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Trade reform under regional integration*

Policy simulations using a CGE model for Guatemala

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The present paper evaluates the effects of alternative trade policy reforms to the Central American Common External Tariff (CET) schedule on the Guatemalan economy. To accomplish this, the paper develops a multiperiod Computable General Equilibrium (CGE) model, with dynamic sequencing to link interperiod equilibria. As is common in other CGE applications, the model allows for product differentiation, sector specific capital, and substitution in production and consumption. Furthermore, the model incorporates explicitly Guatemala's main economic features – including its membership in the Central American Common Market – and gives special attention to the tradable goods and commercial services sectors, to capture adequately the response of the economy to trade policy changes.

The trade reforms analyzed include small changes in the average CET rates, and a reduction in the dispersion of nominal protection rates across sectors. The results suggest that GDP, investment, employment and exports, particularly non-traditional exports to non-regional markets, are likely to increase moderately as a result of the policy reforms. Although the changes are modest, they are commensurate with the magnitude of the trade reforms analyzed – and they are likely to underestimate the gains achieved from trade liberalization.

1. Introduction

After achieving high growth of output and exports in the previous two decades, Guatemala began to experience serious economic and political difficulties in the 1980s. GDP and exports declined markedly, inflation increased, large fiscal and balance of payments deficits emerged, and substantial external payments arrears accumulated. These problems were in part the result of adverse external factors – declining terms of trade and

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tighter external borrowing – but were compounded by poor domestic economic policies and continued anti-export bias for non-regional exports, arising from the protective nature of the Central American Common Market (CACM) agreements.

Created in 1960, and integrated by Costa Rica, El Salvador, Honduras, Nicaragua and Guatemala, the CACM was a major instrument of regional industrialization and economic integration up to the late 1970s. With the decline of the easy import substitution phase and the emergence of economic and political difficulties in the 1980s, however, the CACM agreements became a drag to most Central American economies, including Guatemala.

Although regional trade revived in recent years, Guatemala is still in need of a comprehensive reform package that provides simultaneously a neutral and flexible trade and fiscal incentives system. This package is needed because regional trade is unlikely to provide the impetus needed to redress the significant economic deterioration experienced in the early and mid-1980s, and would be strengthened by the private sector's increased willingness to look into non-regional markets for its exports. Because transitory adjustment costs are likely to arise, and the reform process will not be easy or risk-free – as it will require concerted action in the region – a careful evaluation of alternative policy changes seems particularly useful.

To accomplish this task, the present paper develops a multiperiod Computable General Equilibrium (CGE) model – suitably adapted to reflect Guatemala's stylized economic features – that allows for an explicit evaluation of alternative trade policy reforms. The paper illustrates the use of this model by evaluating the economic consequences of two reform proposals of the Central American Common External Tariff (CET) schedule on the Guatemalan economy.

The model distinguishes eight productive sectors, four income groups, three factors markets, a government and an external sector, and focuses on the effects of the trade policy changes on sectoral output, employment, trade and fiscal balance, and on the distributional costs of adjustment. As is common in other CGE applications, the model developed here allows for product differentiation – the Armington assumption, sector specific capital, and substitution in production and consumption. Furthermore, the model incorporates explicitly Guatemala's membership in the CACM, and introduces a specific domestic requirement (commercial services) for each unit of good consumed. This requirement provides another reason, besides aggregation and quality differences, to invalidate the law of one price for tradable commodities, and reduces the speed of adjustment of domestic factors of production to changes in relative prices.

To obtain a multiperiod solution, the model allows for dynamic sequencing via stock adjustment in factor markets and financial assets. Rural and urban work forces are assumed to grow at exogenously given rates, but labor

market conditions determine rural–urban migration. Net investments determine sectoral capital stock changes, while net savings determine the growth of financial assets and new loans determine the growth of liabilities.

Although other approaches have been suggested in the literature to evaluate the effects of alternative tariff reforms, general equilibrium models have gained wide acceptance.[1] Because they can incorporate the direct and indirect effects of the reforms, and allow for explicit treatment of structural features facing developing economies, CGE models have been used extensively in recent years to analyze trade reforms – see de Melo (1988) for a good survey of this literature. Recent studies using CGE models include those of Hamilton and Whalley (1985), Cox and Harris (1985) and Wiggle (1988), which analyze the welfare effects of different integration schemes, with particular emphasis on the US–Canada trade liberalization agreements. Finally, Harrison et al. (1988) develop a CGE model to analyze the welfare effects of a customs union accession, and Polo and Sancho (1990) study the economic impact of Spain's entry into the European Economic Community.

The rest of the paper is organized as follows. Section 2 discusses Guatemala's stylized economic features, and shows how they were incorporated into the model. Section 3 presents a brief description of the CGE model and of the solution strategy, and summarizes the results of the policy simulations. Finally, section 4 presents the implications of the model results, and discusses the risks of policy inaction.

2. Stylized features of the Guatemalan economy and their implications for the CGE model

2.1. Structural differences in agriculture

Agriculture is by far the most important economic activity in the Guatemalan economy, producing more than one fourth of total value added and more than 70 percent of total merchandise exports, and employing about 50 percent of the total labor force (tables 1 and 2). In the past, Guatemalan agriculture has been characterized by a dualistic structure, with a modern, export-oriented sector producing traditional agricultural goods – coffee, sugar, bananas, cotton, beef and cardamon – and a subsistence sector producing food crops for domestic consumption: basic grains, hogs, potatoes, and legumes. More recently, however, a third hybrid agricultural sector has emerged. This sector produces tropical and temperate climate fruits and vegetables, poultry, timber, ornamental plants, and rubber.

[1]Partial equilibrium models have been criticized because they omit the terms of trade effects and neglect other important features that can only be captured with a disaggregated CGE model. See Hamilton and Whalley (1985) for a good discussion on this subject, and Méndez and Rousslang (1989) for a recent study on the welfare effects of establishing import tariffs in the CACM countries using a partial equilibrium model.

Table 1

Guatemala: Agricultural output and exports, 1970–1987.

	Comp. (%)	Growth rates (% p.a.)		
	1986	1970–1980	1980–1985	1985–1987
Value added (at constant prices)				
GDP	100.0	5.7	−1.4	1.6
Agriculture	25.6	4.7	−0.5	1.4
Other sectors	74.4	6.0	−1.4	1.7
Agriculture	100.0	4.7	0.0	1.4
Trad. crops	43.7	5.7	−1.7	1.5
Subsist. agric.	12.3	3.8	1.0	0.0
Hybrid sector	44.0	3.6	0.5	1.7
Merchandise exports (at current prices)				
Total merchandise	100.0	6.9	3.0	−6.9
Agric. exports	76.5	4.8	0.1	−10.8
Other exports	23.5	14.0	−24.4	3.5
Agric. exports	100.0	4.8	0.1	−10.8
Trad. crops	88.1	3.2	1.8	−15.2
Hybrid sector	11.9	13.9	−8.9	10.0

Source: World Bank data.

Table 2

Guatemala: Population, employment and wages, 1986.

		Urban				
		Industry & mining	Services	Subtotal	Rural	Total
Population	(Thousands)					8,200
Work force	(Thousands)	365	1,036	1,401	1,415	2,816
Employment	(Thousands)	338	934	1,272	1,373	2,645
Unemployment	(%)	7.4%	9.8%	9.2%	3.0%	6.1%
Real wages (1986 = 100)		122.9	161.3	151.1	59.9	100.0

Source: Instituto Nacional de Estadisticas y Empleo, Vol. 2, Diciembre 1987.

The three agricultural sectors are marked by geographical, technological and economic differences, as well as by differences in land tenure systems.[2] The traditional agricultural products are mostly produced in large scale

[2]There are also differences in export potential. Prospects for most traditional agricultural exports are poor, due to increased international competition, thin markets (for cardamon) and possibly low real prices. By contrast, non-traditional agricultural goods – produced by the hybrid sector – have good prospects for increased foreign exchange earnings, under appropriate exchange rate and trade policies, increased investment in infrastructure, and enhanced credit availability.

technologically advanced farms with fertile soils located in the upper slopes of the Piedmont Region, in the Pacific coastal plains, and more recently in the northern slopes of the Highlands, areas with relatively good access to transportation, infrastructure and commercial credit. The subsistence sector, by contrast, is mostly located in the Western Highlands, an area with poor soils, poor infrastructure, difficult access, and with limited or no access to modern technology and commercial credit. Finally, the output produced by the hybrid sector comes in part from small land holdings in the Western slopes, an area with adequate rainfall and moderately fertile soils, as well as from the Northern Lowland plains, a more humid and tropical area.

To incorporate these features, the CGE model developed here distinguishes three rural sectors: (1) a traditional export-oriented agricultural sector; (2) a hybrid sector producing non-traditional agricultural goods with good export potential; (3) a backward agricultural sector producing goods for domestic consumption. Profit maximization is assumed in the first two sectors. Thus employment in these sectors is determined by equating labor demand to the rural wage. The third sector, however, is characterized by a Lewis-type structure. That is, workers in the backward agricultural sector receive their average labor productivity. The model also assumes complete labor mobility within the rural sector and flexible rural wages – ensuring the existence of one common real rural wage and full employment in the agricultural sector.

2.2. Segmented labor market

As in most developing countries, factor markets in Guatemala are segmented and insufficiently developed. The labor market, in particular, is highly fragmented between the urban and rural populations. Separated by cultural and language barriers, rural workers receive wages that are about one half of those prevailing in urban areas (table 2). The wage gap has contributed to the permanent migration of workers from rural to urban areas, a factor which was strengthened during the 1980s by the migrations to the cities and neighboring countries triggered by the guerilla war. The migration flow has been sobered, however, by high urban rates of unemployment and low skill levels among rural workers.

Although segmentation in the urban areas is less pervasive than that prevailing between urban and rural workers, there are still significant rigidities in the industrial and services sectors. Rural urban wages – for both industry and services – did not respond sufficiently to the significant increase in urban unemployment in the early and mid-1980s. Moreover, the services wage remains significantly above the manufacturing sector wage, a gap explained by skill differences and market segmentation (table 2).

In order to reflect these rigidities, the CGE model assumes labor market segmentation and exogenous real urban wages. Since the cost of living index

is chosen as the numeraire, nominal urban wages are also exogenous. The corresponding work forces are assumed to grow at exogenously given rates, but the urban and rural labor markets are linked via a Harris–Todaro migration function, i.e. labor migrations are assumed to be positively related to the expected rural–urban wage gap.

2.3. *Inefficient capital market*

The capital market is also segmented between a formal banking sector and an informal sector. The formal sector includes several private commercial banks, three public sector development banks and five other formal financial institution or 'financieras'. The informal sector includes a dynamic and well organized set of small 'financieras', which emerged as a means of avoiding excessive regulations of the formal banking sector and which provide financial assistance to small projects.

High administrative and bureaucratic controls and extensive government regulations (interest rate ceilings and administrative barriers preventing the entry of new banks), have limited the competition among formal financial institutions and increased the cost of intermediation. Lack of competition has created a highly rigid and bureaucratic financial system, which seeks strong guarantees – limiting the financing of good and innovative projects with weaker ties to the formal banking sector. This has encouraged excessive concentration of credit on large and well known firms, but not necessarily representing good risks. Furthermore, the absence of a strong stock exchange market and the limited competition among financial institutions have inhibited private savings and the intermediation role of capital markets.

Reflecting the limitations of the domestic capital market, the model assumes that a constant fraction of sectoral cash flows is reinvested in the same sector. As a consequence, a significant proportion of new private investment is financed by retained earnings. The sectoral allocation of investment is also responsive to sector's relative profitability, however.

2.4. *The Central American Common Market (CACM)*

The CACM constitutes a free-trade zone protected by a Common External Tariff (CET) schedule that applies to almost all non-regional imports. The revitalization of regional trade in the second half of the 1980s allowed a significant increase in Guatemalan exports to other CACM countries, but was still substantially below the level achieved earlier. In 1987, Guatemalan exports to the CACM region reached 23.4 percent of total exports, compared to 32.6 percent in 1981 (table 3).

An important feature of Guatemala's economy is the differentiated structure of manufactured exports to regional and non-regional markets. Manu-

Table 3

Guatemala: Trade structure, 1970–1987 (in millions of U.S.$).

	1970	1975	1980	1985	1987
Total merchandise exports (FOB)	289.6	623.0	1,485.2	1,059.7	987.3
Exports to CACM	99.1	172.8	404.5	207.8	230.6
Agriculture	8.9	8.6	51.8	27.0	40.3
Manufacturing	89.5	163.6	351.0	180.3	190.3
Mining	0.7	0.6	1.7	0.4	0.0
Non-CACM exports	190.5	450.2	1,080.7	851.9	756.7
Agriculture	177.2	423.2	924.8	783.2	675.4
Manufacturing	12.8	23.4	137.2	55.4	63.2
Mining	0.5	3.6	18.7	13.3	18.1
Total merchandise imports (CIF)	259.4	668.3	1,435.9	1,174.8	1,447.2
Imports from CACM	59.3	94.5	143.7	90.0	132.1
Agriculture	4.1	3.3	12.0	12.5	4.5
Manufacturing	54.7	89.8	130.1	72.0	126.1
Mining	0.5	1.4	1.6	5.5	1.5
Non-CACM imports	200.1	573.8	1,292.3	1,084.8	1,315.1
Agriculture	10.3	36.8	58.4	99.0	90.7
Manufacturing	188.5	467.7	1,063.2	720.0	1,028.7
Mining	1.3	69.3	170.7	265.8	195.7
Trade balance	30.2	(45.3)	49.2	(115.1)	(459.9)
CACM trade balance	39.8	78.3	260.8	117.8	98.5
Non-CACM trade balance	(9.6)	(123.6)	(211.6)	(232.9)	(558.4)

Source: 1985–1987: Bank of Guatemala; 1970–1980: UNCTAD.

factured exports to non-regional markets differ from those exported to regional markets. Exports to non-regional markets include furniture and other wood products, agro-industrial products, and 'maquila'-type exports of textiles, while regional exports include chemicals, plastic products, and traditional textiles, garments and shoes.[3] Although intra-industry trade among regional partners in these products exists, Guatemala is a net exporter of these commodities to the region – but remains a net overall importer of manufactured goods (table 3).

In addition, differences in the quality and type of products exported to regional and non-regional markets imply that capital mobility between both manufacturing sectors is limited, a factor which partly explains the inability of manufacturing exporters to rapidly increase exports to non-regional markets in the mid-1980s, following the virtual collapse of the CACM.

To incorporate these features, the model distinguishes two types of

[3]Although increased export opportunities to non-regional markets for the latter manufactured products exist, these goods require improvements in product quality and design, better marketing, and need to be produced in sufficient quantities to satisfy the large industrial country markets.

domestic manufactures: those sold to regional partner countries and those sold to non-regional markets. It also restricts capital mobility in the production of both manufacturing goods, by assuming a putty–clay technology and limiting capital substitution among the two sectors. Thus, although investment goods employed in the production of both types of manufactures are similar, once allocated they become sector specific.

Furthermore, the CGE model also distinguishes two export demand curves for manufactures, one for regional exports and another for non-regional exports. Both demand curves depend on the domestic exchange rate and on export taxes. They also depend on relative prices and incomes in the corresponding final markets, implying product differentiation between Guatemala's exports and those of its competitors. The regional manufactured export demand, however, depends on the common external tariff, because Guatemala's manufactured exports to the region compete with imports from non-regional countries. Thus, the trade reform will also have a different impact on each of the two manufactured export demand curves.

2.5. The CET schedule

Trade taxes have important implications for the allocation of economic resources. Although tariff rates have not been excessively high in Central America, when compared to other developing countries, their skewed structure has led to high and widely disperse levels of effective protection rates across sectors, and within the manufacturing sector itself [World Bank (1989b), Cavallo et al. (1989)].[4]

The CET schedule approved in 1986 is divided into three parts. Part I comprises about 90% of all tariff positions, and includes all items on which a regional consensus was reached. Part II covers another 5% of all tariff positions, and contains items on which a regional agreement could not be reached. Finally, Part III covers the remaining 5% of all tariff positions, and contains those items where it was agreed that each country may set rates unilaterally.

The new CET schedule makes a distinction between competing imports (i.e. goods produced in the region) and non-competing imports, and establishes much lower rates for the latter goods. It also sets an average tariff level for agriculture that is similar to that given to manufactures, reflecting a strategy of self-sufficiency in basic foods that has been followed since the 1960s.

As in the past, the new tariff schedule follows a cascading structure, with the highest rates given to final consumer goods, followed by intermediate goods and raw materials, and with the lowest rates on capital goods. This

[4]Quantitative restrictions have not played an important role in Guatemala.

structure is particularly marked for the manufacturing sector, which receives the highest nominal tariff protection – a strategy designed to encourage industrialization by import substitution at a regional level. This has led to capital intensive industrial production of consumer goods for domestic consumption and exports to regional markets, but has discouraged exports to non-regional markets.

Table 4 shows the sectoral tariff rates prevailing in Guatemala in 1987. Columns (1) and (2), in particular, show the sectoral legal average tariff rates and their standard deviation, while column (3) shows the weighted average tariff rates, using dutied imports as weights (i.e. the proportion of imports that effectively paid duties in 1987).[5]

The sectoral average tariff rates are used extensively in the model, as the trade policy changes are transmitted via changes in these parameters. In addition, because the trade reforms discussed in this paper affect differently the common external tariff on consumption, intermediate and investment manufactures, the model separates the regional manufactured export demand into a consumption, an intermediate, and an investment export demand curves.

3. Estimating the impact of alternative trade policy reforms

3.1. Brief description of the CGE model

The disaggregation and specification of the model was motivated by two main factors. First, special attention was given to the stylized features discussed in section 2, and to the specification of the fiscal structure of Guatemala discussed in more detail in a separate paper [Moran and Serra (1989)]. Second, a good deal of attention was also given to the disaggregation of the tradable goods sector, so as to capture adequately the response of the economy to the alternative trade policy changes, and to commercial services, since the presence of this sector will affect the speed of adjustment to the reforms proposed.

The model distinguishes eight productive sectors, the first six of which (sectors 1–6) produce tradable goods. Sector 1 is the traditional agricultural sector, and includes agricultural commodities mostly exported outside the CACM. Sector 2 is a hybrid agricultural sector producing fruits, vegetables, timber, poultry, eggs and sea products. Sector 3 represents the backward rural sector producing goods for domestic consumption: basic grains, hogs, legumes and potatoes. Sector 4 produces manufactures which compete with imports in the domestic market, and which are also exported to the regional CACM market, including traditional textiles, garments, shoes and chemical

[5]See Moran and Serra (1989) for a detailed explanation of the differences in these tariff measures.

Table 4

Guatemala: Common external tariff structure – 1987 and alternative scenarios.[a]

	1987			Case 1: World Bank proposal			Case 2: Alternative scenario		
	Unweighted (1)	Std. dev. (2)	Weighted avg. (3)	Unweighted (4)	Std. dev. (5)	Weighted avg. (6)	Unweighted (7)	Std. dev. (8)	Weighted avg. (9)
Total	22.0	21.5	10.4	21.3	13.9	12.2	21.3	7.5	15.5
Agriculture	21.6	18.3	7.2	22.3	13.0	10.6	21.7	7.1	16.9
Manufacturing	22.2	21.9	11.9	21.4	14.0	13.9	21.4	7.4	17.4
Consumers goods	35.8	25.0	30.5	29.9	13.2	27.2	25.2	6.8	24.1
Interm. goods	14.2	14.2	8.8	16.6	12.2	11.3	19.2	7.0	16.4
Invest. goods	13.5	15.3	7.5	16.2	10.9	11.3	18.8	5.8	15.8
Fuels	0.4	1.3	0.0	0.4	1.3	0.0	0.4	1.3	0.0

[a]Unweighted averages [columns (1), (4) and (7)] are arithmetic averages of the legal external tariff structure prevailing in 1987, and the two proposals analyzed in the text. Standard deviations [columns (2), (5) and (8)] are calculated using the legal tariff structure. Weighted averages [columns (3), (6) and (9)] use dutied imports (i.e. imports that effectively paid duties in 1987) to calculate the corresponding weights.

products. Sector 5 includes manufactures exported outside the region, mostly agro-industrial and wood products, and more recently maquila-type exports of garments. Finally, sector 6 represents energy related activities, including domestic extraction, refining and net imports of oil.

The final two productive sectors represent non-tradable activities, and include most services. Sector 7 incorporates services other than commercial services, including banking, transportation, housing, personal services, construction and public utilities. Sector 8 includes commercial services, which are linked to unit consumption via fixed proportions. Thus, the demand for commercial services is directly related to the demand for consumption goods.

In addition to the productive sectors of the economy, the model distinguishes four income groups: capitalists, rural workers, industrial workers and service workers; and three factor markets: a rural labor market, an urban market, and a capital market. Two other sectors, representing the government and external sectors, complete the model.

3.2. *Solution strategy*

The solution strategy involved four separate steps. In the first step, a Social Accounting Matrix (SAM) was constructed [Serra and Cruz (1989)]. For this purpose, different types of data – including national accounts, balance of payments, investment, financial, debt, employment, consumption and trade data – were linked to form a consistent 'circular flow of the economy' for a particular base year (1986). The input–output matrix used to represent intermediate transactions was one calculated for 1971 [SIECA (1978)], which is the only one available for Guatemala.

The second step involved the construction of an investment or 'capital composition' matrix, and the computation of parameters indicating the use of commercial services per unit of good consumed. The latter requirements were obtained as residual variables ensuring the consistency of the SAM, and did not differ significantly from the commercial margins for each productive sector reported in Salazar et al. (1985). The investment matrix, which transforms investment by sector of origin into investment by sector of destination, was built from partial information and consistency criteria.

The third step involved the calibration of parameters for the model in the base year (1986). Price, income, and substitution elasticities were chosen so as to obtain a reasonable base case solution. These elasticities do not differ greatly from those used or estimated in other studies, however.[6] Other parameters, including production elasticities, intercept terms, and sectoral shares for financial, investment and capital account transactions were derived in a way that ensured overall consistency of the data. Sectoral savings

[6]See Dervis and Robinson (1982), Grais et al. (1986), and Moran (1988).

parameters and the fraction of cash flows reinvested in each sector, for example, were jointly derived so as to match the sectoral investment rates previously estimated.

The fourth and final step involved the solution of the model, using an iterative procedure – a 'Gaussian' algorithm. For this purpose, the model was expressed in terms of five excess demand equations, representing the two service sectors, the two manufacturing sectors, and the balance of payments. Since only four of these equations are independent by Walras' Law, the procedure involved computing a sequential set of prices for the first four markets.[7] Convergence, achieved when the excess demand (supply) in each market did not exceed sectoral output by more than 0.1%, was generally obtained in less than 50 iterations in each period.

After the model had been solved, a sensitivity analysis was performed. The results of this analysis suggest that the solution of the model would remain largely unaffected by changes in the key parameters, giving us some degree of confidence that the results are not particularly sensitive to the parameter choices made.

3.3. The scenarios analyzed

The trade reforms considered were analyzed by comparing the base case solution of the CGE model, with the results that would prevail under two alternative scenarios. The first scenario (Case 1) – a policy reform suggested by the World Bank – modifies the structure of effective tariff levels by establishing a 40% tariff ceiling on import items in Parts I and II of the CET schedule, and a 5% tariff floor on all import items. This proposal decreases slightly the average legal tariff rate prevailing in 1987 (from 22.0% to 21.3%), and reduces markedly the tariff spread: from 21.5% in the base case to 13.9%. Columns (4), (5) and (6) in table 4 show the corresponding rates that would prevail at the completion of the reform.[8]

The second alternative scenario (Case 2) decreases the average legal tariff rate from 22.0% in the base case to 21.3%, and reduces even further the spread of tariff levels – to 7.5% – by establishing upper and lower limits of 30 and 15%, respectively. Columns (7), (8) and (9) in table 4 show the corresponding tariff rates that would prevail at the completion of the second reform proposal.[9]

In addition, the model also allows for a somewhat higher external

[7]Because each sector in the model is on its budget constraint, the model satisfies Walras' Law.

[8]The weighted average tariff increases from 10.4% to 12.2%. This comparison, however, is not a good estimate of the tariff change, as the weights used – pre-reform dutied imports – are likely to be affected by the trade reform.

[9]The weighted average tariff increases from 10.4% to 15.5%. Note, however, that the effective rates of protection decline markedly, because the cascading tariff structure is significantly attenuated.

Table 5

Guatemala: Output, expenditures and employment, 1988–2003 – base case solution.

	Level	Growth rates (% p.a.)	
	1988[a]	1988–1994	1994–2003
Output and expenditures			
GDP[b]	15,210	2.5	2.4
Consumption	13,506	1.9	2.4
Investment	1,863	4.7	1.3
Private	1,607	5.1	1.1
Public	256	1.9	2.3
Exports[c]	829	5.7	3.6
Traditional	476	1.3	2.9
Non-traditional	352	10.5	4.2
Agriculture	77	23.5	6.4
CACM manuf.	191	3.2	2.2
Non-CACM manuf.	84	8.7	2.2
Imports[c]	1,006	5.0	2.3
Employment and wages[d]			
Total employment	2,745	2.8	2.6
Urban	1,346	3.4	2.9
Rural	1,399	2.3	2.2
Rural wages (real) (index, 1986 = 100)	113	−0.9	−0.4

[a]Base year figures are averages for a 3-year period: 1986–1988.
[b]Figures are expressed in thousands of 1986 Q.
[c]Figures are expressed in thousands of 1986 U.S.$.
[d]Base year employment figures are expressed in thousands of persons.

borrowing in Cases 1 and 2 than in the base case, in the first few years following the implementation of the reforms. This higher borrowing would only be forthcoming if the government undertakes the reform package.

The simulations reported here were all conducted under the same closure rules: foreign and private savings finance the fiscal deficit, which is an endogenous variable, and the exchange rate adjusts to clear the balance of payments. The latter assumption agrees with the stated intentions of government officials, who are committed to adjusting the nominal exchange rate when faced with an important balance of payments disequilibrium. Note that the closure rules adopted here are quite standard.[10]

3.4. *The base case solution*

Table 5 shows the performance of the Guatemalan economy in the base

[10]See Adelman and Robinson (1988) for a lucid discussion of alternative closure rules in CGE models.

case, which assumes that no changes in economic policies are pursued beyond those already contemplated by the government – including the gradual phasing out of taxes on non-traditional exports and the reduction of import surcharges introduced in 1986 and 1987, respectively. The figures in table 5 show the base year (1986–1988 average) level for each of the variables indicated, and average annual growth rates at constant prices for two different periods: 1988–1994 (period 1) and 1994–2003 (period 2).[11]

In the base case, GDP is expected to grow at 2.5% p.a. in period 1 and 2.4% in period 2, after a modest recovery of investment and exports in the first period – following the unification of the exchange rate system and a partial recovery of regional trade in the late 1980s. With projected population increases at about 2.5% p.a. during both periods, per capita income will continue to stagnate, however. Because income per capita in real terms declined by 3.7% p.a. during 1980–87, GDP per capita at the end of the 15-year period (2003) is likely to be significantly below the level achieved in 1980. Note that the base case projections show a partial recovery of non-traditional exports during 1988–94 (table 5), following a decline in real terms in 1980–87.

3.5. Case 1

We now focus our attention on a limited reform package that changes moderately the current CACM tariff structure. The adjustment mechanism in this particular case involves a reduction in the price of manufactured consumer goods, which presently enjoy high effective protection rates, compared with agricultural goods and non-tradables. More important, the decline in the spread of nominal and effective protection rates across sectors induces a reallocation of resources towards more productive activities – making the economy more responsive to international opportunity costs – and inducing investments in non-traditional exports. To account for these effects the model assumes a modest overall productivity increase in all exporting activities, amounting to an accumulated 3% increase, spread over a 10-year period.

Table 6, columns (3) and (4), shows the performance of the economy in Case 1 and compares these results with the base case, summarized in columns (1) and (2) of the same table. GDP growth, in particular, remains roughly unchanged in the short and medium term (1988–1994), when compared to the base case, but grows at a higher rate in the long run (1994–2003): 2.7% p.a. compared to 2.4% p.a. in the base case. It is interesting to note that the positive impact on GDP is only felt after sufficient time has

[11]All model simulations were expressed as 3-year averages for a 15-year period, starting in 1988 and ending in 2003. To simplify the presentation, we focus on the short-term effects (1988–1994), and the medium- and long-run effects (1997–2003) only.

Table 6

Guatemala: Economic consequences of alternative trade reforms.

	Base case		Case 1		Case 2	
	1988–1994	1994–2003	1988–1994	1994–2003	1988–1994	1994–2003
Growth rates, % p.a. at constant prices						
GDP	2.5	2.4	2.6	2.7	2.4	2.9
Consumption	1.9	2.4	1.9	2.6	1.7	2.8
Investment	4.7	1.3	5.0	1.9	5.1	2.3
Exports	5.7	3.6	5.8	4.2	5.6	4.8
Traditional	1.3	2.9	1.4	3.8	1.2	4.8
Non-traditional	10.5	4.2	10.6	4.5	10.6	4.8
Imports	5.0	2.3	5.0	2.8	4.7	3.2
Employment	2.8	2.6	2.9	2.7	2.7	2.8
Annual avg. ratios (% of GDP, current prices)						
Consumption	90.0	90.5	90.9	87.5	90.8	87.6
Investment	14.9	13.9	15.0	14.1	15.2	14.6
Public savings	−2.2	−1.5	−1.9	−0.9	−1.7	−0.2
External savings	5.4	2.1	5.6	2.0	5.6	2.1
External debt	86.5	70.8	86.7	67.4	86.8	66.9

Source: CGE model simulations.

elapsed to permit a reallocation of resources from the production of import substitutes towards non-traditional exports, which are mostly labor intensive activities. As a consequence, the investment–GDP ratio increases from 14.9 and 13.9% in periods 1 and 2 in the base case, to 15.0 and 14.1% in Case 1, while the fiscal deficit declines from 2.2 and 1.5% in the base case to 1.9 and 0.9% in Case 1, respectively (table 6). The latter result is consistent with the slightly higher trade tax receipts in Case 1 than in the base case.

Note, also, that higher external borrowing in Case 1 in the first period (1988–1994), in exchange for the policy reform package, leads to slightly higher debt-to-GDP ratio, when compared to the base case (86.7% vs. 86.5%, respectively). However, because exports increase at a faster rate in Case 1 than in the base case, which allows for a faster repayment in external borrowing, and because GDP grows at a higher pace as well, the debt-to-GDP ratio falls to 67.4% in period 2 in Case 1, compared to 70.8% in the base case.

3.6. Case 2

The policy package pursued in Case 2 strengthens the reforms introduced in the previous scenario, because it reduces even further the dispersion in nominal and effective protection rates, and reduces the level of protection granted to manufactured consumer goods. The accompanying policy measures assumed in Case 2, however, are the same as those assumed in Case 1. Thus, the only difference between both alternative scenarios relies exclusively in the magnitude of the trade reforms.

A more drastic reduction in the price of manufactured consumer goods relative to agricultural goods and non-tradables, and a more drastic reduction in the dispersion of tariff protection, induces a larger increase in allocative efficiency and investment rates. To incorporate these effects, productivity in the exportable sectors is assumed to increase by an accumulated 6% over a 10-year period, when compared to the base case, but to remain unchanged thereafter.

Higher investment and faster long-run productivity increases, however, leads to much higher growth of traditional and non-traditional exports during 1994–2003 in Case 2 than in the base case, to higher GDP growth, and to faster employment growth as well. Total merchandise exports grow at 4.8% p.a. during 1994–2003 in Case 2, compared to 3.6% in the base case, while GDP grows at 2.9% p.a. in Case 2, compared to 2.4% p.a. in the base case. Note, however, that there is a slight decline in export, GDP, and employment growth in period 1 in Case 2, when compared to the base case – due to transitory adjusment costs – as labor reallocates from lower to higher productivity areas. But employment grows at a slightly faster rate in the

Table 7

Guatemala: Functional distribution of income, 1988–2003; base case and alternative scenarios.

		2003		
	1988	Base case	Case 1	Case 2
Total income	100.0	100.0	100.0	100.0
Workers' income	46.7	47.5	47.5	47.6
Urban	31.7	34.5	34.3	34.2
Rural	15.0	13.0	13.2	13.4
Capitalists' income	53.3	52.5	52.5	52.4

Source: CGE model simulations.

second period, increasing at 2.8% p.a. in Case 2, compared to 2.6% p.a. in the base case.

Exports now grow at 5.6% p.a. in period 1 compared to increases of 5.7% p.a. in the base case, and 5.8% p.a. in Case 1. The slight decline in export growth in Case 2 during 1988–1994, when compared to the base case, is due to the smaller increase in traditional exports, a result which is partly offset by a higher increase in non-traditional exports (table 6). Traditional agricultural exports grow at a slower rate during 1988–1994 in Case 2, when compared to the base case, because the trade reform induces a price increase in the agricultural sector (a labor intensive sector), increasing labor demand in the rural area and therefore increasing rural wages.

Finally, table 7 shows the functional distribution of income in the base case and in the two alternative scenarios. Note that there is a slight improvement in the distribution of income in all three cases, when compared to the initial (1988) situation, as workers' income increases more than capitalists' income. In all cases, however, urban workers' income increases at the cost of a decline in rural income. The main difference in the terminal year (2003) distribution across scenarios is that rural workers' income declines at a slower rate in Case 2 than in the other two scenarios, with the faster decline occurring in the base case. This happens because the trade reforms reduce the price of the highly protected manufactured goods relative to agriculture, inducing an increase in the demand for labor in agriculture and an increase in rural wages.

4. Concluding remarks

Guatemala and other Central American countries, most notably Costa Rica, are now increasingly looking at non-regional markets for their export products. They seem, however, unwilling to take strong and rapid steps to dismantle the CACM trade barriers. This occurs because producers and

consumers in these countries do not seem to be aware of the costs incurred by the protective mechanisms in place – continued anti-export bias for non-regional exports and resource misallocation; because of pressures by those who benefit from the protective mechanisms in place; and because of heavy dependence on trade taxes as a source of fiscal revenue.[12]

The speed of adjustment and the transitory costs involved in the switch from a protected and distorted trade regime to a more neutral trade environment will depend on the structural rigidities in factor and goods markets, and on the credibility of the reform package. Because the changes induced by the trade policy reforms are transmitted via changes in relative prices and require re-allocations of factors of production, inflexible prices – including wage rigidities, domestic price and interest rate controls – and impediments to factor movements – including labor and capital market segmentation – will result in unemployment and output losses. In addition, the consistency of the reform package and the persistence in liberalizing the economy are also key elements in determining the credibility of the policy package, a necessary condition before the private sector adjusts to the changes in economic incentives.

These comments are particularly important because of concerns over the need to liberalize the regional trade agreements. As it is well known, trade liberalization in the presence of distortions is not necessarily welfare-improving [for an early reference, see Bhagwati (1968)]. The case is even more complicated because Guatemala is a net exporter of manufactures to the Common Market as a result of the protective mechanism in place. Consequently, a trade policy change that reduces this protection is likely to reduce exports to the region, at least in the short run.

Despite these concerns, the simulations reported here suggest that the trade reforms are likely to produce positive but modest results, although they are commensurate with the magnitude of the policy changes analyzed. These reforms include an important reduction in the dispersion of nominal and effective protection rates across sectors, and small changes in the average levels of legal and effective tariff rates. Although modest, these changes seem politically feasible and are therefore worthwhile evaluating.[13] The results suggest that output, exports – particularly non-traditional exports – investment and employment, are likely to increase as a consequence of the trade reforms, over the medium and long runs. Moreover, the strength of the increase in non-traditional exports to non-regional markets more than offsets the decline in manufactured exports to the region, explaining the overall

[12]Trade taxes in Guatemala accounted for 29.3% of total tax revenue in 1987. Furthermore, because of its relative ease of implementation, trade taxes are often increased temporarily to raise fiscal revenues.

[13]See World Bank (1989b) for a detailed discussion of different approaches to coordinate the trade liberalization efforts in Central America.

increase in exports. In addition, rural workers' incomes are likely to decline at a slower rate as a result of the trade reforms. This results is particularly noteworthy because it slows down the deterioration of income in the rural area, where most of those in extreme poverty live.

It is also likely that the simulations reported here underestimate the effects of the trade reforms. By assuming perfect competition and constant average costs in all but the rural sectors, the model reduces the industrial rationalization gains resulting from a more neutral trade policy environment (Eastman and Stykolt (1966)]. Furthermore, there is now considerable empirical evidence suggesting that economies with a more neutral trade regime have experienced higher and more efficient investment, compared to inward-oriented economies [World Bank (1987)], while other studies have clarified the empirical evidence linking trade liberalization and increases in efficiency [Tybout et al. (1988), Cox and Harris (1985) and Wiggle (1988)], all of which are only partially incorporated into the model.

Two other effects of trade liberalization may also be important. First, trade liberalization may induce increases in foreign investment as the country, and hopefully the region, improves its domestic policy environment. Second, the gains to be obtained will accrue over a longer time span than the 15-year period analyzed here.

Finally, preserving the current CET schedule involves additional risks for Guatemala. If the country continues to bias its manufacturing sector towards satisfying the regional market, then eventual future changes in the CET – a distinct possibility as other CACM members become aware of the costs and benefits involved in the union – could force later an even greater restructuring of its manufacturing sector, with higher adjustment costs. It would also retard the implementation of the accompanying policy changes that would be needed to make the economy more flexible to market signals, maintaining its structural rigiditics.

Appendix

This appendix presents a complete, but simplified, description of the CGE model used in the present paper. A more detailed description is provided in Moran and Serra (1989).

A.1. Notation

Gross output is indicated by the letter X, while sectoral value added is designated by VA. K and L indicate the use of capital and labor, respectively. Several price indices are used, the most important of which are: gross prices (P); net prices (PN); world prices (PW); and the exchange rate (ER). Productive sectors are sub-indexed $i, j = 1, \ldots, 8$. An additional sub-

index ($i, j=9$) indicates imported manufactures, not produced domestically. Income groups are sub-indexed using the letter n: $n=$a indicates rural workers; $n=$s,u indicate service and industrial workers, respectively; while $n=$c designates capitalists. Finally, the government (public) sector is designated by sub-index g. Except when noted, all variables refer to time t, although a separate time sub-index is omitted to simplify the presentation. Other notation is introduced after a brief description of the corresponding equations.

A.2. Production functions

Each productive sector of the economy is characterized by a Leontief aggregation function between value added and an intermediate input index. Sectoral value added is described by a constant elasticity aggregation function of capital and labor, and intermediate inputs are described by a fixed input–output matrix:

$$X_j = \min\{VA_j, IG_j\}, \quad j=1,\ldots,8, \tag{A.1}$$

$$VA_j = [\alpha_j K_j^{\beta j} + (1-\alpha_j) L_j^{\beta j}]^{1/\beta j}, \quad \alpha_j, \beta_j > 0, \; j=1,\ldots,8, \tag{A.2}$$

$$IG_j = \min_i [x_{ij}/a_{ij}], \quad i=1,\ldots,9, \; i\neq 5, \; j=1,\ldots,8, \tag{A.3}$$

$$V_i = \sum_j a_{ij} X_j, \quad i=1,\ldots,9, \; i\neq 5, \; j=1,\ldots,8, \tag{A.4}$$

where X_j (VA_j) = gross output (value added) of sector j; IG_j = intermediate input index of sector j; V_i = intermediate demand for good i; K_j (L_j) = stock of capital (employment) in sector j; x_{ij} = intermediate demands and a_{ij} = input–output coefficients. Note that sector 5 represents manufactured exports to non-regional markets, which are not consumed domestically.

The model allows for capital substitution between the two manufacturing sectors (sectors 4 and 5). The model also assumes that domestic and imported intermediate manufactures are substitutes, linked via a CES aggregation function. Finally, because of resource limitations, the model assumes decreasing returns to scale in the rural sectors.

A.3. Price relationships

A.3.1. Gross prices

Gross prices for tradable goods are converted into domestic currency prices using the exchange rate and the corresponding trade taxes (except for the two manufacturing sectors whose prices are determined endogenously):

$$P_i = PW_i ER(1+ti_i), \quad i=3,6,9, \tag{A.5}$$

$$P_1 = PW_1 ER/(1+te_1), \tag{A.6}$$

where P_j = gross producer price of good j; PW_j = international price of good j (CIF for imports and FOB for exports); ER = exchange rate; and ti_i (te_i) = import (export) tax on good i.

Because imports used in the production of non-traditional exports to non-regional markets are tariff exempt, the price equation for sector 2 is slightly different:

$$P_2 = PW_2 ER/(1+te_2) + a_{92} PW_9 ER ti_9. \tag{A.7}$$

A.3.2. Net prices

Net prices are defined as gross prices minus the cost of intermediate inputs, including value added taxes (VAT). Because the VAT regime varies significantly across sectors and commodities, each transaction is treated accordingly, although simplifications are usually made in order to keep the model simple. Fuels are exempted from VAT charges, but are subject to an oil compensation fund charge:

$$PN_i = \left(P_i - \sum_j P_j a_{ji} \right) - P_6 a_{6i} t_{cf}, \quad i \in B_1, \tag{A.8}$$

$$PN_i = \left[P_i - \sum_j P_j a_{ji} (1+tv_j) \right] - P_6 a_{6i} t_{cf}, \quad i \in B_2, \tag{A.9}$$

where PN_j = net price of good j; t_{cf} = oil compensation fund rate; tv_j = VAT paid by sector j; and B_1 (B_2) = sectors under a general (final consumer) VAT regime. Note that $tv_j = 0, j \in B_2$.

A.3.3. Consumption prices

Consumption prices include the cost of commercial services and the corresponding value added tax:

$$PC_j = (P_j + \sigma_j P_8)(1+tv_j), \quad j = 1,2,3,4,7, \tag{A.10}$$

$$PC_6 = (P_6 + \sigma_6 P_8) + P_6 t_{cf}, \tag{A.11}$$

$$PC_9 = (PW_9 ER(1+tc_9) + \sigma_9 P_8)(1+tv_9), \tag{A.12}$$

where PC_j = consumer price of good j; tc_9 = tariff on manufactured consumer goods; and σ_j = commercial services requirements per unit of good j.

A.4. Labor markets

Urban firms hire workers until the marginal productivity of the last worker employed equals the fixed real urban wage:

$$PN_i(\mathrm{d}f_i/\mathrm{d}L_i) = W_u, \quad i = 4, 5, 6, \tag{A.13}$$

$$PN_i(\mathrm{d}f_i/\mathrm{d}L_i) = W_s, \quad i = 7, 8, \tag{A.14}$$

where W_s (W_u) = fixed services (industrial) wage; and f_j = CES function of capital and labor for sector j [see eq. (A.2)].

The model assumes complete labor mobility within the rural sector and flexible rural wages. Employment in the first two agricultural sectors (sectors 1 and 2) is determined by equating the marginal productivity of labor to the rural wage. Employment in the backward agricultural sector (sector 3), however, is determined by equating the rural wage (W_a) to the average labor productivity in this sector:

$$PN_i(\mathrm{d}f_i/\mathrm{d}L_i) = W_a, \quad i = 1, 2, \tag{A.15}$$

$$[PN_3 f_3(L_3, K_3) - \delta_3 K_3]/L_3 = W_a, \tag{A.16}$$

$$WF_a = L_1 + L_2 + L_3, \tag{A.17}$$

where WF_a = rural work force and δ_j = depreciation rate in sector j.

A.5. Manufactured export demands

The model distinguishes two export demand curves for manufactures, one for regional manufactured exports and another for non-regional exports. The model also separates the regional manufactured export demand into a consumption, an intermediate, and an investment export demand curve:

$$E_{4s} = \bar{E}_{4s}\left[\frac{PW_9(1+ts_9)ER}{P_4(1+te_4)}\right]^{m_{ps}}(Y_r)^{m_{is}}, \quad s = \mathrm{c, i, k}, \tag{A.18}$$

$$E_4 = E_{4c} + E_{4i} + E_{4k}, \tag{A.19}$$

$$E_5 = \bar{E}_5\left[\frac{PW_9ER}{(P_5 - a_{95}PW_9ERti_9)(1+te_5)}\right]^{mn_p}(YN_r)^{mn_i}, \tag{A.20}$$

where E_j = exports of good j; E_{4s} = export demand for good 4 (regional

manufactured exports) going to final use s, where $s=$c (consumption), i (intermediate), and k (investment); $tk_9=$tariff on manufactured investment goods; Y_r (YN_r) = regional (non-regional) output; m_{ps} (m_{is}) = price (income) elasticity of regional manufactured export demand going to final use s; mn_p (mn_i) = price (income) elasticity of non-regional manufactured export demand. Note that eq. (A.20) indicates that imports employed in the production of non-traditional exports are tariff exempt.

A.6. Corporate profits

Corporate profits are calculated by subtracting wage costs, interest payments, lump-sum taxes, and depreciation allowances from gross sales:

$$U_j = PN_jX_j - L_jW_j - PD_jR - LST_j - \delta_jK_j - NFSM_jER, \quad j=2,4,5,6,8, \tag{A.21}$$

where $U_j=$corporate profits in sector j; $PD_j=$financial debt of sector j; $R=$fixed active real interest rate; $LST_j=$lump sum taxes for sector j; and $NFSM_j=$non-factor services imports of sector j.

Profits for two sectors include a slight variation in the above formula, however. Profits for the traditional agricultural export sector (sector 1) include the additional income due to exports under quota agreements, while gross profits for other services (sector 7) include the intermediation gains of the financial system. (Sector 3, the backward rural sector, does not generate profits.)

The model also assumes that a constant fraction of sectoral cash flows is reinvested in the same sector, although these fractions differ between sectors. The remaining cash flows are distributed among shareholders (households, foreigners, and the government):

$$CF_j=(1-tu_j)U_j+\delta_jK_j, \quad j=1,\ldots,8, \; j\neq 3,5, \tag{A.22}$$

where $CF_j=$cash flow of sector j and $tu_j=$corporate income tax of sector j. Sector 5 is assumed to be exempted from income taxes.

A.7. Disposable income

Urban and rural workers receive wage payments (workers in the backward rural sector receive their share of sectoral income), and capitalists receive their corresponding share of dividends. In addition, each group receives transfers and interest income. Only capitalists pay personal income taxes:

$$I_a = W_aWF_a + ERq_aNT + \tau_aTR, \tag{A.23}$$

$$I_n = W_n L_n + R^p A_n + ERq_n NT + \tau_n TR, \quad n = \text{u, s}, \tag{A.24}$$

$$I_c = \sum_j (1 - e_j) b_j CF_j - rb_7 CF_7 + R^p A_c + ERq_c NT + \tau_c TR - PH, \tag{A.25}$$

where I_n = disposable income of income group n; L_u (L_s) = industrial (services) employment;[14] A_n = financial assets owned by consumer group n; R^p = fixed passive real interest rate; NT (TR) = total foreign (domestic) transfers; PH = personal income taxes; bj = fraction of profits distribuyted by sector j; e_j = foreign share of sector j's profits; r = government's share of profits in the services sector; q_n (τ_n) = consumer group n's share of external (domestic) transfers.

The model assumes that the foreign and public sector's share of profits is proportional to their participation in the sector's capital stock:

$$r = KG/K_7; \tag{A.26}$$

$$e_j = KF_j/K_j, \quad j = 1, \ldots, 8, \; j \neq 3, \tag{A.27}$$

where KG = public stock in the other services sector (sector 7), and KF_j = foreign-owned capital in sector j.

A.8. Private consumption

Each income group is characterized by a constant marginal propensity to save, and final consumption of each commodity is determined by a linear expenditure system. There is no domestic consumption of good 5 and consumption of commercial services (sector 8) is linked via fixed coefficients to the consumption of other goods:

$$G_n = (1 - s_n) I_n, \quad n = \text{c, u, s, a}, \tag{A.28}$$

$$C_{jn} = c_{jn} + \mu_{jn} \left(G_n - \sum_i c_{in} PC_i - NFSM_n ER \right) \Big/ PC_j,$$

$$c_{jn}, \mu_{jn} > 0, \quad n = \text{c, u, s, a}, \quad i, j = 1, \ldots 9, \; i, j \neq 5, 8, \tag{A.29}$$

$$C_j = \sum_n C_{jn}, \quad j = 1, \ldots, 9, \; j \neq 5, 8, \tag{A.30}$$

[14]Thus $L_u = L_4 + L_5 + L_6$ and $L_s = L_7 + L_8 + L_g$, where L_g denotes the number of public employees.

where G_n = expenditures of income group n; C_{jn} = income group n's consumption of good j; C_j = aggregate consumption of good j; c_{jn} = group n's minimum requirements of good j; s_n = marginal propensity to save of group n; and $NFSM_n$ = non-factor services imports of group n.

A.9. Government revenues

Government revenues include corporate and personal income taxes (IT), lump sum taxes (LST), value added taxes (VAT), trade taxes (TA), the oil compensation fund (FC), interests from deposits in the financial system, the government's share of dividends from sector 7, and net official transfers received from abroad:

$$I_g = IT + \sum_j LST_j + VAT + TA + FC + A_g R^g + rb_7 CF_7 + NTq_g ER, \quad \text{(A.31)}$$

where I_g = total government revenues: A_g = government's financial assets; R^g = real interest rate received by government deposits; and q_g = public sector's share of external transfers.

Tax revenues are described in the following equations:

$$IT = \sum_{j \neq 5,3}^{8} tu_j U_j + PH, \quad \text{(A.32)}$$

$$TA = \left[ti_9 \left(V_9 - \sum_{j=2,5} a_{9j} E_j \right) + tc_9 C_9 + tk_9 \left(Z_9 - \sum_{j=5,g} z_{9j} ID_j \right) \right] \times PW_9 ER + \sum_{j=3,6} ti_j M_j PW_j ER + \sum_j te_j E_j, \quad \text{(A.33)}$$

$$VAT = \sum_{i \in B_1 \setminus [5]} [tv_i/(1+tv_i) C_i PC_i] + \sum_{i \in B_1} tv_i \left\{ \sum_{j \in B_2} a_{ij} X_j P_j \right\}, \quad \text{(A.34)}$$

$$FC = \sum_{i=1}^{8} P_6 a_{6i} t_{cf} X_i + C_6 P_6 t_{cf}, \quad \text{(A.35)}$$

where Z_i = investment demand for good i; and x_j = exports of good j.

A.10. Government expenditures

Government current expenditures are divided into four components: (1) wage payments; (2) purchases of goods and services; (3) government transfers; and (4) debt service payments. The sectoral composition of government

expenditures in goods and services is determined according to fixed proportions:

$$CE = L_g W_s + \sum_{j \neq 5,8}^{9} P_j G_j + NFSM_g ER + TR + R^* D \cdot ER, \tag{A.36}$$

where CE = total public current expenditures; G_j = public consumption of good j; R^* = international real interest rate; D = foreign debt; and $NFSM_g$ = public imports of non-factor services.

Public investment, including investment in infrastructure and transfers to public enterprises, is exogenous to the model:

$$CI = PI + ID_g PK_g, \tag{A.37}$$

where CI = capital expenditures of the public sector; PI = capital transfers to public enterprises; ID_g = fixed capital formation; and PK_j = price of capital for sector j.

A.11. Investment

The sectoral allocation of investment is separated into three components: (1) investment financed through retained earnings; (2) investment financed through the local financial system, determined according to the sector's relative profitability; and (3) foreign investment, distributed among sectors according to fixed coefficients (sector 7 also includes public capital transfers, PI):

$$ND = \sum_n s_n I_n + S_g, \quad n = \text{s, c, u}, \tag{A.38}$$

$$ID_j = [CF_j(1 - b_j) + \mathring{A}_j ND + y_j FI]/PK_j, \quad j \neq 3, \tag{A.39}$$

$$\mathring{A}_j = (U_j/PK_j K_j)^{\varepsilon} / \sum_i (U_i/PK_i K_i)^{\varepsilon}, \quad \varepsilon > 0,\ j \neq 3, \tag{A.40}$$

$$FI = NFI \cdot ER + (1 - f) \sum_{j \neq 3} e_j b_j CF_j, \tag{A.41}$$

where ND = corporate borrowing; S_g = public sector lending; ID_j = gross investment in sector j; NFI = new foreign direct investment (in U.S.$); FI = foreign direct investment (in Q.); f = repatriated share of foreign profits; $\mathring{A}_j$ = sector j's share in corporate borrowing; and y_j = share of foreign investment going to sector j.

An investment transformation matrix determines the price of capital for each sector and the investment demand for each good;

$$PK_j=\sum_i z_{ij}P_i+(1+tk_9)z_{9j}PW_9ER, \quad i,j=1,\ldots 8,\ i,j\neq 5, \tag{A.42}$$

$$PK_j=\sum_i z_{ij}P_i+z_{9j}PW_9ER, \quad j=5,\mathrm{g},\ i=1,\ldots 8,\ i\neq 5, \tag{A.42'}$$

$$Z_i=\sum_j z_{ij}ID_j+z_{i\mathrm{g}}ID_{\mathrm{g}}, \quad i,j=1,\ldots 9,\ i\neq 5,8,\ j\neq 9, \tag{A.43}$$

where z_{ij} = investment transformation matrix.

A.12. Market equilibrium

Quantity adjustments prevail in those sectors producing non-differentiated tradable goods (sectors 1, 2, 3 and 6), while price adjustments prevail in all other sectors:

$$X_j-C_j-V_j-Z_j-G_j=E_j, \quad j=1,2,4, \tag{A.44}$$

$$X_j-C_j-V_j-Z_j-G_j=M_j, \quad j=3,6, \tag{A.45}$$

$$X_5-E_5=0, \tag{A.46}$$

$$X_7-C_7-V_7-G_7-NFSE\cdot ER=0, \tag{A.47}$$

$$X_8-\sum_j \sigma_j C_j-V_8=0, \tag{A.48}$$

where $NFSE$ = non-factor service exports, which are exogenous to the model.

A.13. Closure rules

Foreign and private savings finance the fiscal deficit, which is endogenously determined, while the exchange rate adjusts to clear the balance of payments:

$$D_{\mathrm{g}}=CE+CI-I_{\mathrm{g}}, \tag{A.49}$$

$$S_{\mathrm{g}}+DR\cdot ER+D_{\mathrm{g}}=F\cdot ER, \tag{A.50}$$

where D_g = overall government deficit; F = net foreign borrowing; and DR = change in reserves.

Total exports (E) and imports (M) are described in the following equations:

$$E=[E_4P_4(1+te_4)+E_5(P_5-a_{95}PW_9ERti_9)(1+te_5)]/ER + \sum_{j=1,2} E_jPW_j, \tag{A.51}$$

$$M=[(V_9+C_9+Z_9)PW_9+M_3PW_3+M_6PW_6]/ER, \tag{A.52}$$

$$NS=NFSE-R^*D-f\sum_j e_jb_jCF_j/ER-\sum_n NFSM_n-\sum_j NFSM_j - NFSM_g, \tag{A.53}$$

$$F+E-M+NS+NFI+NT-DR=0, \tag{A.54}$$

where NS = net services account.

A.14. Intertemporal linkages

The model presents three sets of intertemporal equations: the first describes adjustments in the labor market; the second describes adjustments in sectoral capital stocks; and the third describes adjustment in financial assets. Urban and rural work forces are assumed to grow at exogenously given rates, but they are adjusted to consider the rural–urban migration:

$$WF_{u+}=(1+n_u)WF_u+MI, \tag{A.55}$$

$$WF_{a+}=(1+n_a)WF_a-MI, \tag{A.56}$$

$$MI=\overline{MI}[W_u(L_u/WF_u)/W_a]^{\Omega}, \quad \Omega>0, \tag{A.57}$$

where the subindex + denotes the next period; MI = rural–urban migration; WF_u = urban work-force; and n_u (n_a) = rate of growth of the urban (rural) work force.

Finally, intertemporal adjustments of sectoral capital stocks and financial assets are guided by the corresponding short-run solutions:

$$K_{j+}=ID_j+(1-\delta_j)K_j, \quad j=1,\ldots,8, \tag{A.58}$$

$$KG_+=KG(1-\delta_7)+PI+r(1-b_7)CF_7, \tag{A.59}$$

$$KF_{j+} = KF_j(1-\delta_j) + e_j(1-b_j)CF_j + y_jFI, \quad j=1,\ldots,8, j\neq 3, \tag{A.60}$$

$$A_{n+} = A_n + S_n, \quad n=\text{c, u, s, g}, \tag{A.61}$$

$$PD_{j+} = PD_j + \mathring{A}_jND, \quad j=1,\ldots,8, j\neq 3, \tag{A.62}$$

$$D_+ = D + F. \tag{A.63}$$

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