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UNITED STATES ADJUSTMENT IN THE 1990S: A CGE ANALYSIS OF ALTERNATIVE TRADE STRATEGIES

by

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Abstract

There is a general consensus among macro economists that the U.S. trade deficit will be largely eliminated over the next decade. This paper investigates the implications for the structure of the U.S. economy of such a reduction. We explore two alternative adjustment scenarios. First, we assume an environment of world trade liberalization, with successful resolution of the Uruguay round of GATT negotiations. In this environment, the U.S. pursues a strategy of export-led growth, with a significant real devaluation and rapid expansion of exports, including agriculture. An alternative view is that the current round of GATT negotiations will end in failure and the world economy will lapse into a protectionist environment. In this second scenario, the U.S. is assumed to adopt protectionist policies to improve the trade balance and pursue an inward-looking growth strategy.

We use a thirty-sector CGE model of the U.S. to analyze the impact of these two scenarios. The model includes significant detail in the agricultural sectors, including explicit specification of agricultural support programs. The CGE model is benchmarked to a 1988 base. The first adjustment scenario starts from a set of macroeconometric projections of the U.S. economy to 1991 and 1995 that incorporate a fall in the trade deficit and an assumed improvement in the world trade environment. These projections provide exogenous macro variables for the CGE model. The CGE model is then solved for the two forward years and provides projections of the structure of the U.S. economy, given the macro projections. Next, we model the alternative scenario in which the U.S. adjusts by means of import protection with a shrinking volume of trade. In analyzing the protectionist scenario, we do a variety of experiments designed to explore the impact of protectionist policies on the U.S. economy.

I. Introduction

In spite of the enormous current U.S. trade deficit, many macro economists project that the current account will move back into surplus in the 1990s. This view rests on a scenario which projects a significant real devaluation and rapid growth of U.S. exports. This view, implicitly or explicitly, presupposes a successful resolution of many of the disputes currently being debated within the GATT and places the U.S. in an environment of expanding world trade. Alternatively, the current round of trade negotiations could end in failure and the world might then lapse into a protectionist environment. The mounting trade deficit has certainly unleashed protectionist sentiments in the U.S., as import-competing industries clamor for protection from foreign competitors. If enacted, extreme protectionist policies might well induce retaliatory measures from our major trading partners, ultimately forcing the U.S. to adjust in an environment of shrinking world trade.

In this paper, we investigate the implications of these different trade scenarios on the structure and performance of the U.S. economy. We use a thirty-sector computable general equilibrium (CGE) model benchmarked on 1988 data. The first adjustment scenario starts from a set of macroeconometric projections of the U.S. economy to 1991 and 1995 that incorporate a fall in the trade deficit and improvement in the world trade environment. These projections provide exogenous macro variables for the CGE model. The CGE model is then solved for the two forward years and provides projections of the structure of the U.S. economy, given the macro assumptions.

Next, starting from the 1995 projection, we model the alternative scenario in which the U.S. adjusts by means of import restrictions with a shrinking volume of trade. In analyzing the protectionist scenario, we do two types of experiments designed to explore the impact of protectionist policies on the U.S. economy. First, we explore the impact of increased tariff protection for each of seven selected sectors, assuming in each case no other changes in tariffs. The underlying assumption is that protectionist political pressure is sector specific, and we analyze what happens if a single sector succeeds in obtaining protection, with no other changes in trade policy. Second, we impose an across-the-board tariff of fifty percent, which is added to existing tariffs in all sectors. In this case, the assumption is that there is a general increase in protectionist pressure resulting in something like the Smoot-Hawley tariff of 1930. With these experiments, we can compare the impact of sectoral protection to that of across-the-board protection.

The sector-specific and overall-protection experiments are run under varying assumptions about intersectoral capital mobility. For both policy experiments, we assume that capital is sector specific, a common assumption in recent trade theory literature which emphasizes the role of industry-specific factors in determining the demand for protection.[1] We also repeat the overall-protection policy experiment assuming capital is freely mobile.

In the next section, we describe the thirty-sector CGE model used in the study, focusing on the model's treatment of foreign trade, including a new approach to modelling import demand functions. In Section three, we briefly review the theoretical properties of a model such as ours, with imperfect substitution for both exports and imports. We then present the forward projections to 1991 and 1995 and the protection experiments.

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[1]For a survey of recent trade models emphasizing the role of industry specific factors, see Magee (1978). Findlay and Wellisz (1983) examine the role of specific factors in determining the demand for protection in a two good general equilibrium model.

II. The CGE Model Structure

In this section, we give a brief overview of the structure of the model, focusing on the treatment of trade and omitting the details of the model equations. A complete description of the underlying CGE model can be found in Robinson, Kilkenny, and Hanson (1989).

Supply and Demand

The model contains thirty sectors, each producing a composite commodity which can be transformed into an export good or a commodity sold only on the domestic market. Each industry's output is produced according to a constant returns to scale, constant elasticity of substitution (CES) production function which uses three primary inputs: labor, capital, and, in the agricultural sectors, land. In addition, intermediate inputs are required according to fixed input-output coefficients. Sectoral input demands are derived from first order conditions for profit maximization. Total endowments of land, labor, and capital are fixed, and factor prices are assumed to adjust to equate aggregate supply and demand in each factor market.

Aggregate domestic demand in the model has four components: consumption, intermediate demand, government, and investment (including inventory accumulation). The model has three households, with expenditure functions derived from a Cobb-Douglas utility function, yielding fixed nominal expenditure shares. Each household pays income taxes to the government and saves a proportion of its income, determined by fixed average propensities to save. Intermediate demand is calculated from total sectoral outputs, given the fixed input-output coefficients. For the government, aggregate spending on goods and services is fixed and its sectoral composition is given by fixed shares. Inventory demand by sector is a fixed proportion of domestic output.

Aggregate investment is either set exogenously from a macro model or is "savings driven." The difference between aggregate investment and inventory demand represents the total available funds for purchasing new capital goods, i.e. fixed investment. Expenditure on investment goods by sector is a fixed share of the total funds available for investment, giving investment demand by sector of destination. Investment demand by sector of origin is translated from investment demand by sector of destination by using a capital composition matrix.

Aggregate savings is the sum of household saving, government saving, and foreign saving. Household savings is a fixed fraction of household income. Government saving is the difference between government revenue from income taxes, tariff revenue, and excise taxes, less government spending.

The model also contains a balance of payments constraint in that the value of imports at world prices must equal the value of exports at world prices plus foreign savings, net remittances, and foreign borrowing. In the experiments reported in this paper, we assume that the balance of trade for goods and non-factor services, and hence foreign saving, is fixed exogenously and is given from macroeconometric projections. In the CGE model, the real exchange rate adjusts to achieve equilibrium, given the fixed balance of trade.

The model makes the "small country" assumption on the import side, assuming that the U.S. cannot affect world prices of its imports. On the export side, we assume downward-sloping world demand functions for U.S. agricultural exports. Non-agricultural exports have fixed world prices.

Imports

A common feature in trade-focused CGE models is the Armington assumption that imported and domestic commodities are imperfect substitutes. [Armington (1969)] This treatment is appealing in that it naturally accommodates the presence of two-way trade at the sectoral level --a common observation at the level of aggregation of multisector models. In the usual treatment, imports are combined with domestic commodities according to a constant elasticity of substitution (CES) aggregation function to form a composite commodity. Users of the composite commodity will choose an optimal combination of imports (M) and domestic commodities (D) so as to minimize total expenditure subject to the CES aggregation function. The optimal ratio of import demand to domestic demand for domestic goods is a function of their relative prices, the elasticity of substitution, and the share parameters in the import aggregation functions.

One drawback of using CES aggregation functions is that the expenditure elasticity of import demand is constrained to be one in every sector. Econometric work indicates that this constraint is statistically inappropriate.[2] Instead, for a number of sectors, we specified a more flexible functional form, the almost ideal demand system or AIDS.[3] We estimated the parameters of the AIDS function using sectoral time-series data for the 1970-1986 period. The AIDS formulation of the Armington assumption yields an import demand function of the following form:

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[2]See, for example, Allston et al. (1989).

[3]See Deaton and Muellbauer (1980) and Chalfant (1987) for discussions of the AIDS expenditure function.

$$S_m = A_m + \gamma \cdot \ln(PD/PM) + \beta \cdot \ln(X/X0)$$

where S_m is the value share of imports in total expenditure on the composite commodity, A_m is the intercept term and represents the base year share when all prices equal one, $\gamma \cdot \ln(PD/PM)$ captures the influence on the import share of changes in relative prices, and $\beta \cdot \ln(X/X0)$ captures the income effect.

Since total expenditure on the composite commodity, $P \cdot X$, must equal $PM \cdot M + PD \cdot D$, real composite demand, X, can be written:

$$X = (PM \cdot M + PD \cdot D)/P.$$

The usual approach is to define P as a cost function of PD and PM, using either a Cobb-Douglas, CES, or translog functional form. We have chosen to use a CES function, mainly to be consistent with the treatment in the non-AIDS sectors.

The income elasticity of demand, ϵ_{ym}, and the elasticity of substitution between imports and domestic commodities, σ, are related to the parameters γ and β in the AIDS equation by the following formulae:[4]

$$\epsilon_{ym} = 1 + \beta/S_m$$

$$\sigma = 1 + \gamma/(S_m \cdot S_d)$$

where $S_d = (1 - S_m)$.

As a flexible functional form, the AIDS formulation has some advantages over the CES import-aggregation function. It is, however, an approximation. While it has the advantage of allowing expenditure elasticities different from one, it may be inappropriate for analyzing shocks that move import shares a large distance from the initial shares. In our application, we are analyzing

[4]See Chalfant (1987) or Deaton and Muellbauer (1980) for a derivation of these expressions. Green and Allston (1990) discuss how the choice of the aggregate price index for the cost function will affect these formulae.

scenarios in which total income changes a great deal, so we need a formulation that allows expenditure elasticities to differ from one.

Exports

One treatment of export behavior which has become increasingly common in trade-focused CGE models is to employ a constant elasticity of transformation (CET) function. The CET function, whose form is analogous to the CES function, describes how sectoral production can be transformed into goods suitable for the domestic and export markets. Sectoral output is transformed into two different goods, each with its own price: PD for domestic output sold only on the domestic market and PE for exports (in domestic currency).

The small-country assumption can be retained for exports in that the domestic price of exports, PE, equals a fixed world price times the exchange rate and any subsidy rate, but the price of output for domestic use, PD, will no longer be tied to the world market price. Producers want to maximize revenue from sales subject to the CET transformation function. The optimal division of domestic output into part for export and part for domestic use will be a function of the ratio of PE to PD, the elasticity of transformation between the two uses, and the share parameters in the CET function.

Macro Balances

The CGE model includes the major macro balances: savings-investment, government deficit, and the balance of trade. How these balances are reconciled constitutes much of the subject matter of macroeconomic theory. In the literature on CGE models, the problem of achieving equilibrium among these macro aggregates is termed the "macro closure" problem.[5] For our purposes, the problem is relatively straightforward since we rely on a separate macroeconometric model to project the balance of trade, the government deficit, and aggregate investment. We "close" the CGE model by making these macro aggregates exogenous. Endogenously, the model solves for enterprise savings rates and the equilibrium real exchange rate to equilibrate savings-investment and the balance of trade.

In common with the neoclassical real trade model, the CGE model incorporates a functional relationship between the real exchange rate and the balance of trade. The real exchange rate is defined as the relative price of non-tradables to tradables (PD for non-tradables and PM and PE for tradables).[6] Ceteris paribus, an improvement in the balance of trade is associated with a real depreciation. The CGE model can only solve for relative prices. We choose as the numeraire price index the GDP deflator for the base forward run and the aggregate price of domestic goods sold on the domestic market for the protection experiments.[7] Given the choice of numeraire, the model also solves for the equilibrium nominal exchange rate. That is, the CGE model takes as exogenous any two of the following three variables: the aggregate price level, the balance of trade, and the nominal exchange rate.[8] We use the macro model to project the

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[5]Robinson (1989) surveys this literature.

[6]In the various tables, we report exchange rate indices. A decrease of the index indicates a depreciation of the exchange rate.

[7]For the single-tariff experiments, the two are effectively equivalent. For the overall protection experiments, the use of the domestic price index as numeraire makes the solution value of the exchange rate close to the real exchange rate since it is effectively an index of non-tradable prices.

[8]See de Melo and Robinson (1989) who sort out these relationships in a small analytic model that is close in structure to the CGE model.

aggregate price level and the balance of trade, and let the CGE model solve for the equilibrium exchange rate.

When we model uniform protection, there is a large increase in government revenue from tariffs. In this case, we fix net government revenue and rebate the increased tariff revenue to households so that there are no macro feedbacks through the government account. When changing a tariff in a single sector, the change in tariff revenue is small, so we do not bother to adjust aggregate government transfers in those experiments.

Farm Programs

The U.S. CGE model contains a fair amount of detail in the agricultural sectors. The model also incorporates government programs to support agriculture. The standard approach to modelling government support programs in economywide models is to compute an ad valorem measure of the value of the programs to farmers and incorporate these ad valorem rates into the behavioral equations of the model. Kilkenny and Robinson (1989) argue that this approach can lead to serious errors in estimating the impact on the economy of changes in agricultural programs and in estimating changes in the cost of such programs given changes in macro conditions.

In this model, following Kilkenny and Robinson, we have taken a different approach. Instead of modelling agricultural programs with an ad valorem wedge, we have modelled the various programs explicitly. The model captures the major features of the deficiency payment program, the loan program (including government stocking operations through the Commodity Credit Corporation), and various trade restrictions on agricultural imports.

III. Theory of Protection

The U.S. CGE model assumes downward-sloping demand curves for exports in four agricultural sectors out of thirty sectors in all. The U.S. is assumed to behave as a "small" country on world markets for the other export sectors, and for all imports. In theory, tariff protection for the four exporting agricultural sectors might be welfare improving, given the ability to affect international prices and assuming no retaliation from other countries. However, the model also incorporates a variety of other market distortions, including existing tariffs, indirect taxes, and disequilibria in the factor markets. In general, we cannot predict the aggregate welfare effect of changes in protection. Given empirical work with a variety of models, however, we can expect that the aggregate welfare effects will be small.[9]

While aggregate welfare effects are liable to be small, protection can benefit particular groups in the economy at the expense of others. As demonstrated by Stolper and Samuelson (1941), interest in protection should form according to factor intensities. For example, if the import good is labor intensive, then labor has a clear interest in an import tariff since the increase in the price of the import good will raise the real wage, while lowering the return to capital. Thus, there exists a potential tension over trade policy among factor owners, with the interest determined by factor intensities.[10]

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[9] For example, see the summary discussion in Srinivasan and Whalley (1986).

[10] There is also a "magnification effect" commodity price changes have upon factor prices, an effect which generalizes to the multi-commodity, multi-factor case. See Jones and Schienkman (1977) and Ethier (1974).

Alternatively, recent literature on rent seeking and pressure group models of trade policy formation has focused on models which incorporate a production structure characterized by specific factors.[11] With a sector-specific factor and a perfectly mobile factor, owners of the specific factor have a clear interest in protection for their own industry since such protection confers rents. They also have an interest in lower tariffs for all other industries because higher tariffs in other industries will cause the return to the specific factor in every industry but its own to fall. Thus, there exists a clear tension among owners of industry-specific factors over trade policy.

In our model, we do experiments in which capital is treated as sector specific and, alternatively, as intersectorally mobile. We can thus explore both the factor-proportions version of the argument with all factors mobile and the sector-specific factor version. We do not, however, consider the case in which labor is also sector-specific, nor do we consider models of imperfect competition.[12]

The literature in trade theory describing the effects of protection has concentrated almost exclusively on the case where imports are perfect substitutes for domestically produced commodities. In a model where imports are imperfect substitutes for domestically produced commodities, the effect of an import tariff upon the price of the domestically produced substitute depends on the elasticity of substitution between the import and domestic good, the import

[11]The properties of the specific factors or Ricardo-Viner model are discussed in Mussa (1974), Mayer (1974), and Jones (1971). Empirical evidence in support of this view for the U.S. is presented in Magee (1978).

[12]See de Melo and Tarr (1989) for a related U.S. CGE model in which they explicitly consider the effect of protection on sectors in which there is imperfect competition.

share, and the elasticity of demand for the composite good. In general, the larger the elasticity of substitution between imports and domestic commodities, and the larger the import share, then the larger will be the effect of changes in tariffs upon domestic prices.[13] In the U.S. model, the elasticities of substitution between imports and domestic commodities are sufficiently large to expect protection to be effective, but we expect protection to have a smaller impact than it would have in a model where commodities are perfect substitutes.

In addition, any tariff increase should introduce an incentive bias against exports. This notion is attributable to Lerner (1936), who showed in a model with perfect substitutes that an import tariff is symmetrical to an export tax in its effects. This result generalizes to an across-the-board tariff increase, which should provide a general bias against exports.

We are interested in measuring the degree of protection afforded to an industry as a result of the sector-specific tariff experiments. Looking solely at nominal sectoral tariffs can be misleading because they do not account for the fact that industries may use inputs which are themselves subject to tariffs. To get a more precise measure of industry protection, we calculate the effective rate of protection (ERP) for each industry. The ERP measures the degree of protection to sectoral value added associated with a particular tariff structure.[14] In addition, we use the CGE model to calculate explicitly the change in

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[13]De Melo and Robinson (1985) explore the relationships in a partial-equilibrium model. They show that if the elasticity of substitution between imports and domestic commodities is less than the elasticity of demand for the composite commodity, then the price of the domestically produced commodity will fall in response to a tariff increase and the tariff will fail to protect the domestic industry.

[14]The formula we use for the effective rate of protection is from Corden (1966): $ERP_j = (t_j - \Sigma_i \theta_{ij} \cdot t_i)/(1 - \Sigma_i \theta_{ij})$, where t_j is the tariff on good j, θ_{ij} is the cost share of intermediate good i in final good j, and t_i is the

value added due to tariff changes. In computing ERP's, we are interested only in comparing the effects of different tariff regimes. We thus make no attempt to take into account any non-tariff barriers in the computation.

IV. Base Projections to 1991 and 1995

The thirty-sector CGE model for the U.S. is calibrated to a 1988 data base.[15] The calibration procedure is described in Robinson, Kilkenny, and Hanson (1989). The sectoral and macro data were reconciled in the framework of a social accounting matrix (or SAM). Hanson and Robinson (1989) describe the procedure. An aggregate SAM for 1988 is presented in Figure 1 and Table 1 presents the sectoral structure of the economy.

From 1988 we project forward to 1995 in two steps. First, from 1988 to 1991 and then from 1991 to 1995. The projections for macro aggregates come from a small multi-country macro model developed by Malley, Foster, and Bell (1988). As described above, the CGE model takes these macro projections as exogenous. Some indicators from the base projection are given in Tables 2 and 3.

In terms of growth, the projection is conservative. Real GDP is projected to grow at 3.1% a year to 1991, decline to 2.6% a year from 1991 to 1995. Total factor productivity growth is projected to account for less than half of total growth, a share somewhat lower than the long-run historical average. Government expenditure is projected to grow much more slowly than GDP.

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tariff on input i.

[15]We started from a 1982 data base which was then updated to 1986 and 1988. Sectoral output and employment data for 1986 and 1988 are taken from unpublished BLS data. The National Income and Product Accounts for 1986 and 1988 are used as macro control totals for aggregation of sectoral structure. The 1986 and 1988 NIPA data are from the Survey of Current Business, July 1988 and February 1989, respectively.

Figure 1: 1988 U.S. Social Accounting Matrix
(billions of current dollars)

RECEIPTS OR INCOME / EXPENDITURES OR OUTLAYS

	1 Suppliers: Commodity	2 Suppliers: Activity	3 Value Added: Labor	4 Value Added: Capital	5 Institutional Actors: Enterprise	6 Institutional Actors: Household	7 Institutional Actors: Government	8 Institutional Actors: Capital	9 Institutional Actors: World	Row Totals
Suppliers:										
1 commodity		3894.1				3226.4	968.4	773.7	412.5	9275.1
2 activity	8726.7						11.0			8737.6
Value Added:										
3 labor		2995.5								2995.5
4 capital		1469.2								1469.2
Institutional Actors:										
5 Enterprise	0.2			1469.2			82.8		24.1	1576.4
7 Household			2551.9		856.4		555.4		-1.0	3962.7
8 Government	16.7	378.8	443.7		140.5	594.1			-40.9	1532.8
9 Capital Acct					579.5	142.2	-84.8		136.9	773.7
10 Rest of World	531.5									531.5
Column Totals	9275.1	8737.6	2995.5	1469.2	1576.4	3962.7	1532.8	773.7	531.5	

Table 1: Economic Structure for 1988 Base

	Sectoral Composition:				Trade Shares:		Elasticities:	
	Real Output	Nominal Value Added	Real Exports	Real Imports	Real E/XD	Real M/XD	Import Subst.	Export Transf.
	- - - - - - - - - - - percent - - - - - - - - - -							
dairy	0.3	0.2	-	-	0.0	0.0	-	-
livestock	0.9	0.3	0.1	0.3	0.7	2.0	2.0	2.0
cotton	0.1	0.1	0.2	0.0	17.5	0.2	4.0	4.0
food grains	0.1	0.1	1.0	0.0	55.7	0.5	4.0	4.0
feed crops	0.4	0.3	0.8	0.0	9.6	0.4	4.0	4.0
oil crops	0.1	0.2	1.3	0.0	44.8	0.7	3.0	4.0
sugar	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.0
other crops	0.4	0.4	0.5	1.0	5.8	17.0	0.5	2.0
meat processing	1.0	0.4	0.9	0.9	4.5	6.1	1.7	2.0
dairy processing	0.5	0.2	0.1	0.2	1.2	2.9	1.7	2.0
grain milling	0.3	0.1	0.5	0.0	9.5	1.2	1.7	2.0
prepared feeds	0.2	0.1	0.1	0.0	2.1	0.7	1.7	2.0
corn milling	0.0	0.0	0.2	0.0	16.1	1.1	1.7	2.0
sugar processing	0.2	0.1	0.1	0.3	1.4	8.1	5.0	2.0
soy milling	0.2	0.1	0.7	0.2	15.6	6.1	4.0	2.0
misc food	1.7	0.7	0.5	1.3	1.6	5.4	1.7	2.0
mining & forestry	1.2	0.9	2.7	0.8	11.6	4.4	2.0	2.0
petroleum	5.3	2.3	6.3	16.9	6.0	21.6	1.8	2.0
construction	7.2	4.9	-	0.0	0.0	0.0	-	2.0
chemicals	3.7	2.4	7.0	3.7	9.5	6.7	2.6	2.0
other nondur mfg	4.8	3.5	4.9	15.2	5.1	21.5	2.6	2.0
other durable mfg	2.4	1.9	3.2	5.9	6.7	16.8	1.9	2.0
metal mfg	3.6	2.3	6.0	9.3	8.6	17.8	1.9	2.0
machinery	4.0	1.9	13.9	5.4	17.6	9.2	1.9	2.0
other electronics	2.5	1.9	10.8	5.2	21.6	14.0	1.9	2.0
cons electronics	0.9	0.6	4.4	14.4	25.0	110.0	1.9	2.0
transp equip	4.4	2.6	15.0	14.4	17.1	22.2	2.8	2.0
trade & trans	16.7	20.1	13.0	3.5	3.9	1.4	0.2	2.0
finance	11.9	16.8	2.3	0.1	1.0	0.1	0.2	2.0
other services	24.9	34.6	3.9	0.9	0.8	0.3	0.2	2.0
total	100.0	100.0	100.0	100.0	5.1	6.8		
agriculture	2.3	1.5	3.9	1.3	8.5	3.8		
food processing	4.1	1.7	3.0	3.0	3.6	4.9		
other industry	40.1	25.3	74.0	91.1	9.4	15.5		
services	53.5	71.5	19.1	4.6	1.8	0.6		

Notes:
A "-" denotes no value. A "0.0" denotes a value less than 0.1 percent.

Table 2: Macroeconomic Indicators, Base Projection

	1988-1991	1991-1995
	annual growth rates (%)	
GDP factor inputs, and productivity		
Real GDP, constant 1982 $	3.1	2.6
Labor	1.5	0.9
Capital	2.5	2.5
Land	4.0	1.2
Total factor inputs, weighted	1.8	1.4
Total factor productivity	1.3	1.2

	1988-1991		1991-1995	
Demand Aggregates	Real Product	Real Deflator	Real Product	Real Deflator
	annual growth rates (%)			
Consumption	2.2	4.1	2.3	3.7
Fixed investment	5.0	4.0	3.2	3.6
Inventory	3.3	4.4	2.4	3.4
Government	1.0	4.1	1.0	3.7
Exports	11.0	7.5	6.6	5.9
Imports	3.4	10.5	4.3	6.9
GDP	3.1	4.0	2.6	3.7

Foreign Trade Indicators	1988	1991	1995
Real exchange rate index (1988=100)	100	91.8	85.3
Nominal exchange rate index (1988=100)	100	89.9	81.9

Foreign Trade balances Billions of Current $	1988	1991	1995
Nominal trade balance (goods & nfs)	-118.3	-46.6	29.7
Nominal net factor Services (nfs)	24.1	-2.3	-13.0
Nominal current account balance	-94.2	-48.9	16.7
Nominal govt & hhld net transfers & interest abroad	41.9	41.9	48.5
Nominal net foreign investment	-136.9	-92.1	-33.9
Real trade balance (bil 1982 $)	-97.6	-52.1	-16.4

Table 3: Agricultural Sector Indicators, Base Projection

	1988	1991	1995
Agricultural Terms of Trade			
Indices (1988=100)			
Output prices	100	101.1	106.3
Value added	100	97.7	100.8
World export prices	100	97.9	95.1
Agricultural Program Costs			
Outlays to Farmers			
$ Billions, current prices	6.5	9.4	5.9
$ Billions, 1988 prices	6.5	8.3	4.5
Export Subsidies			
$ Billions, current prices	1.0	1.4	2.1
$ Billions, 1988 prices	1.0	1.3	1.6
Premia From Import Quotas			
$ Billions, current prices	0.2	0.0	0.0
$ Billions, 1988 prices	0.2	0.0	0.0
Shares of Real GDP (%)			
Livestock	0.3	0.3	0.3
Crops	1.1	1.3	1.4
Total agriculture	1.4	1.7	1.7
Agric processing	1.9	1.9	1.9
Other manufacturing	22.6	23.0	23.1
services	74.1	73.4	73.3

Notes:

The value added terms of trade measure relative value added per unit output in agriculture relative to non-agriculture. The output and export price terms of trade measure agricultural prices relative to non-agricultural prices (Fohlin, Robinson, and Schluter, 1989).

Farm program costs as outlays to farmers consist of "recoverable" and "nonrecoverable" costs. They exclude disaster payments and reserve storage payments.

The base projections to 1995 represent an optimistic trade scenario, projecting that the current account will move into surplus by 1995. An 18.1% nominal depreciation of the dollar (14.7% real depreciation) accompanies the movement to a trade surplus. Real exports and imports grow much faster than GDP, and the scenario essentially describes a successful policy of export-led growth.

Even with the rapid growth of exports, in 1995, the macro model projects a net foreign investment of $33.9 billion into the U.S. (Table 2). There are two reasons. The balance of net factor services from abroad, which historically has been significantly positive for the U.S., is projected to be negative by 1995. The rising ownership of U.S. assets by foreigners will generate a net flow of factor income to the rest of the world. Secondly, government interest payments abroad are also projected to increase in the 1990s, since the ownership of government bonds by foreigners has been increasing during the 1980's.

The base scenario is largely favorable for agriculture. Table 3 indicates the agricultural terms of trade improve and that agriculture's share of real GDP increases slightly, arresting the long-term decline observed in the post-war period. The cost of farm programs is projected to decline in both real and nominal terms. The decline is due to two factors. First, the various reference prices (target prices and loan rates) against which market prices are compared in determining agricultural support are projected to decline in real terms until 1991, thus lowering support levels. From 1991 to 1995, they are projected to rise only with average inflation. Second, export-led growth increases domestic agricultural prices, thus narrowing the gap between market prices and reference prices and lowering program costs.

V. Protection Experiments

Our fundamental macro assumption is that the United States trade deficit will be reduced during the early 1990's. The macro model projects a simultaneous reduction in both the government and trade deficits, which we incorporate into our model solutions for 1991 and 1995. We consider two alternatives through which the reduction in the trade deficit is accommodated in the economy. In the Base Run projections to 1995, the deficit is accompanied by a depreciation of the dollar, with no change in tariff structure. The alternative we consider in this section is that the U.S. increases protection against imports.

Using 1995 as a point in time when the trade deficit is eliminated with either strategy, we compare the protection experiments with the 1995 Base Run. It is impossible to predict the mix of quantitative and tariff restrictions that might emerge if the present round of GATT negotiations fails.[16] We use a simple approach of imposing a fifty percent tariff which is added to the existing tariff in affected sectors. The idea is not to project what might actually happen, but to explore the structural impact of following a protectionist regime. In all experiments, the balance of trade is fixed in world dollars and the exchange rate adjusts to achieve equilibrium given the trade balance.

We perform two kinds of comparative static experiments. The first set of experiments imposes "sector specific" protection. In seven separate experiments, a fifty percent tariff is added to the existing tariff in seven sectors, keeping all other tariffs at existing levels. In the second set of experiments,

[16]For a discussion of some possibilities, see Bhagwati (1988) and Salvatore (1985).

"overall" protection, all sectors receive a fifty percent tariff on top of existing tariffs. We consider two versions of the overall protection experiment; one in which sectoral capital is assumed to be sector-specific and one in which capital is assumed to be mobile among sectors. The idea behind the two sets of experiments is to compare what might happen when each sector seeking protection in its own self interest succeeds in having policy makers increase tariffs, leading to a situation in which all sectors receive protection simultaneously.

Sector-Specific Protection

In each sector-specific protection experiment, we perform a comparative static experiment from the 1995 base, adding a 50% tariff to each sector individually. The overall balance of trade is assumed unchanged, capital is sector specific, and labor is mobile across sectors.

Seven sectors are chosen for the single sector protection experiments: dairy processing, sugar processing, crude and refined petroleum, other nondurable manufacturing (which includes textiles and apparel), metal manufacturing (which includes iron and steel), consumer electronics (which includes computers and household appliances), and transportation equipment (which includes vehicles and aircraft). We choose these sectors because either they haver large trade shares or they have historically achieved significant protection from imports.

Table 4 reports results from the experiments. The change in the exchange rate illustrates the macro impact, which is slight. Three sectors have a large enough import share so that increased sectoral protection leads to an appreciation of the exchange rate from 1.7 to 3.4 percent.

Table 4: Sector-Specific Protection Experiments

	Exp1: dairy process	Exp2: sugar process	Exp3: petro-leum	Exp4: other ndur mfg	Exp5: metal mfg	Exp6: cons electric	Exp7: transp equip
	- - - - - - - - -	Change (%) From	1995 Base	- - - - - - - - -			
Exchange rate	0.0	0.0	0.4	2.6	0.5	1.7	3.4
Sectoral Results:							
Production	0.8	7.0	3.0	16.3	10.7	71.8	18.1
Value added	1.9	16.7	6.4	18.9	11.8	77.0	18.9
Employment	1.4	11.8	10.0	23.6	13.5	85.1	21.4
Profit rate	2.8	25.0	4.1	10.4	4.9	32.3	8.5
Domestic price	0.9	5.6	8.7	5.1	2.8	6.0	5.6
Composite price	2.1	4.0	15.0	12.1	7.6	25.5	10.0
Export price	0.0	0.0	-0.4	-2.6	-0.5	-1.7	-3.4
Exports	-0.9	-3.9	-8.3	1.0	4.4	56.0	3.5
Imports	-47.9	-81.4	-33.9	-45.2	-40.3	-27.7	-46.8
	- - - - - - - - - -	1995 Value in percent	- - - - - - - - - -				
Effective rate of Protection							
1995 base	15.7	-1.1	0.5	8.3	5.8	0.8	0.6
experiment	211.3	115.9	79.8	96.2	102.1	109.6	103.9

Notes:

Each experiment is a 50% tariff in a single sector. The values reported are for the sector in which the tariff is imposed.

exp1: Tariff on dairy processing
exp2: Tariff on sugar processing
exp3: Tariff on petroleum (crude and refined)
exp4: Tariff on other non-durable manufacturing (textiles, apparel, etc.)
exp5: Tariff on metal manufacturing (steel, fabricated metals, etc.)
exp6: Tariff on consumer electronics (computers and appliances)
exp7: Tariff on transportation equipment (vehicles, aircraft, etc)

The impact of sector-specific protection is primarily on the sector itself. The increase in protection is certainly significant. The effective rate of protection after the addition of a fifty percent tariff jumps dramatically, to over a hundred percent in five of the seven sectors.[17] While protection in every case leads to an increase in the domestic price, the increase is much less than the increase in the price of the imported substitute. With the exceptions of petroleum and dairy processing, at the new equilibrium, the percent increase in production is much greater than the increase in domestic price. Consumer electronics is an especially dramatic case, with an equilibrium increase in production of 71.8%. It is also the sector with the highest import share (see Table 1).

The increased sectoral protection does generate an incentive bias against exporting. In every case, the ratio of the price on the domestic market to that on the export market (PD/PE) increases. In the four manufacturing sectors, however, the general increase in supply incentives due to the import protection actually leads to an increase both in output and in absolute exports, even though the change in relative prices leads to a fall in the sectoral export share.

The increased protection does benefit the affected sector in every case. Demand for the variable factor, labor, increases, leading to significant increases in employment in the protected sectors. The return to the fixed factor, capital, also increases significantly. Consumer electronics is again the most dramatic case, with profits increasing by 32.3% and employment by 85.1 percent. If labor were also modelled as sector specific, one would expect the sectoral wage to rise dramatically instead of employment. In any case, the protection works in that it greatly benefits the protected sectors. The effect is least for dairy processing, in which the initial import share is very small (2.9%),

[17] Note that ranking the sectors according to the percent increases in sectoral value added due to the tariff does not give the same result as ranking them according to effective rates of protection.

so there is little scope for further import substitution, regardless of the elasticity of substitution.

Interindustry flows link sectors, spreading the impact of protection among users of the output and suppliers of inputs. The suppliers of inputs to the protected sector gain from protection through an increase in demand. For instance, protection for dairy processing increases production and value added for dairy farmers and feed crop growers. Sectors which compete for the same inputs as those used by dairy farmers, such as livestock competing for feed crops, experience a fall in production and value added from the protection. The higher costs of inputs (feed crops) reduces value added to livestock producers and meat processors, but the effect is small relative to the gains of the dairy related sectors.[18]

Those sectors which use the commodities of a protected sector as inputs have to pay a higher price, increasing their costs. This effect is measured by the increases in sectoral composite prices due to the sectoral tariffs, which are given in Table 4. The effects are significant for the industrial sectors, ranging from 7.6% for metal manufacturing to 25.5% for consumer electronics. However, they are much less than the amount of the increased tariff (50%). Also, while large, these increases still represent a relatively small share of the expenditure of demanding sectors. In general, one would expect that the benefits to the protected sector will exceed the increased costs to the demanding sectors. Sectors in which there are large import shares have a strong incentive to lobby for protection, while demanding sectors have less incentive to try to block it.

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[18]While the value added of both dairy processing and dairy farming goes up around 2%, the value added of feed crops only goes up by 0.2%, and the value added of livestock goes down by 0.1%. These results are not tabulated.

What happens when all sectors succeed in gaining protection is examined in the next section.

Overall Protection

In the overall protection experiments, all sectors receive a 50% tariff on top of any existing tariff. As discussed above, the balance of trade, nominal investment, and nominal net government revenue are all fixed at their 1995 base run levels. As a result, the increase in overall protection is not allowed to change the macro aggregates. The model is designed to determine the structural impact of protection--its effect on the volume and structure of trade, demand, and production, and on the equilibrium exchange rate. We perform two versions of the overall experiment, one with sector-specific capital and one with mobile capital.

Aggregate indicators from the two overall protection experiments are given in table 5. There is a very small (0.25%) fall in real GDP, with a slightly greater loss when capital is sectorally mobile. In theory, one would expect the distortion to induce greater efficiency losses when more factors are free to adjust to the distorted incentives. The difference, however, is tiny and probably dominated by existing distortions which imply that we are moving among second-best equilibria.

In both experiments, the additional across-the-board 50% tariff causes a 13% appreciation of the dollar and about a 28% fall in both real exports and imports (calculating from Table 5). Nominal exports and imports both fall about 37%. As theory suggests, a general tariff effectively imposes a tax on exports and leads to a reduction in the volume of trade. In macro terms, the effect is to change the growth scenario from export-led growth to domestic-demand-led

Table 5: Aggregate Indicators, Overall Protection Experiments

	Base 1995	Overall protection: fixed capital	Overall protection: mobile capital
Trade Indexes (1995=100)			
Real exchange rate index	100.0	112.1	112.9
Nominal exchange rate index	100.0	115.5	114.6
Domestic price of imports	100.0	128.6	129.5
Domestic price of exports	100.0	86.7	87.4
Effective trade bias	100.0	148.3	148.2
Aggregate Trade, (billions of $)			
Real GDP (constant 82 $)	4802.4	4787.0	4779.3
Real exports (constant 82 $)	672.2	486.9	483.2
Real imports (constant 82 $)	702.0	504.3	499.5
Nominal exports (current $)	1138.4	716.5	714.1
Nominal imports (current $)	1110.8	692.6	690.0
Agriculture Terms of Trade			
Final demand	100.0	94.8	94.5
Value added	100.0	96.1	94.9
Exports	100.0	101.7	103.0
Imports	100.0	98.7	98.8
Agricultural Program Costs			
Outlays to farmers			
$ Billions, current prices	5.9	11.3	11.0
$ Billions, 1988 prices	4.5	8.6	8.4

Notes:
Overall protection is modelled with a 50% tariff added to all imports, across the board. "Fixed capital" assumes capital is sector specific. In "mobile capital," both capital and labor are mobile across sectors.

growth.

Except for the agricultural sectors, the world prices of commodities are fixed, following the small-country assumption. Consequently, the domestic export price index goes down with the appreciation of the dollar. The domestic import price index goes up with the tariff and appreciation of the dollar. The change in the ratio of the domestic export price index to the domestic import price index measures the incentive bias against exporting induced by the tariff. This index of "effective trade bias" is defined by Bhagwati and Srinivasan (1979, p. 6). In both experiments, this index stands at 1.48.[19] While in these experiments the incentive bias arises only from the tariff, the effect of quantitative controls that yielded a similar fall in imports would yield a similar trade bias value. Any restriction on imports generates a corresponding tax on exports.

As discussed earlier, farm support programs are explicitly modelled in the CGE model. The agricultural sectors are adversely affected by overall protection. The agricultural terms of trade, which measure agricultural prices relative to prices in the rest of the economy, fall about 5% (for both experiments and for both output and value-added prices). Major farm programs (e.g., deficiency payments and the loan program) are keyed to the difference between the market price and fixed reference prices (target price or loan rate). In this policy environment, the fall in agricultural market prices in the overall-protection experiments generates an increase in farm-program costs. The aggregate cost of farm programs doubles (Table 5) and the increase in agricultural subsidies reduces the fall in income in the agricultural sectors compared to the fall in value added (Table 6).

Table 6 reports the structural impact of overall protection in the sector-specific capital case. In general, sectors with high import shares gain, while those with high export shares lose. Overall, the industrial sector loses. Consumer electronics is the largest gainer in percent terms and also has the largest import share. Transportation equipment has high import and export shares and is a net loser. All the agricultural sectors that have significant export

[19] It would equal 1.5 for a 50% tariff, if it were not for the fact that the tariff leads to a reduction in agricultural exports and a rise in their world prices.

Table 6: Sectoral Effects of Overall Protection with Sector-Specific Capital

Sector	Real Output	Real Exports	Real Imports	Nominal Value Added	Nominal Sector Income	Employment
	- - - - - - Change (%) From 1995 Base Run - - - - -					
1 dairy	1.7	na	na	3.8	4.0	4.8
2 livestock	2.4	-17.9	-42.7	4.8	5.5	5.9
3 cotton	2.3	-11.1	-70.3	-10.7	-3.6	1.2
4 food grains	-0.6	-2.7	-77.9	-24.7	-11.6	-4.5
5 feed crops	1.6	-6.8	-75.3	-17.4	-7.5	-1.2
6 oil seeds	-7.3	-11.9	-63.4	-18.9	-19.0	-11.7
7 sugar	5.2	na	-8.1	2.6	2.6	5.9
8 other crops	0.4	-20.5	-10.2	-5.2	-5.2	-0.6
9 meat processing	1.4	-20.8	-35.5	-0.6	-0.6	2.3
10 dairy processing	1.5	-22.3	-34.4	-0.5	-0.5	2.4
11 grain milling	-1.6	-21.4	-36.5	-7.1	-7.2	-2.6
12 prepared feeds	1.8	-18.9	-37.2	0.1	0.2	2.9
13 corn milling	-2.3	-16.7	-39.7	-8.5	-8.5	-3.6
14 sugar processing	5.3	-24.2	-67.8	8.3	8.3	8.8
15 soy milling	-3.4	-22.0	-64.7	-10.7	-10.8	-5.4
16 misc food	-0.2	-26.1	-32.3	-2.9	-4.0	-0.3
17 mining & forestry	-3.5	-27.0	-37.3	-7.7	-8.1	-5.5
18 petroleum	-5.9	-26.3	-28.9	-14.9	-15.9	-18.8
19 construction	-2.1	-26.9	na	-6.0	-6.1	-2.9
20 chemicals	-0.6	-26.1	-41.9	-4.3	-4.5	-1.0
21 other nondur mfg	9.8	-21.1	-32.4	7.9	7.7	14.0
22 other durable mfg	2.1	-23.7	-30.9	-1.2	-1.3	3.0
23 metal mfg	-0.2	-26.2	-30.8	-3.8	-3.9	-0.2
24 machinery	-11.1	-35.7	-27.8	-14.9	-15.1	-12.5
25 other electronics	-7.5	-31.9	-29.2	-11.3	-11.4	-8.5
26 cons electronics	19.9	-13.9	-19.2	17.2	17.1	23.3
27 transp equip	-7.1	-35.9	-30.8	-10.8	-11.1	-8.3
28 trade & transport	-1.1	-22.5	-13.2	-4.8	-5.0	-1.6
29 finance	1.5	-21.6	-12.9	-0.6	-0.7	5.0
30 other services	0.9	-21.3	-13.4	-2.6	-2.7	1.2
agriculture	0.9	-10.3	-18.7	-9.7	-5.9	0.2
food processing	0.5	-22.0	-37.2	-2.0	-2.4	0.9
other industry	-2.7	-30.0	-28.9	-6.2	-6.4	-1.5
services	0.4	-22.1	-13.3	-2.8	-2.9	0.5
Average	-0.9	-27.6	-28.2	-3.8	-3.9	0.0

Note:
Nominal sector income equals nominal value added net of subsidies and indirect taxes. Sectoral subsidies include farm income support programs. Nominal sectoral value added does not include changes in tariff collections.

shares lose. The only agricultural gainers are dairy, livestock, and sugar. Cotton, feed crops, and other crops increase their output, but still have lower incomes because of the fall in prices. Overall, real agricultural output increases slightly, but value added and income fall. Three sectors have high import shares, but lose sectoral income nonetheless: petroleum, other durables, and metal manufacturing. These lose because they provide intermediate inputs to sectors whose outputs fall, and hence who generate less demand for intermediate inputs.

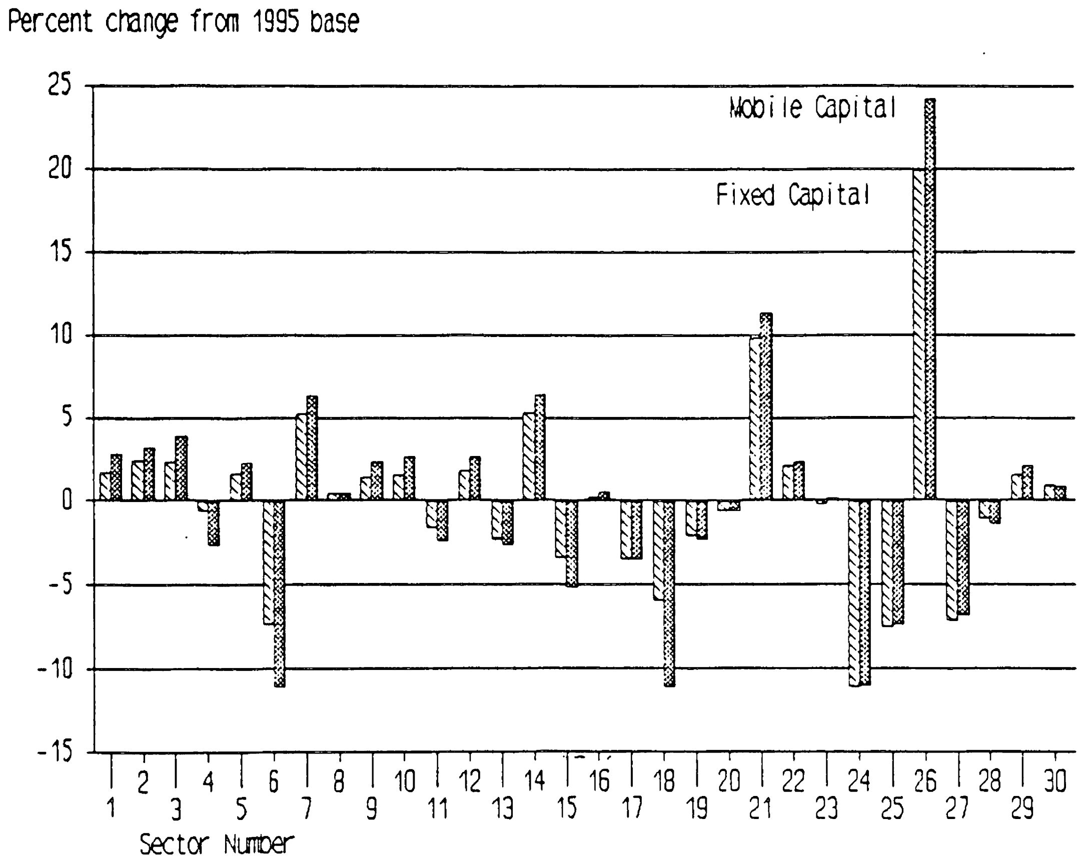
Note that aggregate nominal value added falls by 3.8%. This result is a statistical phenomenon. In the U.S. national income and product accounts, tariffs are included as part of value added in the trade services sector. In Table 6, however, we do not report the large change in tariff collections, which amounts to about 3% of GDP, as part of the change in value added in this sector. The change in aggregate value added reported in Table 6 thus appears larger than in the GDP accounts.

The structural impact of pursuing a protectionist trade strategy is quite dramatic, even with restrictions on factor mobility which limit the ability of the economy to respond to the changed incentives. Figure 2 compares the results for sectoral output of imposing overall protection with and without intersectoral capital mobility. Allowing capital mobility leads to a larger output adjustment in almost every sector. However, the differences are not large in most sectors.

Whether or not capital mobility is assumed, the effect of overall protection on economywide average wage and profit rates is negligible. In the mobile-capital experiment, the average profit rate fell by less than half a percent and the real wage did not change (numbers not tabulated). With sectorally fixed capital, there was no change in either the average wage or average profit rate.

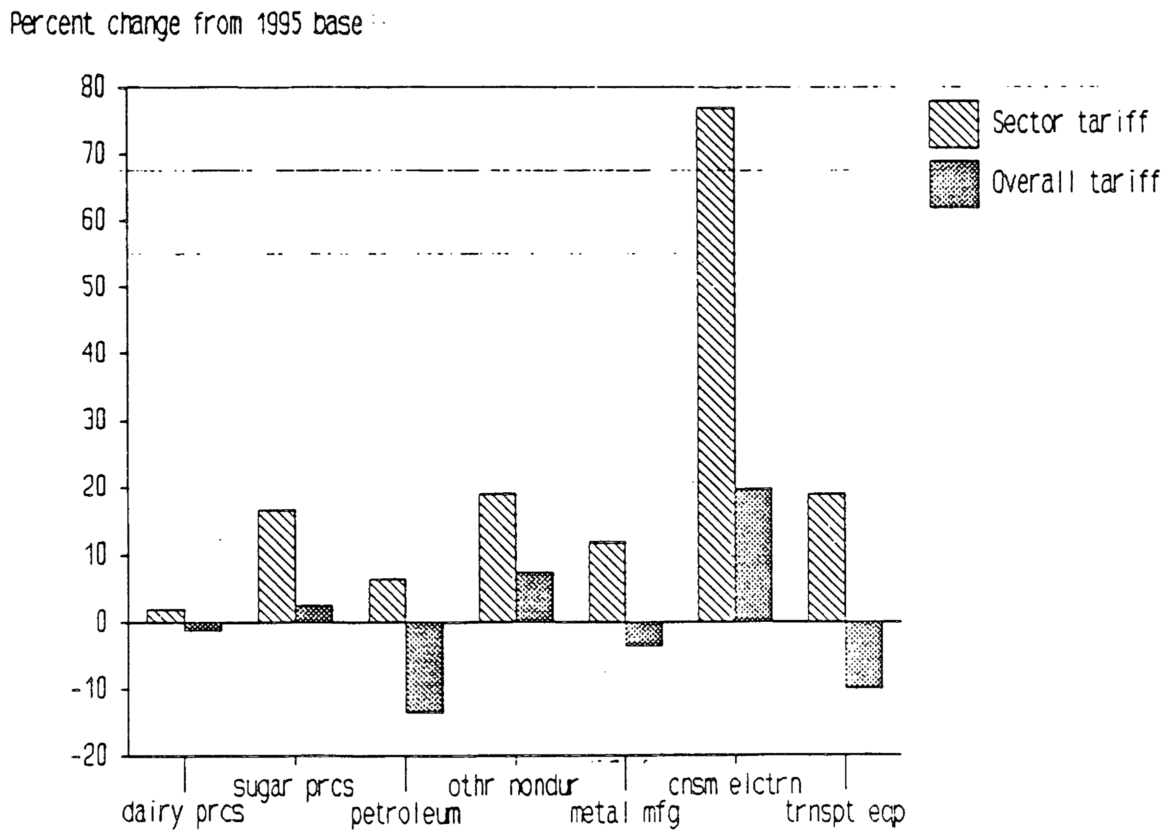
The theoretical argument indicating that protection will favor one factor over another appears to be empirically irrelevant in the U.S. The probable reason is that, with extensive input-output linkages, changes in protection are diffused across the economy. The differences in factor intensities across sectors are simply not great enough to yield significant changes in average factor returns, even given fairly large changes in the sectoral structure of production.

Figure 2: Overall Protection Experiments, Sectoral Output Changes with Sectorally Fixed and Mobile Capital



The model results, however, do lend support to the notion that sector-specific factors gain significantly from protection. While there is clearly an incentive for individual sectors to seek protection, there are also risks. Figure 3 charts sectoral value added when there is a fifty percent tariff on each sector singly versus an across-the-board tariff. The differences are striking. Across-the-board protection is much less beneficial to these sectors. In four cases, the sign is reversed and the sector actually loses value added. These experiments indicate the fallacy of composition of protectionist arguments. Protection which benefits an individual sector only does so if other sectors are not also protected.

Figure 3: The Impact of Sector-Specific and Overall Protection on Sectoral Value Added for Seven Sectors



VI. Conclusion

The results from these experiments yield a few lessons for policy makers. The U.S. has undergone a variety of macro shocks in the 1980s, including dramatic increases in the federal budget deficit and trade deficit. These shocks and concomitant policy reactions led to major changes in the real exchange rate, relative prices, volume of trade, and sectoral structure of production, imports, and exports. Current macro projections, which provide the starting point for our analysis, indicate continuing macro swings into the 1990s as the U.S. seeks to adjust its macro balances.

We have used the CGE model to trace out the implications of alternative forms of "structural adjustment" to the changing macro environment. Implicit in the macro projections is a fairly optimistic trade scenario in which the U.S. pursues an open trade strategy in an environment of liberal world trade. In this scenario, aggregate exports and imports grow faster than GDP and the economy pursues a successful strategy of export-led growth.

An alternative is that the world trading environment worsens and that the U.S. gives in to domestic protectionist pressures. Our experiments tracing out the implications of this scenario indicate a dramatic decline in the volume of trade, with a relative decline in aggregate industrial output and serious damage to exporting sectors, including agriculture. The cost of programs to support agriculture roughly double, as government support policies keyed to the difference between market and reference prices for agriculture kick in.

Our results also indicate that the existence of protectionist pressures is certainly understandable. Sectors clearly gain if they can achieve protection without any change in policies affecting other sectors. However, the risks are high. If lobbying for particular sectoral protection leads to a general increase in tariffs or restrictions on imports, the sectoral implications are much less beneficial or positively harmful. What works for one does not work for all.

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