effects of a dual-structure and revenue replacement mechanisms.

2. Foundations

In the standard trade model, the welfare effect of a tariff can be derived from the budget constraint of the economy. For a small economy (for which world prices are given) producing *X* and *Y* (the importable) under competitive conditions, the budget constraint can be expressed in terms of the GDP and expenditure functions as:

$$G(p_Y, \overline{K}, \overline{L}) + (p_Y - p_Y^*)M_Y = E(p_Y, u) \tag{1}$$

Totally differentiating (1) and simplifying yields the following well-known expression:

$$dW = (p_Y - p_Y^*)dM_Y \tag{2}$$

Which states that the change in welfare is equal to the difference between the domestic and world price (the magnitude of the tariff), multiplied by the change in the volume of imports. This term (the Harberger effect or deadweight loss) is unambiguously negative, and hence starting from a tariff-ridden equilibrium, we know that liberalization must raise welfare.

For a small developing economy the effects of protection are somewhat different. In particular, the sectoral balance of protection is critical. Consider a developing economy with distinct rural and urban regions. Suppose *X* is an industrial good produced in the urban region, and exported. Let *Y* be an agricultural good produced in the rural region and imported. We follow the neoclassical Harris-Todaro characterization of the dual economy (Corden and Findlay, 1975). Full employment of labor prevails in the rural region, but a rigid wage in the urban region creates unemployment. Migration occurs between the two regions until the expected urban wage is equal to the actual rural wage. Capital is fully mobile. A compact algebraic description of the model is then:

$$c_X(\overline{w}, r) = 1 \tag{3}$$
$$c_Y(w, r) = p_Y \tag{4}$$

$$w = \pi\overline{w} \tag{5}$$
$$a_{XL}X + \pi a_{YL}Y = \pi\overline{L} \tag{6}$$
$$a_{XK}X + a_{YK}Y = \overline{K} \tag{7}$$
$$G(p_Y, \overline{K}, L_X, L_Y) + (p_Y - p_Y^*)M_Y = E(p_Y, u) \tag{8}$$

Equations (3) and (4) are zero profit conditions (we have chosen p_X as numéraire), which can be solved for the factor prices. Once these are known, Shepherd's lemma enables us to derive the optimal input-output coefficients (a_{ij}). Equation (5), the HT labor market equilibrium condition, can be solved for the equilibrium rate of employment π. Equations (6) and (7) are the factor market constraints, which can then be solved for output levels. Finally, (8) is the budget constraint expressed in terms of the GNP and expenditure functions, which can be solved for the welfare level as above. All the usual assumptions apply, production functions are homogeneous of degree one, continuous, and strictly concave, the utility function is continuous, quasi-concave and increasing in consumption of both goods. To guarantee stability, assume that *X* is capital intensive (the Neary, 1987, condition). Now, totally differentiating (8) yields:

$$dW = (p_Y - p_Y^*)dM_Y + \overline{w}L_U d\pi \tag{9}$$

Thus the incremental change in welfare is the sum of a Harberger effect, and the effect of changes in the employment rate (see Gilbert and Wahl, 2001, for a more complete derivation in a related model). As is well-known, free trade is sub-optimal, since $dW \neq 0$ when $p_Y = p_Y^*$ (only the first term drops out). The first term in (9) reflects the deadweight loss, and is negative as above. However, a sufficiently small tariff will raise social welfare if it raises the probability of employment.

Factor prices are determined entirely by goods prices by construction, and so from logarithmically differentiating (1) and (2) and solving we obtain:

$$\hat{w} = \hat{p}_Y \theta_{KX} / (\theta_{LY}\, \theta_{KX}) \tag{10}$$

where a circumflex denotes a proportional change, θ_{ji} is the cost share of factor *j* in industry *i*, and $\hat{p}_Y > 0$. It is clear from (1) that the return to capital is fixed. From (3) we know that $\hat{\pi} = \hat{w} - \hat{\overline{w}}$, hence the probability of finding urban employment improves with a small tariff on *Y*. Reversing the arguments: *liberalizing trade in Y may lower welfare, because unemployment rises*. Similarly, it should be clear that removing an existing tariff on *X* would unambiguously raise welfare, were *X* the importable. Hence, when considering liberalization in a developing economy, the structure of protection takes on new importance, even when world prices are given.

The picture is further complicated if we believe that labor is less than perfectly mobile in developing economies. A recent paper (Gilbert and Mikić, 1998) introduces the concept of the 'elasticity of labor migration'. Consider a situation where there is a differential between the rural wage and the expected urban wage, ρ, and hence (5) becomes $w = \pi\overline{w} - \rho$. The variable ρ is positive and may represent locational preferences, attachments to existing arrangements, a high cost of relocation, and/or the effect of a restrictive government policy. The elasticity of labor migration can then be defined in a natural way as $\varepsilon = \hat{L}_U / \hat{\rho}$, the proportional change in the total urban population induced per proportional change in the expected wage differential ($0 < \varepsilon < \infty$). All other equations remain unchanged, as does the fundamental welfare derivation for a tariff on *Y* given above (9).[4] However, the proportional change in the probability of employment is now:

$$\hat{\pi} = \frac{\varepsilon w \hat{w} + \rho(\hat{a}_{XL} + \hat{X})}{\varepsilon \pi \overline{w} + \rho} \tag{11}$$

which is of ambiguous sign in general. However, note that $\lim_{\varepsilon \to 0} \hat{\pi} = \hat{a}_{XL} + \hat{X}$, which in the case of a tariff on *Y* discussed above can be shown to be negative. Hence, the less labor movement is allowed, the greater the potential for gains from agricultural liberalization. Note also that $\lim_{\varepsilon \to \infty} \hat{\pi} = (w / \pi\overline{w})\hat{w}$, and so this model converges to the standard HT case. It is also clear that there will be a critical value of ε (such that $\hat{\pi} = 0$) beyond which the model will behave in the same manner (qualitatively) as the standard HT model.[5]

The intuition behind the result is quite straightforward. An agricultural tariff in the standard HT model draws labor and capital out of the urban region, but because agriculture is labor intensive, more labor is drawn than capital. The end result is an improvement in urban

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[4] Strictly speaking, this depends on our assumption of what happens to the migration cost. In this section we assume it represents real resources lost (e.g., work days). An alternative is to assume that the cost is like a tax on mobility, which is redistributed like other revenue. This latter assumption does not alter the results in a fundamental way (see Gilbert and Tower, forthcoming).

[5] Without going into the details of model solution, which are somewhat involved, it can be shown that: $|D|\hat{\pi} = -\rho\pi(\lambda_{YL}\hat{K} - \lambda_{YK}\hat{L}) - \{\delta_\pi|\lambda| + \rho(\lambda_{YK}\delta_L + \pi\lambda_{YL}\delta_K)\}\hat{p}_Y$, where: $|D| \equiv \varepsilon\pi\overline{w}|\lambda| - \rho\lambda_{XK}\pi\lambda_{YL}$, $|\lambda| \equiv \lambda_{XL}\lambda_{YK} - \pi\lambda_{YL}\lambda_{XK} < 0$, $\delta_L \equiv \{\pi\lambda_{YL}\theta_{YK}\sigma_Y / (\theta_{XK}\theta_{YL}) + \lambda_{XL}\sigma_X\}$, $\delta_K \equiv \{\lambda_{YK}\sigma_Y / \theta_{XK} + \lambda_{XK}\theta_{XL}\sigma_X / (\theta_{XK}\theta_{YL})\}$, and $\delta_\pi \equiv \{\varepsilon w\theta_{YK} / (\theta_{XK}\theta_{YL}) - \rho\sigma_X\}$. This implies that: $\hat{\pi}/\hat{p}_Y > 0 \iff \varepsilon > \lambda_{YL}\rho\pi\{\lambda_{XK}\sigma_X(\theta_{XK}\theta_{YK} - 1) - \sigma_Y\lambda_{YK}\} / (w\theta_{YK}|\lambda|)$, which is the result stated. A complete derivation is available from the author on request.

employment. Now consider the limiting case of no labor migration. The rural wage rises as before and agricultural output expands. Now, however, labor cannot move to fill the needs of agriculture. A reduction in production of X then leads to higher urban unemployment. Welfare subsequently declines. Hence, the level of labor mobility, in addition to the prevalence of urban unemployment, become important variables when evaluating the consequences of agricultural trade liberalization in a developing economy.

3. An Overview of the CGE Model

The CGE model that we utilize in this paper is a slightly modified version of that used in Gilbert and Wahl (2001b). An equation listing is presented in the appendix, here we briefly discuss the salient features. The model is derived from the standard Armington trade model, and its basic structure is thus familiar. The economy under analysis is assumed to be composed of a set of competitive industries, each of which use the given endowments of factors of production (in a CES composite) along with the output of the other sectors (in a Leontieff composite) to produce a joint product. This joint product is a composite of an exportable and a domestic good, with the transformation being based on a CET function.

A single representative consumer maximizes a Stone-Geary utility function subject to the economy-wide budget constraint (with quantities of investment and government purchases held constant). Having allocated expenditure across the consumption goods, a second-level optimization procedure allocates consumption of each good across domestic and imported goods in that product category (that is, import and domestic goods are treated as imperfect substitutes). The aggregation function takes the CES form, and is constant across all consumption activities (we do not incorporate the Salter specification).

The world price of importables is held constant. The world price of exportables is derived from a CED rest-of-world demand function. The model can accommodate goods that are non-traded, in which case the domestic price is determined by the interaction of domestic supply and demand. The numeraire of the model is based on a domestic price index (a no-inflation assumption), and the nominal exchange rate is assumed to adjust to maintain a fixed current account surplus/deficit.

The specification of factor markets is where the model differs most conspicuously from others in the genre. There is considerable flexibility. Any factor may be denoted as mobile or specific. If a factor is denoted as being mobile, it can be classified as being fully employed (in which case the factor return is flexible), or partially employed (in which case the factor return is fixed in at least some sectors). We can also specify which industries are rural and which are urban, and allow migration to occur between the two in response to expected wages and be controlled by a migration elasticity as discussed above.[6] By adjusting the model sets we can replicate a 'standard' model or a Harris-Todaro developing economy model with or without imperfect labor mobility. Under our 'standard' assumptions we treat land and resources as specific factors, and treat labor and capital as being fully mobile and fully employed. Under our developing economy assumptions, we again treat land and resources as being specific factors, and we treat capital as being mobile, but we treat labor as being partially unemployed (the wage is fixed in urban sectors and the HT mechanism with migration cost applies). Note that labor is still classified as fully mobile between sectors within a region, the migration constraints apply only to aggregate labor movements between regions.

The data that we are using is from the GTAP4 database (MacDougall et al. 2000), although we should be able to update to the GTAP5 database easily in due course. We have chosen 5 economies to experiment with: Argentina, Brazil, Chile, Mexico and Venezuela.[7] For each we have drawn an 18 sector dataset from the GTAP database. We present the results of liberalization experiments for the remaining American economies for using the standard model only. Our experimental design is as follows. We calibrate each economy model to the initial 1995 database and a set of behavioral parameters. We then close the model in a 'standard' fashion, and consider the effect of removal of all import tariffs. We then switch to a HT specification with a high migration elasticity, holding all other behavioral parameters constant (our objective is to isolate the effect of specification). We then conduct the tariff removal experiment again. We next consider the effect of restricting migration by lowering the migration elasticity, and re-running the liberalization scenarios. Finally, we consider the effect of tax replacement – in this case by scaling output taxes (leaving output subsidies unchanged) so as to maintain a constant government deficit. All of the model results are sensitive to the underlying behavioral parameters, hence our focus is more on the comparison between the specifications than the absolute levels of the estimated effects of reform. The model is implemented in levels form using GAMS.

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[6] We should note that other model features, in particular the use of Armington-type aggregation functions, result in a model behavior that is somewhat different to the simple theoretical model developed above, as is true of all CGE models. Armington aggregation functions eliminate the direct correspondence between relative exportable and importable prices observed in a homogeneous two good model.

[7] Colombia and Uruguay are also available in the database, but have been excluded from experiments using our developing economy closure because the data for these countries does not seem to fit the HT paradigm very well. When matching the GTAP labor payments data to ILO sectoral employment data we find a small, well-paid agricultural sector.

4. Effects of Trade Reform in the Americas

Standard Trade Model

The estimated net welfare effects of the complete removal of all tariffs under the assumptions of the standard trade model are presented in Table 1, Column 1, using the equivalent variation measure. We note that the estimated net welfare effects of reform under this standard specification are rather small, ranging between a very small negative result for Canada, Chile and Uruguay (which is somewhat curious, perhaps reflecting adverse terms-of-trade consequences and/or the second-best implications of the remaining taxes in the system), to gains of just over $700 million for Brazil. Gains of this magnitude are consistent with typical CGE estimates.

It is important to note that we can in some ways regard these type of estimates as being 'lower bounds' on the effects of liberalization. Introduction of imperfect competition, or dynamic features will typically magnify the gains. The results are also bounds in terms of our factor market assumptions – we have implicitly assumed away the possibility that trade could increase (or decrease) the total level of employment.

The Dual Model

Consider now the estimated net welfare effects of reform under our characterization of the developing economy, presented in Table 1, Column 2, for selected economies that seem to fit our developing economy characterization. The obvious point to note is that the estimated net gains from reform are considerably larger than in the standard model. What is it that accounts for such a large discrepancy? The standard model assumes that the economy is operating on the efficiency locus, albeit at a point that is sub-optimal. Changes in trade policy effect the familiar movements around the economy's transformation frontier – however the gains associated with these movements are very small (as is often said, we are measuring small triangles).

In our characterization of the developing economy, these same efficiency gains are enjoyed when domestic prices align with world prices. However, here there is an additional effect. In the initial equilibrium, the economy is assumed to not be on the efficiency locus, as a consequence of the unemployment caused by the fixed urban wage. Changing the price vector can shift the allocation of resources. If more of the economies' resources are employed post-liberalization, the net effect on welfare can be substantial. Consider Table 2, Column 2. This shows the rate of urban employment that is estimated to hold in the post-liberalization equilibrium. The first column of Table 2 shows the initial calibrated employment rates (based on World Bank data). In all cases the rate of urban employment is estimated to rise – it is this feature of the model that accounts for the substantially greater net welfare estimates relative to the standard model.

However, while the incorporation of urban-unemployment seems to substantially increase the net welfare effects of trade liberalization in the case of the selected American economies, and thus makes trade liberalization appear a much more attractive prospect, it needs to be emphasized that these results hold only under certain conditions. The developing economy framework used here is much more capricious than the standard model. In particular, the model will tend to predict substantial welfare gains when the reform program involves dismantling high industrial tariffs, but the opposite may occur in cases where, for example, agricultural support alone is dismantled (depending on the balance between efficiency gains and employment losses). Hence, the structure of the distortions in the model takes on extreme importance in this framework – if a liberalization initiative results in a higher rate of urban unemployment by increasing the incentive to migrate beyond the capacity of urban industry to absorb labor, the result can be a substantial net welfare decline. A check of the protection levels in the GTAP database reveals that these economies tend to have industrial tariffs that are considerably higher on average than agricultural tariffs, and the welfare results reflect this fact.

Imperfect Labor Mobility

Now consider the effect of introducing imperfect labor mobility to our framework. In the standard model, introducing imperfect labor mobility (this is an available feature in models like GTAP) will have a relatively predictable effect. By not allowing labor to move freely in response to price changes, the ability of the economy to adapt to reform is constrained and, barring any unusual terms-of-trade or second-best effects, this will result in lower net welfare gains from reform. In the HT framework, the second-best implications of the rigid urban wage again take on new importance and make the analysis of imperfect labor mobility more nuanced. If migration to urban areas is feeding urban unemployment, then constraining labor movements could have a positive effect on welfare by allowing urban industry to absorb more unemployed labor. If on the other hand, migration out of urban areas is diminishing urban unemployment, then constraining labor movements could have an adverse effect on employment. These effects on employment can easily outweigh any allocative efficiency considerations in terms of the net welfare effect. Again, the exact structure of protection and reform takes on new significance.

The net welfare results of introducing imperfect labor mobility to our analysis are presented in column 3 and Table 1. There are three sources of welfare effects associated with labor mobility constraints in this model – through migration costs, through employment effects, and through allocative efficiency effects. The migration cost effect is always positive (migration costs are diminished/avoided when labor is constrained). The employment effect may be positive or negative as discussed above. The allocative efficiency effect will generally be negative. In all cases the mobility restrictions appear to improve the rate of urban employment (Column 3, Table 2), suggesting the migration into urban regions is being curtailed. This has a positive effect on net welfare in all countries except Argentina, where net welfare falls by a negligible amount (perhaps a consequence of negative allocative efficiency effects). In most cases the net effect of imperfect labor mobility is relatively small.[8]

Tax Replacement

As our final set of experiments on the effect of trade liberalization in the Americas, we consider the effect of tax replacement. In our standard closure, the volume of government consumption is fixed. The government is assumed to pay market prices for its consumption, hence total government expenditures are variable. Government expenditures are deducted from household income to determine the household budget constraint, with all tax revenue being redistributed back to consumers in a lump-sum fashion. Implicitly, the government budget deficit is a variable. Removing tariffs will tend to lower the cost of government purchases, but will also lower tariff revenue. Any shortfall is implicitly assumed to be financed through a lump-sum transfer from the household, just as any surplus is redistributed via lump-sum transfer. This setup is common in trade theory, and very common in CGE models (even if not made explicit). The implications for net welfare estimates are important – lump-sum transfers impose no distortion on the economy and thus maximize the welfare effects of reform. However, lump-sum taxes are notoriously difficult to implement in practice. Hence, an important question is how the model results change when alternative taxation mechanisms are used to finance the government deficit.

In the following simulations we must make some specific alternative assumptions. We assume that the government deficit/surplus is binding. It is not allowed to fall. Removing tariffs lowers tariff revenue, and this revenue must be replaced via taxation in other parts of

[8] Other experiments (not shown) indicate that the majority of the gains are through migration cost saving rather than employment effects in most cases, but the effects do take the same sign.

the economy. Here we assume that output taxes are scaled endogenously to ensure the government budget constraint holds, while holding output subsidies constant. It is important to note that this assumption of deficit financing is not the only possible assumption, and the choice is not innocuous in terms of the net welfare effect.[9] In particular, by scaling output taxes while holding output subsidies fixed, we are increasing the degree of distortion in the production decisions across the economy. A better alternative from a net-welfare perspective would be to impose a uniform output tax, since there may be significant potential benefits from imposing uniformity in the tax regime. Examining the effects of alternative choices is beyond the scope of this paper (although it is an important issue, and one which will warrant further research). Therefore, given the potential arbitrariness of the tax replacement assumption, we want a way to isolate the trade liberalization effect with given alternative tax regimes. We take the following approach. We first find the required tax scaling factor in the presence of trade liberalization to hold the deficit constant. We then impose the same output tax regime in isolation (without concurrent trade reform). Subtracting the net welfare effect on society in the latter experiment from the former, gives us a welfare figure directly comparable with trade liberalization alone, having isolated the welfare effect associated with the change in the output tax regime. That is to say, our comparison is the between the effects of trade reform under the two output tax regimes, having netted out the effect of the new output tax regime itself.[10]

The net welfare results of our simulations are presented in Table 3, in our developing economy framework. Some of the results at first glance seem somewhat peculiar. In Brazil and Mexico, the net welfare effect of reform is actually improved. In other words, higher output taxes seem to diminish the potential for negative second-best net welfare effects in these cases. What could explain this result? We suspect that the result can again be traced back to the specific features of the tax regime, which we have argued will take on considerably more importance in this framework than in a more standard approach. According to the GTAP data that we are using in these models, both Brazil and Mexico have output tax regimes that subsidize agriculture and tax industry. In Chile agriculture is taxed as is most industry. In Argentina, most output activities are mildly taxed, but much of the manufactures sector is subsidized. In Venezuela, all outputs are taxed, although with industry

[9] In this framework, output, export, input and consumption taxes are possible candidates. Income taxation is not interesting in the context of a single representative household, and factor taxes are not interesting in the context of fixed factor supplies. We could also consider a migration tax.

[10] Alternatively, this approach could be thought of as isolating the second-best implications of trade reform under alternative tax regimes.

tending to be at a higher level. In most cases the output tax structure is combined with relatively high import taxes on manufactures. Now consider how the economies respond to trade reform in the aggregate. We tend to expect declines in industrial output and expansion of rural output (both as a result of back migration and declines in the relative protection afforded to industry – although the pattern is not as clear in a multi commodity model as in the 2x2 models). Since agricultural subsidies remain the same by assumption, the second-best effect of increased agricultural output should remain roughly unchanged. On the other hand, the positive second-best effect of declining industrial output is higher the larger the assumed initial output tax. When both agriculture and industry have output taxes, the second best effects are likely to be largely offsetting (as in Chile and Venezuela). When industry is subsidized, however, the positive second-best effects of moving out of industry are held roughly constant, while the negative second-best effects of moving into agriculture are amplified. This seems to be the case in Argentina.

5. Summary and Conclusions

The features that we have emphasized in this model (budget constraints, urban unemployment, and imperfect labor mobility) are not the only important features emphasized in developing economy general equilibrium literature. We have of course already mentioned the work of Lewis (1995). Other possibly important features often associated with developing economies include rent-seeking behavior (see Krueger, 1974), and the existence of 'informal' sectors (see Beladi and Yabuuchi, 2001, for a recent contribution). The key (and perhaps somewhat obvious) point of the simulations presented in this paper is not that our specification is in any sense 'right' and that other specification are in any sense 'wrong'. Rather, it is that CGE models can be tailored to individual economy circumstances, that significant differences in results can be derived from tailoring the models in different ways, and that it is important to systematically analyze these differences to gain a full picture of the potential effect of trade liberalization initiatives.

The important policy implications that can be derived from the specific model features incorporated here include the critical role that the sectoral structure of protection and tax regimes can have in a model with urban unemployment. In a standard model, this is not such an issue – if an economy is small and relatively free from domestic distortions, liberalization in any sector will raise welfare. This result does not hold in the typical developing economy framework utilized here. Much depends on how the policy changes affect the incentive to migrate, and consequently the level of urban unemployment. Fortunately, in the case of the American economies to which we have applied our model in this paper, industrial protection seems to dominate agricultural protection, and this is exactly the protection structure under which liberalization is most rewarding in the HT framework. Although as always we are cautious about placing undue weight on net welfare estimates, the magnitude of the estimated net welfare effects of trade reform in the America's appear to be considerably more positive once urban unemployment is incorporated. This casts the typical debate over North-South benefits from trade reform in a new light – the South is estimated to benefit by considerably more in both absolute and relative terms.

We have considerable future work to complete in this area. We would like to update the data to GTAP5, and to incorporate the full GTAP elasticity parameter database. Also important is the application of sensitivity techniques to the results. As we have mentioned, the specification that we have used in this paper is much more sensitive to both parametric and liberalization scenario changes than the standard model. This aspect of the model behavior has yet to be fully explored.

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Table 1: Estimated Net Welfare Effects of Trade Liberalization in Selected Economies ($US1995 millions, Equivalent Variation)

	Standard Closure	*Dual Closure A*	*Dual Closure B*
Argentina	66.6	1287.4	1280.2
Brazil	735.9	3152.8	5971.6
Canada	-157.4	-	-
Chile	-8.5	509.2	566.1
Colombia	69.8	-	-
Mexico	13.8	457.2	765.2
United States	18.8	-	-
Uruguay	-23.9	-	-
Venezuela	68.3	873.3	921.0

Table 2: Estimated Net Employment Effects of Trade Liberalization in Selected Economies (Employment Rate %)

	Initial Equilibrium	*Dual Closure A*	*Dual Closure B*
Argentina	81.2	82.1	82.1
Brazil	93.9	94.7	95.7
Chile	95.3	97.9	98.2
Mexico	95.3	95.9	96.3
Venezuela	89.7	92.7	92.9

Table 3: Estimated Net Welfare Effects of Trade Liberalization in Selected Economies ($US1995 millions, Equivalent Variation) – Endogenous Output Taxes

	Dual Closure A
Argentina	-511.8
Brazil	3794.7
Chile	490.0
Mexico	496.5
Venezuela	856.4

Table A1: Equations of the Model

Sets:

g :	Agents	$u \subset i$:	Urban sectors
$i(j) \subset g$:	Sectors	$m \subset f$:	Under-employed endowments
f :	Endowment commodities		

Production:

$$Q_i = \{\alpha_i^Q \big/ (1 - \sum_j a_{ji})\}(\sum_f \theta_{fi}^Q FD_{fi}^{-\rho_i^Q})^{-1/\rho_i^Q} \quad (1)$$

$$PF_{fi} = PN_i \{\alpha_i^Q \big/ (1 - \sum_j a_{ij})\}(\sum_f \theta_{fi}^Q FD_{fi}^{-\rho_i^Q})^{-1/\rho_i^Q - 1} \theta_{fi}^Q FD_{fi}^{-\rho_i^Q - 1} \qquad PF_{mu} = \overline{PF}_{mu},\ PF_{fi} = PF_f \quad f \notin m \quad (2)$$

$$ER_m = \sum_i FD_{mi} \big/ (\sum_i FD_{mi} + UN_m) \quad (3)$$

$$PF_{mi} = ER_m \overline{PF}_{mu} - COST_m \qquad i \notin u \quad (4)$$

$$\sum_u FD_{mu} + UN_m = \alpha_m^M COST_m^{\varepsilon_M} \quad (5)$$

$$\sum_i FD_{fi} = \overline{END}_f - UN_f \quad (6)$$

Demand:

$$NDI = \sum_i Q_i PN_i + \sum_i tm_i \overline{PWM_i} \sum_g M_{ig} \overline{XR} + \sum_i tx_i PD_i X_i - \sum_i ty_i PD_i Q_i - \sum_{ig} C_{ig} P_{ig} - \overline{CA} \cdot \overline{XR} \qquad g = \text{government, investor} \quad (7)$$

$$U = \alpha \prod_i (C_{ig} - \lambda_i)^{\theta_i^C} \qquad g = \text{household} \quad (8)$$

$$C_{ig} = \lambda_i + (\theta_i^C \big/ P_{ig})(NDI - \sum_j \lambda_j P_{jg}) \qquad g = \text{household} \quad (9)$$

$$C_{ij} = \sum_j a_{ij} Q_j \quad (10)$$

$$C_{ig} = \overline{G}_i \qquad g = \text{government} \quad (11)$$

$$C_{ig} = \overline{I}_i \qquad g = \text{investor} \quad (12)$$

$$D_{ig} = \left[\alpha_{ig}^{A^{-1}} \{PD_i \big/ (1 - \theta_{ig}^A)\}^{\sigma_i^A} C_{ig}\right] \Big/ \left[\theta_{ig}^A (PM_i \big/ \theta_{ig}^A)^{\sigma_i^A \cdot \rho_i^A} + (1 - \theta_{ig}^A)\{PD_i \big/ (1 - \theta_{ig}^A)\}^{\sigma_i^A \cdot \rho_i^A}\right]^{-1/\rho_i^A} \quad (13)$$

$$M_{ig} = \{\theta_{ig}^A \big/ (1 - \theta_{ig}^A)\}^{\sigma_i^A} (PD_i / PM_i)^{\sigma_i^A} D_{ig} \quad (14)$$

Prices:

$$PM_i = \overline{PWM}_i (1 + tm_i) \overline{XR} \quad (15)$$

$$PD_i = PWX_i \overline{XR} \big/ (1 + tx_i) \quad (16)$$

$$P_{ig} = \alpha_{ig}^{A^{-1}} [\theta_{ig}^{A^{\sigma_i^A}} PM_i^{(1 - \sigma_i^A)} + (1 - \theta_{ig}^A)^{\sigma_i^A} PD_i^{(1 - \sigma_i^A)}]^{1/(1 - \sigma_i^A)} \quad (17)$$

$$PN_i = PD_i (1 + ty_i) - \sum_{j=1}^N a_{ji} P_{ji} \quad (18)$$

$$X_i = \alpha_i^X PWX_i^{\varepsilon_X} \quad (19)$$

Equilibrium Conditions:

$$Q_i = X_i + \sum_g D_{ig} \quad (20)$$

$$\sum_i \overline{PWM}_i \sum_g M_{ig} + \overline{CA} = \sum_i PWX_i X_i \quad (21)$$

Table A2: Notation

Parameters		Variables	
a_{ij}	Input-output coefficients	PM_i	Importable price
$\overline{PWM}_i$	World price of importables	PD_i	Domestic price
$\overline{END}_f$	Factor endowments	PWX_i	World price of exportables
$\overline{PF}_g$	Institutionally rigid factor returns	P_{ig}	Domestic-import aggregate price
$\bar{I}_i$	Investment	PN_i	Net prices
$\bar{G}_i$	Government expenditure	PF_f	Factor returns
$\overline{CA}$	Current account balance		
$\overline{XR}$	Exchange rate	Q_i	Gross output
		FD_i	Factor demands
tm_i	Import taxes/subsidies	ER_f	Employment rate ($=1$ $f \notin g$)
tx_i	Export taxes/subsidies	UN_f	Unemployment ($=0$ $f \notin g$)
ty_i	Output taxes/subsidies	$COST_f$	Cost of migration ($=0$ $f \notin g$)
α_i^Q	Production function shift	U	Utility level
θ_{fi}^Q	Production function share	C_{ig}	Total agent consumption
σ_i^Q	Production elasticity*	NDI	Household income
ρ_i^Q	$(1/\sigma_i^Q)-1$	M_{ig}	Imports
		D_{ig}	Domestic demand
α	Utility function shift	X_i	Exports
θ_i^C	Utility function share parameter		
λ_i	Subsistence consumption level		
η_i	Income elasticity of demand*†		
ϖ	Frisch parameter*†		
α_{iq}^A	Armington shift parameter		
θ_{iq}^A	Armington share		
σ_i^A	Armington elasticity*		
ρ_i^A	$(1/\sigma_i^A)-1$		
α_i^X	Export demand shift		
ε_i^X	Export demand elasticity*		
α_q^M	Migration function shift		
ε_f^M	Migration elasticity*		

Notes:

* These parameters are independent of the base year data ('free') and are supplied independently. Other parameters then follow by calibration.

† These parameters do not appear in the model, but are used in the calibration process of the Stone-Geary utility function.