How Should Developing Countries Adjust to External Shocks in the 1980s?

An Examination of Some World Bank Macroeconomic Models

Warren C. Sanderson
Jeffrey G. Williamson

WORLD BANK STAFF WORKING PAPERS
Number 708
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The World Bank
Washington, D.C., U.S.A.
This paper arose out of the desire to review the quantitative relationships between external shocks, economic policies and performance across a sample of developing countries, as background to the World Development Report 1984. Initially, it was proposed to attempt to confront comparably modeled economies with similar shocks or shocks characteristic of the early 1980s. But such a data- and model-intensive effort proved to be impractical given time and other constraints.

The paper thus reviews two types of existing studies. The first consists of cross-country comparative studies of the shock-policy-adjustment relationship, the second of eight exercises in quantitative modeling of individual economies. It attempts to infer elements of the relationship from existing exercises using these quantitative analytical tools—no simulations were especially run for this exercise. As a result, the treatment of issues and results is not uniform. Far more could have been extracted from the country studies had it been possible to subject the various models to comparable scenarios. The paper does, however, provide an indication of some important interactions between shocks, policy, and performance (such as the role of the real exchange rate in adjustment) as well as an overview of the various modeling frameworks used in country analyses.
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I. The Issues: Bad Luck, Structural Constraints, and Good Policy

The past decade will appear in future economic histories as ten years of serious convulsions in the world economy, perhaps the first such decade since the 1930s. Petroleum prices quadrupled in 1973-74, fell by almost 20 percent between 1974 and 1978, and then rose by 80 percent in real terms between 1979 and 1980. Not only were the magnitudes of these price shocks very large, but their instability introduced stop-go cycles and great uncertainty in world markets. To make matters worse for Third World exporters, the industrial market economies went into a recession in 1974-75 and again in 1979-80 followed each time by recovery. On top of this induced instability in world trade, productivity slow-down in the advanced economies spread to the periphery as Third World export demand sagged. As a result, the prices of many primary products exported by the Third World have declined to their lowest levels in some thirty years. In addition, much of the Third World carried foreign debt burdens which were being shocked by rising interest rates in capital markets responding to rapid inflation and restrictive monetary policies.

When the developing countries are surrounded by such "bad luck," how can we assess good performance from bad? Which policies seem to work best? Which policies work the worst? Answers are difficult since each country's economic performance is the result of a combination of three ingredients: (i) the size of the external shocks—that is, the amount of bad luck; (ii) the structure of the economy—that is, the ability of the economy to absorb the shock by shifting quickly out of those sectors hit most heavily by the shocks; and (iii) the quality of the policy which facilitates structural adjustment with the minimum short-run cost. How can we sort out these three
influences? How can analysts best do comparative economic history? In the absence of brilliant intuition, the answer lies with fairly complex macro models and counterfactual analysis.

II. World Bank Macroeconomic Models

For some time now, analysts in the World Bank have been constructing large-scale macroeconomic models which are capable of assessing the issue of structural adjustment to external shocks. The effort is relatively new, but expertise has grown at an impressive rate. There are at least a dozen such models currently being used in the Bank.

Table 1 lists eight such models which seem to be best suited to the problem of assessing structural adjustment to external shocks. Of the countries modeled, two are major oil exporters while six are oil importers. One is Latin American, two are Middle Eastern or European, two are African, two are South Asian, and one is East Asian. Most of these eight countries are semi-industrial, but one—Indonesia—is certainly low-income.

Most of these models are computable general equilibrium models (CGEs), but there is great variety in approach among the CGEs themselves. For example, while the Thai CGE model is investment-demand-driven, the Chilean model is saving-driven. As we shall see in Section IV below, these CGEs differ in many other dimensions as well, but they all focus on medium-term adjustment over four years to a decade or even more. In contrast, there are two Keynesian models listed in Table 1, and one of them (the Republic of Korea) is actually a short-run quarterly model.
<table>
<thead>
<tr>
<th>Country</th>
<th>Authors</th>
<th>Model type</th>
<th>Estimation and/or analysis period</th>
<th>Projection period for policy analysis</th>
<th>Issues assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>Lewis, urata</td>
<td>CGE</td>
<td>1978-81</td>
<td>1981-90</td>
<td>Impact of liberalization</td>
</tr>
<tr>
<td>Chile</td>
<td>Condon, Corbo, de Melo</td>
<td>CGE</td>
<td>1977-81</td>
<td>none</td>
<td>Impact of macro policies</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>Robinson, Tyson</td>
<td>CGE</td>
<td>1976-80</td>
<td>1981-85</td>
<td>Impact of trade policies</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>Michel, Noel</td>
<td>CGE</td>
<td>1980</td>
<td>none</td>
<td>Impact of trade policies</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Gelb</td>
<td>CGE</td>
<td>1970s</td>
<td>none</td>
<td>Adjustment to price shocks</td>
</tr>
<tr>
<td>Thailand</td>
<td>Amranand, Grais</td>
<td>CGE</td>
<td>1975-82</td>
<td>1982-89</td>
<td>Adjustment to price shocks</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Taylor, Yurukoglu Chaudhury</td>
<td>Keynesian</td>
<td>1980-82</td>
<td>1982-86</td>
<td>Adjustment to price shocks</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>van Wijnbergen</td>
<td>Keynesian</td>
<td>1972-80</td>
<td>1981</td>
<td>Adjustment to shocks</td>
</tr>
</tbody>
</table>

Note: For other World Bank models examined, see the bibliography attached.

CGE = Computable general equilibrium model.
What follows in Section IV of this report is a country-by-country assessment of these models. What light do they shed on the issue of adjustment to external shocks?

III. The Size of the Shocks and Modes of Adjustment: A Typology of Past Performance

Before exploring the eight models in detail, it might be useful to place these countries and others like them in some kind of perspective. Which Third World countries suffered the greatest external shocks over the past decade? How did they deal with those shocks? The best comparative assessment that we have seen appears in two recent papers, one by Mitra (May 1983) and one by Balassa and McCarthy (1983).

Mitra develops a very simple Keynesian model which is then estimated on the period 1963-78. The model makes no effort to incorporate policy variables explicitly, and thus can say nothing about the role of policy in producing observed adjustment. Nonetheless, Mitra's approach offers an excellent typology for classifying countries both by size of external shock as well as by observed response.

The shocks to the macroeconomic system are of two kinds, and both are related to world market conditions: export prices (e.g., the country's key export staple) and import prices (e.g., oil); and the net contraction in export demand from a recession-induced slowdown among trading partners. Domestic investment and partners' GDPs are exogenous. The external shocks require that the ex ante resource gap between import and export values be covered ex post. Mitra develops an elaborate ex post decomposition of that gap. While the framework does not offer an economic narrative on just how the
observed adjustments took place, it does offer a very useful ex post macro-accounting nevertheless.

The decomposition of the resource gap is performed on both sides of the equation, that is, the source of the shock and the source of the adjustment are both decomposed into the following parts:

<table>
<thead>
<tr>
<th>Two shocks:</th>
<th>Seven modes of adjustment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>export and import prices</td>
<td>export expansion</td>
</tr>
<tr>
<td>recession in net export demand</td>
<td>import substitution</td>
</tr>
<tr>
<td></td>
<td>tax intensification</td>
</tr>
<tr>
<td></td>
<td>investment slowdown</td>
</tr>
<tr>
<td></td>
<td>private consumption restraint</td>
</tr>
<tr>
<td></td>
<td>external borrowing</td>
</tr>
<tr>
<td></td>
<td>public consumption restraint</td>
</tr>
</tbody>
</table>

Mitra uses this framework to perform the decomposition on thirteen semi-industrial oil importers in the aftermath of the first oil price shock, 1974-78. Unfortunately only three of Mitra's thirteen countries have been modeled by Bank teams (Turkey, Korea, and Yugoslavia) *, but the typology is useful nonetheless.

Two of the thirteen, Mexico and Colombia, were favored by "good" shocks (Table 2). The rest were hit by "bad" shocks. The variety is enormous: the shocks to Uruguay having been ten times as severe as those suffered by Brazil; the shocks suffered by Portugal having been more than twice that suffered by Spain, Turkey or Yugoslavia; and the shocks suffered by two success stories, Korea and Taiwan, having been twice that of the average for all thirteen.

On average, the vast majority of the external shocks (80 percent) were price related, and most of that was import price related. On the adjustment side, trade adjustment dominates (60 percent) although increased

* We understand, however, that Mitra is now applying the same analysis to lower income, primary product exporters, some of which will overlap with the countries listed in Table 1.
Table 2  Balance of Payments Effects of External Shocks and Modes of Adjustment, 1974-78, Group 3 Countries
(Percent of local currency GNP, 1974-78)

<table>
<thead>
<tr>
<th>Item</th>
<th>Mexico</th>
<th>Colombia</th>
<th>Group average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. External shocks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. International price effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export price effect</td>
<td>-0.674</td>
<td>-1.911</td>
<td>-1.292</td>
</tr>
<tr>
<td>b. Import price effect</td>
<td>-0.198</td>
<td>-0.138</td>
<td>-0.168</td>
</tr>
<tr>
<td>Sum (la + lb)</td>
<td>-0.871</td>
<td>-2.049</td>
<td>-1.460</td>
</tr>
<tr>
<td>2. Recession-induced effect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export volume effect</td>
<td>0.681</td>
<td>0.305</td>
<td>0.493</td>
</tr>
<tr>
<td>b. Import saving effect</td>
<td>0.303</td>
<td>0.136</td>
<td>0.220</td>
</tr>
<tr>
<td>Difference (2a - 2b)</td>
<td>0.378</td>
<td>0.169</td>
<td>0.273</td>
</tr>
<tr>
<td>3. Total (1 + 2)</td>
<td>-0.494</td>
<td>-1.860</td>
<td>-1.187</td>
</tr>
<tr>
<td><strong>II. Modes of adjustment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Trade adjustment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export expansion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Direct effect</td>
<td>0.247</td>
<td>0.728</td>
<td>0.487</td>
</tr>
<tr>
<td>(ii) Import augmenting effect</td>
<td>0.110</td>
<td>0.325</td>
<td>0.217</td>
</tr>
<tr>
<td>Difference ((i) - (ii))</td>
<td>0.137</td>
<td>0.403</td>
<td>0.270</td>
</tr>
<tr>
<td>b. Import substitution</td>
<td>-0.022</td>
<td>0.303</td>
<td>0.140</td>
</tr>
<tr>
<td>Sum (la + lb)</td>
<td>0.115</td>
<td>0.706</td>
<td>0.410</td>
</tr>
<tr>
<td>2. Resource mobilization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Private</td>
<td>1.648</td>
<td>0.330</td>
<td>0.989</td>
</tr>
<tr>
<td>b. Public</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Public consumption restraint</td>
<td>-0.908</td>
<td>0.297</td>
<td>-0.306</td>
</tr>
<tr>
<td>(ii) Tax intensification</td>
<td>0.128</td>
<td>-0.316</td>
<td>-0.094</td>
</tr>
<tr>
<td>Sum ((i) + (ii))</td>
<td>-0.779</td>
<td>-1.020</td>
<td>-0.400</td>
</tr>
<tr>
<td>Sum (2a + 2b)</td>
<td>0.869</td>
<td>0.310</td>
<td>0.590</td>
</tr>
<tr>
<td>3. Investment slowdown</td>
<td>-1.590</td>
<td>-0.173</td>
<td>-0.881</td>
</tr>
<tr>
<td>4. Additional real external financing</td>
<td>0.112</td>
<td>-2.724</td>
<td>-1.306</td>
</tr>
<tr>
<td>5. Total (1 + 2 + 3 + 4)</td>
<td>-0.494</td>
<td>-1.880</td>
<td>-1.167</td>
</tr>
</tbody>
</table>

Source:  P. Mitra (May 1983), Table 5, p.23.
external financing is not far behind. Private sector consumption restraint was more or less offset by public sector consumption excesses. On average, investment did not sag in response to these shocks, but rather underwent a modest speed-up.

Apart from Mexico and Colombia, which experienced favorable external shocks, the remaining eleven countries can be allocated between two groups, split along lines of "modes of adjustment." The typology is very useful.

Group 1 (Table 3: Argentina, Brazil, Korea, Taiwan, Yugoslavia). These five countries adjusted primarily through trade adjustment and resource mobilization. The trade adjustment took place almost exclusively through export expansion. The resource mobilization was all attributable to private sector consumption restraint, since the public sectors leaned toward excesses. Investment growth did not suffer, and these countries relied only moderately on additional external finance.

Group 2 (Table 4: Israel, Portugal, Turkey, Spain, the Philippines, Uruguay). These countries exhibit quite different adjustment behavior to what were somewhat larger shocks. Trade adjustment was only very moderate, and this was more than offset by public sector excesses. As a result, they relied on the combination of additional external financing and investment slowdown, the former far more than latter.

Balassa and McCarthy (1983) offer a similar ex post accounting of the size of external shocks and their source. While the underlying model is less comprehensive, the Balassa-McCarthy analysis offers two distinct advantages over that of Mitra. First, they cover the more recent period 1979-81. Second, they expand the sample to cover thirty developing economies and all eight of the countries in Table 1 are included in the augmented
Table 3 Balance of Payments Effects of External Shocks and Modes of Adjustments, 1974-78, Group I (Percent of local currency GNP, 1974-78 average)

<table>
<thead>
<tr>
<th>Item</th>
<th>Brazil</th>
<th>Argentina</th>
<th>Korea</th>
<th>Taiwan, China</th>
<th>Yugoslavia</th>
<th>Group Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. External Shocks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. International Price Effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export Price Effect</td>
<td>-0.673</td>
<td>1.001</td>
<td>1.001</td>
<td>0.046</td>
<td>-2.134</td>
<td>-0.152</td>
</tr>
<tr>
<td>b. Import Price Effect</td>
<td>1.069</td>
<td>0.766</td>
<td>1.549</td>
<td>3.899</td>
<td>3.926</td>
<td>2.242</td>
</tr>
<tr>
<td>Sum ( = 1a + 1b)</td>
<td>0.397</td>
<td>1.766</td>
<td>2.550</td>
<td>3.945</td>
<td>1.791</td>
<td>2.090</td>
</tr>
<tr>
<td>2. Recession-Induced Effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export Volume Effect</td>
<td>0.171</td>
<td>0.352</td>
<td>4.412</td>
<td>4.147</td>
<td>1.576</td>
<td>2.132</td>
</tr>
<tr>
<td>b. Import Saving Effect</td>
<td>0.050</td>
<td>0.074</td>
<td>2.532</td>
<td>2.208</td>
<td>1.217</td>
<td>1.216</td>
</tr>
<tr>
<td>Difference ( = 2a - 2b)</td>
<td>0.121</td>
<td>0.279</td>
<td>1.880</td>
<td>1.939</td>
<td>0.359</td>
<td>0.916</td>
</tr>
<tr>
<td>3. Total ( = 1 + 2)</td>
<td>0.518</td>
<td>2.045</td>
<td>4.430</td>
<td>5.884</td>
<td>2.151</td>
<td>1.006</td>
</tr>
<tr>
<td><strong>II. Modes of Adjustment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Trade Adjustment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export Expansion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Direct Effect</td>
<td>0.369</td>
<td>1.822</td>
<td>16.840</td>
<td>11.827</td>
<td>-0.585</td>
<td>6.055</td>
</tr>
<tr>
<td>(ii) Import Augmenting Effect</td>
<td>0.108</td>
<td>0.381</td>
<td>9.664</td>
<td>6.296</td>
<td>-0.451</td>
<td>7.200</td>
</tr>
<tr>
<td>Difference ( = (i) - (ii))</td>
<td>0.261</td>
<td>1.441</td>
<td>7.177</td>
<td>5.531</td>
<td>-0.133</td>
<td>2.855</td>
</tr>
<tr>
<td>b. Import Substitution</td>
<td>0.575</td>
<td>0.492</td>
<td>-1.087</td>
<td>-0.581</td>
<td>1.227</td>
<td>0.125</td>
</tr>
<tr>
<td>Sum ( = 1a + 1b)</td>
<td>0.835</td>
<td>1.932</td>
<td>6.089</td>
<td>4.950</td>
<td>1.094</td>
<td>2.980</td>
</tr>
<tr>
<td>2. Resource Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Private</td>
<td>0.585</td>
<td>1.448</td>
<td>2.705</td>
<td>-0.059</td>
<td>2.812</td>
<td>1.498</td>
</tr>
<tr>
<td>b. Public</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Public Consumption Restrains</td>
<td>0.004</td>
<td>-0.968</td>
<td>-0.126</td>
<td>0.587</td>
<td>-1.431</td>
<td>-0.381</td>
</tr>
<tr>
<td>(ii) Tax Intensification</td>
<td>-0.723</td>
<td>-0.223</td>
<td>0.203</td>
<td>-0.065</td>
<td>1.501</td>
<td>0.139</td>
</tr>
<tr>
<td>Sum ( = (i) + (ii))</td>
<td>-0.720</td>
<td>-1.171</td>
<td>0.077</td>
<td>0.533</td>
<td>0.070</td>
<td>-0.242</td>
</tr>
<tr>
<td>3. Investment Slowdown</td>
<td>-0.517</td>
<td>0.104</td>
<td>-3.313</td>
<td>-1.819</td>
<td>-0.773</td>
<td>-1.264</td>
</tr>
<tr>
<td>4. Additional Real External Financing</td>
<td>0.334</td>
<td>-0.268</td>
<td>-1.129</td>
<td>2.281</td>
<td>-1.053</td>
<td>0.033</td>
</tr>
<tr>
<td>5. Total ( = 1 + 2 + 3 + 4)</td>
<td>0.518</td>
<td>2.045</td>
<td>4.430</td>
<td>5.884</td>
<td>2.151</td>
<td>3.006</td>
</tr>
</tbody>
</table>

Source: P. Mitra (May 1983), Table 3, p. 21.
<table>
<thead>
<tr>
<th>Item</th>
<th>Israel</th>
<th>Portugal</th>
<th>Turkey</th>
<th>Spain</th>
<th>Philippines</th>
<th>Uruguay</th>
<th>Group Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. External Shocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. International Price Effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export Price Effect</td>
<td>1.716</td>
<td>0.067</td>
<td>-0.157</td>
<td>-0.327</td>
<td>-0.700</td>
<td>5.944</td>
<td>1.068</td>
</tr>
<tr>
<td>b. Import Price Effect</td>
<td>-0.991</td>
<td>5.637</td>
<td>2.483</td>
<td>2.272</td>
<td>4.026</td>
<td>4.948</td>
<td>3.063</td>
</tr>
<tr>
<td>Sum (-la + lb)</td>
<td>0.725</td>
<td>5.571</td>
<td>2.326</td>
<td>1.945</td>
<td>3.326</td>
<td>10.893</td>
<td>4.131</td>
</tr>
<tr>
<td>2. Recession-Induced Effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export Volume Effect</td>
<td>1.618</td>
<td>0.849</td>
<td>0.656</td>
<td>0.317</td>
<td>0.765</td>
<td>0.096</td>
<td>0.717</td>
</tr>
<tr>
<td>b. Import Saving Effect</td>
<td>1.377</td>
<td>0.628</td>
<td>0.321</td>
<td>0.140</td>
<td>0.264</td>
<td>0.049</td>
<td>0.463</td>
</tr>
<tr>
<td>Difference (-2a - 2b)</td>
<td>0.241</td>
<td>0.221</td>
<td>0.335</td>
<td>0.177</td>
<td>0.501</td>
<td>0.047</td>
<td>0.254</td>
</tr>
<tr>
<td>3. Total (-1 + 2)</td>
<td>0.966</td>
<td>5.792</td>
<td>2.661</td>
<td>2.122</td>
<td>3.827</td>
<td>10.940</td>
<td>4.385</td>
</tr>
<tr>
<td>II. Modes of Adjustment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Trade Adjustment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Export Expansion</td>
<td>4.001</td>
<td>-9.266</td>
<td>-1.101</td>
<td>-0.222</td>
<td>2.430</td>
<td>8.289</td>
<td>0.156</td>
</tr>
<tr>
<td>(i) Direct Effect</td>
<td>3.406</td>
<td>-6.852</td>
<td>-0.538</td>
<td>-0.099</td>
<td>0.837</td>
<td>4.196</td>
<td>0.156</td>
</tr>
<tr>
<td>(ii) Import Augmenting Effect</td>
<td>0.595</td>
<td>2.414</td>
<td>-0.563</td>
<td>-0.124</td>
<td>1.592</td>
<td>4.093</td>
<td>0.530</td>
</tr>
<tr>
<td>Difference (- (i) - (ii))</td>
<td>-0.107</td>
<td>-1.589</td>
<td>1.469</td>
<td>-0.047</td>
<td>-0.309</td>
<td>1.278</td>
<td>0.646</td>
</tr>
<tr>
<td>b. Import Substitution</td>
<td>-0.107</td>
<td>0.221</td>
<td>0.335</td>
<td>0.177</td>
<td>0.501</td>
<td>0.047</td>
<td>0.254</td>
</tr>
<tr>
<td>Sum (-la + lb)</td>
<td>0.488</td>
<td>-0.825</td>
<td>0.906</td>
<td>-0.171</td>
<td>1.283</td>
<td>5.371</td>
<td>1.175</td>
</tr>
<tr>
<td>2. Resource Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Private</td>
<td>-1.374</td>
<td>-1.619</td>
<td>1.897</td>
<td>0.093</td>
<td>0.664</td>
<td>4.022</td>
<td>0.614</td>
</tr>
<tr>
<td>b. Public</td>
<td>0.200</td>
<td>-2.956</td>
<td>0.096</td>
<td>-0.528</td>
<td>0.198</td>
<td>0.828</td>
<td>-0.427</td>
</tr>
<tr>
<td>(i) Public Consumption Restraint</td>
<td>-2.418</td>
<td>-0.841</td>
<td>-0.732</td>
<td>-0.564</td>
<td>0.282</td>
<td>-3.342</td>
<td>-1.269</td>
</tr>
<tr>
<td>(ii) Tax Intensification</td>
<td>-2.218</td>
<td>-3.797</td>
<td>-0.636</td>
<td>-1.093</td>
<td>0.084</td>
<td>-2.514</td>
<td>-1.696</td>
</tr>
<tr>
<td>Sum (- (i) + (ii))</td>
<td>-3.593</td>
<td>-5.417</td>
<td>1.261</td>
<td>-1.000</td>
<td>0.748</td>
<td>1.507</td>
<td>-1.082</td>
</tr>
<tr>
<td>3. Investment Slowdown</td>
<td>5.669</td>
<td>3.521</td>
<td>-2.857</td>
<td>0.131</td>
<td>-2.391</td>
<td>-1.159</td>
<td>0.486</td>
</tr>
<tr>
<td>5. Total (-1 + 2 + 3 + 4)</td>
<td>0.966</td>
<td>5.792</td>
<td>2.661</td>
<td>2.122</td>
<td>3.827</td>
<td>10.940</td>
<td>4.385</td>
</tr>
</tbody>
</table>

Source: P. Mitra (May 1983), Table 4, p. 22.
sample. The results are summarized in Table 5. As with the 1974-1978 period, the size of the shocks vary enormously from a negative shock of some 20.2 percent of Sri Lanka's GDP to a positive shock of some 10.4 percent of Algeria's GDP. Furthermore, our eight countries seem to be well distributed across the full range of the Balassa-McCarthy thirty country sample. Korea and the Ivory Coast clearly suffered unusually large negative shocks; Indonesia and Nigeria (both oil-exporters) enjoyed unusually large positive shocks; and Yugoslavia, Thailand, Turkey, and Chile suffered negative shocks about average for those twenty-three countries in the Balassa/McCarthy sample whose shocks were negative. Finally, while the terms of trade effect was the dominant source of external shock, there were three interesting exceptions to that rule among our eight countries: interest rate effects dominated Chile's experience; and export volume effects were very important to the Korean and Yugoslav experience.

IV. Adjustment to External Shock: The World Bank Models

How did each of these eight countries adjust to these external shocks? Were the adjustment policies effective? Which alternative policies would have been more effective? Since Mitra's model has no explicit policy variables and is a simple Keynesian system with no supply-side tales, it cannot offer any answers to these questions. Similarly, while Balassa and McCarthy actually score the quality of the policy responses in each of these countries, the underlying assessment does not appeal to any explicit model, and thus cannot really confront these questions either. However, the eight country macro-models reviewed below are designed to supply those answers.
### Table 5 External Shocks to Selected Developing Countries, 1979-81 Averages

<table>
<thead>
<tr>
<th>Country</th>
<th>External Shock Share in GDP (percentage)</th>
<th>Percentage Share of External Shock Due to:</th>
<th>Terms of Trade Effect</th>
<th>Export Volume Effect</th>
<th>Interest Rate Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sri Lanka</td>
<td>20.2</td>
<td>98</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>13.8</td>
<td>91</td>
<td>8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>9.0</td>
<td>41</td>
<td>43</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>7.2</td>
<td>95</td>
<td>-9</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Zaire</td>
<td>6.3</td>
<td>79</td>
<td>0</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>3.9</td>
<td>62</td>
<td>6</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>3.8</td>
<td>68</td>
<td>5</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>3.7</td>
<td>101</td>
<td>-6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>3.6</td>
<td>40</td>
<td>38</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>3.4</td>
<td>72</td>
<td>2</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>3.0</td>
<td>62</td>
<td>10</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>2.8</td>
<td>98</td>
<td>-2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>2.7</td>
<td>71</td>
<td>1</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>1.9</td>
<td>82</td>
<td>24</td>
<td>-6</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>1.8</td>
<td>23</td>
<td>5</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>1.5</td>
<td>37</td>
<td>51</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.3</td>
<td>-13</td>
<td>133</td>
<td>-21</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>1.0</td>
<td>-40</td>
<td>39</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>0.9</td>
<td>32</td>
<td>8</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>0.7</td>
<td>-90</td>
<td>149</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>0.7</td>
<td>26</td>
<td>2</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>0.5</td>
<td>-5</td>
<td>110</td>
<td>-4</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>0.5</td>
<td>-457</td>
<td>330</td>
<td>228</td>
<td></td>
</tr>
<tr>
<td>Senegal</td>
<td>-0.1</td>
<td>-1,871</td>
<td>874</td>
<td>897</td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>-0.6</td>
<td>-43</td>
<td>-79</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>-3.9</td>
<td>-186</td>
<td>76</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Jamaica</td>
<td>-5.3</td>
<td>134</td>
<td>1</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>-7.8</td>
<td>-159</td>
<td>59</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>-10.2</td>
<td>-161</td>
<td>60</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td>-10.4</td>
<td>180</td>
<td>67</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

Source: Balassa and McCarthy (1983), Table 2.
What follows in this section is a country-by-country assessment of structural adjustment to external shock in the eight countries listed in Table 1. Section V will attempt to offer a comparative assessment of the insights derived from these macro-models as a group.

IV.1 A Keynesian Model for Nigeria */

1. The Problem

Through the 1970s, changes in the structure of the Nigerian economy followed the now-classic pattern of the oil exporter. Since oil extraction requires only minimal use of domestic resources, structural adjustment requires the absorption of foreign resources as well as a "crowding out" of other tradeables to accommodate the oil export expansion. Thus, Nigeria's production pattern during the 1970s shifted toward non-traded goods and agricultural exports actually declined from over $1 billion to less than $100 million a year with the arrival of oil. This accommodating adjustment was facilitated, of course, by a change in relative prices favoring the non-tradeables and penalizing the non-petroleum tradeables. The outcome was an "overvalued" real exchange rate which helped lower the relative price of non-petroleum traded goods.

More recently, things have changed. Oil exports fell after 1980, the current account has swung into deficit, and growth rates have slumped.

How should Nigeria adjust to slow growth in oil export receipts after the boom of the 1970s? The key lies with the speed with which relative prices change as well as with the ability of the economy to respond to those relative price changes. The central goal is to reduce the current account

*/ Based on Taylor, Yurukoglu, and Chaudhury (October 1983).
deficit by a shift out of non-traded home goods into exports and import substitution. In an economy where institutional behavior may inhibit the relative price drift (e.g., workers may resist a decline in real wages which is too severe), adjustment may be difficult although technically feasible. In an economy where "structuralist" features prevail, matters are even worse since it takes very large changes in relative prices to induce any structural adjustment.

2. The Model

The authors of the Nigeria model are committed to the structuralist view. They are also committed to the view that demand is the only constraint on Nigerian growth, and that those conditions will prevail well into the medium term. Thus, they develop a model which is Keynesian demand-driven, and one in which most (although not all) responses to price are relatively slow.

There are four sectors in the model: agriculture, manufacturing, petroleum extraction, and "home goods." Trade occurs in the first three of these, while the home good (e.g., construction) is not exported. There are five import categories: capital goods, services, intermediates, manufactured consumer goods, and agricultural goods for final consumption.

Petroleum supply is assumed to be perfectly elastic. Export demand and world price are determined exogenously, and thus so are oil revenues, all of which accrue directly to the central government. Domestic petroleum demand is endogenous with prices and income playing their usual role, but the domestic price is determined exogenously by policy (set below the world price). Manufacturing and agricultural supplies are also taken to be perfectly elastic, and the domestic consumption mix between imports and domestic goods is determined by relative prices.
Prices of home-produced manufactures and agricultural goods are determined endogenously. In both cases, the exchange rate will influence domestic price directly via imported intermediates--devaluations generating inflation of both goods; nominal wages drive up domestic prices--and these are exogenous in the model; the cost of credit to manufacturing affects prices there and tight credit conditions are likely to produce inflationary pressure; intermediate inputs are a variable mix of imported and home-produced goods, and since the latter includes the non-traded home goods, these have a high degree of endogeneity--indeed, most of the truly endogenous price formation forces come from this source. Finally, exogenous, technologically induced cost reductions are allowed in the model. Thus, what appears to be extensive price endogeneity in reality is not: prices of domestically produced manufactures and agricultural goods rise in the face of devaluations and exogenous nominal wage hikes. A policy of heavy investment in export and import-competing activities will not have any influence on relative costs and thus on structural adjustment in this model since the rate of cost reduction through technical change is exogenous and unrelated to such policies.

The home goods producing sector is treated quite differently. Here, domestic supply tends to be highly inelastic. Not only is domestic supply constrained by exogenously determined credit, but it responds to own price and nominal wages only with very low elasticities. Thus, home goods supply is very inelastic. Since so much of the adjustment to oil shocks among oil exporters is the ability to shift into and out of "non-traded" home goods, the Nigerian model begins by assuming that such shifts are unlikely to take place without massive price shocks.

For the most part, the demand side of the Nigerian model is standard Keynesianism. Investment is determined exogenously in the model. Private
consumption demand obeys a simple linear Keynesian relation (although workers consume at a higher rate than capitalists), and total consumption is distributed across commodities by a linear expenditure system. An interesting and important novelty, however, appears with the government demand specification and it may account for much of the results coming from the simulations. Federal outlays on both the capital and the current account are exogenous, so anything that augments revenues—and it is petroleum earnings that matters most here—automatically generates a federal surplus (or a diminished deficit). By assumption, however, the Nigerian model assumes that a constitutionally mandated fixed share of that surplus must be delivered to the state and local governments. Since they are assumed to spend it all, government demand is augmented when the federal revenue stream rises. This is an important mechanism: since devaluation will increase government revenues in local currency (given that oil revenue sources dominate the result), public consumption expenditures are augmented, the initial current account gains are offset, price inflation makes matters worse and the devaluation has little net positive impact. Its positive impact will be strengthened, of course, if devaluations are accompanied by austere fiscal policy. But austere fiscal policy is difficult in the face of expansionary state and local government expenditure behavior.

3. **Key Results**

As with almost all other models used at the World Bank, the Nigerian model is first simulated through a "base run," in this case from 1982 to 1986. The base run makes projections over these five years given assumptions about the exogenous variables: e.g., nominal wages in manufacturing and agriculture are assumed to rise according to wage indexation rules with a one year lag; agriculture and manufacturing undergo exogenous rates of total
factor productivity growth; world demand for Nigeria's exports (including oil) are assumed to grow at some plausible rate, and prices are also set exogenously; and so on. In addition, the base run assumes that Nigeria continues to pursue the policies set in motion in 1981 and 1982. That is, it is assumed that they will continue to attack the current account deficit by devaluation, increased tariffs, and austere federal fiscal policy.

The outcome of the base run over the five years is low GDP growth (2.8 percent per annum, and 1.3 percent per annum for non-oil output), net capital inflows of 17 billion dollars over the five years as a whole (rising sharply over the period), a 5.9 percent inflation rate, the real wage remains stable over the period as a whole, and the share of home-goods in real non-oil GDP falls from 59 percent to 57 percent.

Although Nigeria is assumed to follow conventional contractionary and restrictive commercial policy, the current account actually gets worse in the base run! Perhaps that disappointing result is to be expected. After all, real wages remain stable over the five years--thus failing to improve Nigeria's competitive cost position in home or foreign markets, and the real exchange rate hardly changes at all.

Alternative policy counterfactuals are then attempted so that we can assess the impact of various policy packages relative to the base run. Eight policy counterfactuals are assessed:

(1) a 30 percent devaluation;

(2) a modest rise in tariffs on capital goods and intermediates (10-14 percent rise);

(3) the same modest rise in tariffs on final consumption goods (10-15 percent);

(4) a 30 percent export subsidy across the boards;
What do we learn from these experiments?

First, the massive devaluation has only a small impact on the current account. The explanation is simple enough. Oil revenues in local currency increase, and these are spent, cranking up aggregate demand, thus augmenting import demands. It follows that the expansionary effect of the devaluation offsets its initial positive impact. In addition, the devaluation is inflationary, and on two grounds. It raises the costs of imported items which appear directly in the consumer price index and indirectly via the domestic goods which use such goods as intermediate inputs. Scarce credit also serves to inflate the domestic price level. The inflationary and expansionary aggregate demand forces in response to the devaluation are sufficiently large so that the real exchange rate drifts upward after the initial devaluation. Nevertheless, a devaluation reduces Nigeria's current account deficit even though the inflationary response and the fiscal expansion tend to offset it.

Second, tariffs on capital goods and intermediate imports tend to worsen the current account deficit, rather than improve it. The explanation here is clear. Given Nigeria's inability to shift into capital and intermediate goods production, the rise in tariffs serves mainly to inflate the cost of production in import-competing and export sectors. As a result, non-oil exports fall and foreign import penetration of final goods goes up. In contrast, tariffs on consumer goods produce an unambiguous improvement in the current account deficit as Nigerian import substitution is encouraged.
Third, export subsidies have a powerful positive effect on the current account deficit. Of course, the 30 percent export subsidy does not improve the current account as much as the 30 percent devaluation (since the latter subsidizes import-competing sectors too), but it has a more lasting impact in the sense that it has little inflationary effect.

Fourth, an equivalent cutback in federal investment expenditures improves the balance of payments by an amount roughly equal to the 30 percent devaluation. This, however, has unfavorable implications for long-run adjustment to external shock. We shall return to this issue below.

Fifth, fairly dramatic changes in the wage indexation policy have very little impact on the current account deficit. For example, if such policies were of a magnitude to allow the real wage to deteriorate at 1.3 percent per annum, rather than at the more modest 0.5 percent per annum revealed by the base run, then the current account deficit would be 4.65 billion dollars in 1986 rather than the 4.74 billion dollars in the base run.

Sixth, a "conservative policy package" which includes all of the above policies except the export subsidies would have very potent effects on Nigeria's adjustment to external shocks. That is, the current account deficit would fall to 1.86 billion dollars by 1986 (compared with the 4.74 billion in the base run). What would the policy cost? Is it feasible? While real GDP growth is hardly affected at all by the imposition of the conservative package in the place of the base run policies, real wages are. While real wages decline by only 2 or 3 percent over the five years in the base run, they decline by 22 percent under the conservative policy package.

Seventh, an "export promotion package" can achieve much the same results as the conservative policy package without the severe real wage declines. Suppose that the massive 30 percent devaluation is replaced by a
modest 10 percent devaluation plus the heavy 30 percent export subsidies, while retaining all the other components of the conservative package. We already know that such a policy would create less inflation and thus less real wage erosion. So would such an alternative create the same trade improvement with much less inflation and real wage loss? Apparently so: the rate of inflation is cut in half, real GDP growth hardly changes, the improvement in the current account surplus is almost exactly the same, and the real wage declines at a much slower rate—a total five-year decline of 9 percent rather than 22 percent.

4. Summary

This structuralist view of the Nigerian economy suggests that conventional macro policy will be ineffective in dealing with current account deficits. Devaluations are unlikely to be effective simply because they are likely to be politically infeasible since they imply far too sharp a decline in real wages. Government expenditure austerity is not only politically constrained in the Nigerian case, but it also has very unfavorable implications for long-run adjustment to external shock. After all, any reduction in federal investment implies even greater difficulties in implementing long-run shifts in output mix, and it is the latter which is at the heart of structural adjustment.

The better policy appears to be sector-by-sector interventions to implement the structural adjustment. Not only does the model suggest that export subsidies are just as effective in reducing the current account deficit as devaluations, but they are also more likely to be politically feasible since they imply far smaller real wage losses through inflation.
IV.2 A Quarterly Keynesian Model for Korea */

1. The Problem

Korea's economic development since the mid-1960s has been widely acclaimed. A series of trade liberalization measures and an "opening up" of the financial sector to foreign capital inflows set the stage for the unprecedented growth rates of nearly 10 percent per annum up to 1978. Exports grew even faster at 26 percent per annum so that their share in GNP rose from 4.7 percent to 45.6 percent. With the exception of the oil shock years, inflation rates usually ranged between 10 percent and 20 percent per annum.

All of this changed in 1979 and 1980. Exports actually fell in real terms in 1979, and real GNP did the same in response to both the oil shock and a disastrous rice harvest. At the same time the inflation rate reached nearly 45 percent per annum over 1980.

What were the short-run macroeconomic policy options facing Korea in 1981? What was and is the best way to adjust to these external shocks during the 1980s? Van Wijnbergen develops a quarterly Keynesian model for Korea which offers some concrete answers which often conflict with conventional wisdom.

2. The Model

The Korea model is distinctive and impressive. In contrast with all the other models we have examined, the Korea model focuses on short-run quarterly adjustment to external shocks. The other models tend to focus instead on the medium term. Furthermore, the Korea model pays elaborate attention to financial markets, a focus which is completely missing from every

*/ Based on Van Wijnbergen (November 1981; May 1983).
other model we have examined. The results are extremely interesting, plausible, sometimes surprising, and very useful in generating insight into problems of consistency between short-run and long-run policy tools and targets. While it is hardly surprising that Korea would be the first to be modeled along "financial-intensive" lines--since Shaw, McKinnon and others pressed financial reform there in 1962/1964 at the start of the Korean "miracle," we suspect that the morals can be generalized to some, if not a large, degree to other newly industrialized countries (NICs) such as Turkey and Yugoslavia.

The model has a "real" Keynesian component which interacts with an elaborate financial component. The financial component distinguishes between the formal financial market, where bank lending rates are artificially low and credit rationed, and informal "curb" markets, where lending rates are determined by demand and supply.

There are thirteen critical equations on the real side of the model. It might be useful to review them:

Export Demand. The specification is similar to most CGEs, with relative prices and income of the trading partners (US and Japan) playing a crucial role. The elasticities for both prices and income turn out to be very high, confirming conventional wisdom.

Export Prices. The export price equation is derived from cost-minimization of a production function. The empirical results suggest that wage costs have only weak and delayed effects on export prices, while imported intermediates (including oil) have very strong and immediate impact. Export subsidies matter as well. Most important to what follows, the cost of credit has a strong, positive impact on export prices. Thus, credit market
conditions have a potent impact on the competitiveness of Korean exports in world markets.

Consumption Demand. The specification is standard. The empirical results confirm that the long-run private saving rate is quite high (0.28); they also confirm that the real curb market rate has a very strong positive effect on savings. Any policy which serves to raise the curb market rate will, therefore, generate a rise in the private sector saving rate. On the other hand, a rise in the curb rate is likely to choke off investment, as we shall see.

Government Sector. Government expenditures are exogenous in the model, and will be manipulated in policy experiments. Taxes are endogenous, and related to nominal GDP and nominal imports, which seems sensible.

Investment Demand. Investment demand is "finance-driven" in this model. Indeed, only two variables determine current investment (ignoring lagged investment: most of these equations, of course, do have lagged dependent variables on the RHS). These two variables are the flow of real credit coming from the formal banking sector (at low regulated interest rates) and the cost of credit in the informal curb market. The empirical results are surprisingly good. The results also point out how government deficits with "tight" monetary rules can crowd out private investment: the first order effect is to reduce the real credit available from the banking sectors; the second order effect is to make credit in the curb market more expensive. Private investment is very responsive to both effects. We find this investment demand specification quite plausible, and it will do a lot of work in the analysis which follows.

Import Demand. There are three import categories. The imports of consumer goods are exogenous and subject to policy manipulation. The imports
of capital goods are a function of private investment only. The import of intermediate goods has a more complex specification where gross output, relative prices, and credit conditions all play a role.

**Domestic Prices.** The wholesale price index is simply the weighted sum of rice prices and the prices of all other goods. The price of rice is exogenous and subject to policy manipulation in the simulation experiments. Prices of "Other" goods are explained by wages, intermediate goods prices, and credit conditions. In the empirical results, credit conditions in the curb market matter a great deal. This should be stressed: policies which serve to raise the curb rate will tend to crank up the rate of inflation--that is, tight money will fuel the rate of inflation in the short-run, not dampen it. Finally, the consumer price index is driven by the price of rice and "other."

**Nominal Wages.** Nominal wages are driven by the consumer price index and the unemployment rate, according to a modified Phillips Curve.

**Unemployment.** Unemployment obeys a variant of Okun's Law, where the differential between actual and potential GNP drives unemployment rates. The empirical results seem plausible, especially the long-run "natural rate" of 3.7 percent implied. Investment drives potential GNP. The financial side of the model is fairly elaborate, and we won't attempt a summary here. It should be noted, however, that the financial side of the model yields empirical results which suggest that substitution between curb market assets and time deposits is more important than substitution between currency and time deposits. In fact, the econometric estimates suggest that the increase in time deposits after the 1965 reforms was caused by a switch out of curb to time, and not by a rise in the saving rate, contrary to conventional wisdom.
3. Key Results: Fiscal and Monetary Policies

Van Wijnbergen begins by assessing the impact of the policies that actually prevailed in the early 1980s. His "base run" and all subsequent counterfactual simulations are confined to the four quarters of 1981. The comparisons between each of these simulations serves to isolate "bad luck" from "bad policy." It illustrates once again the value of intelligent counterfactual analysis.

Actual monetary and fiscal policies lead to unsatisfactory results: there is a large drop in private investment, growth is unimpressive, and inflation rates remain high. Thus, the actual monetary and fiscal package fails to satisfy either short-run goals of price stability or long-run goals of accumulation to facilitate structural adjustment. Suppose a less stringent monetary policy had been pursued?

Three counterfactual scenarios are explored: first, more expansionary monetary policy; second, more expansionary fiscal policy; and third, both. Three variables attract attention in assessing policy performance: inflation—a short-run goal; income growth and investment rates—the latter important for long-run structural adjustment; and the current account—since it serves as a measure of foreign capital requirements and Korea hopes to be self-sufficient in savings in the near future.

Expansionary fiscal policy by itself serves to crowd out private investment. Since investment is more import-intensive than are government expenditures, the current account improves. There is little impact on inflation.

Expansionary monetary policy by itself serves to raise investment (though only slightly), real GNP grows by even more than in the fiscal expansionary case, but the current account deteriorates.
With both policies expansionary, investment increases even more, real GNP growth is greater, the inflation rate is still the same, but the current account deteriorates more.

The bottom line of all of this appears to be support for a more expansionary monetary policy. While such a policy will create current account deterioration, it will do better (not worse) in holding down inflation and it will raise (not lower) investment making long-run structural adjustment easier.

4. **Key Results: Interest Rate and Rice Price Policies**

What does the Korea model suggest would happen if the regulated rates on bank time deposits were increased? If this is done at the same time as when the money supply is restricted, the results are disastrous. The shift from curb to time drives curb market rates upward, creating an investment slowdown, a growth slowdown, and, presumably, more rapid inflation. This finding certainly conflicts with conventional wisdom.

The price of rice is currently maintained at a level far above the world market level. The simulations discussed thus far assume that the nominal rice price is stable, so that the real rice price declines. Nonetheless, it still implies a high-rice-price policy, a policy which Korea has pursued for some time. What would happen if the domestic price of rice was lowered? Nominal wage increases slack off, export competitiveness is enhanced, the inflation rate slows down, the real money supply grows more rapidly, the real cost of credit eases, and investment rises. On the other hand, the rice price policy implies a transfer from high-saving farmers to low-saving urban consumers, thus augmenting consumption demand and a deterioration in the current account deficit. In addition, there is the real income gain associated with improved resource allocation. All in all, the
move away from high rice prices would enhance the Korean economy's performance quite a bit.

5. Summary

The finding that higher regulated time deposit rates and monetary restraint will, in combination, lead to a significant investment and growth slowdown is certainly sobering news for those analysts who wish to guide Korea out of the economic doldrums of the early 1980s. After all, it conflicts with conventional wisdom that "freeing up the financial market" will help achieve the higher rates of accumulation and improved resource allocation necessary for long-run structural adjustment to severe external shocks. Van Wijnbergen's model strongly suggests that the short-run investment slowdown (plus inflation) would far exceed any long-run gains from a rise in household saving.

IV.3 A CGE Model for Thailand: SIAM 2 */

1. The Problem

When the domestic price of energy is regulated by government policy, how should that price be adjusted in response to sharp changes in the world market price of oil? Conventional advice recommended on efficiency grounds that the domestic price be kept in line with the rise in world prices during the 1970s, although the same analysts usually warned against possible unfavorable distributional effects. In the case of Thailand, the conventional advice was followed under the additional belief that such a policy would also help choke off energy demands and minimize balance of payments problems and suppress the rise in the foreign debt burden. With the decline in world

*/ Based on Amranand and Grais (1983a, b), and Vongpradhip (n.d.).
prices of oil in the early 1980s, the issue has reappeared. Should Thailand lower the domestic price of energy in line with the fall in world oil prices?

A computable general equilibrium model, called SIAM 2, has been developed for Thailand to offer answers to this and other questions dealing with fiscal, exchange rate, wage, and rice pricing policies. Which policies are best to foster structural adjustment in response to external price shocks? What are the distributional, growth, and balance of payments implications of each?

2. The Model: Standard CGE Components

SIAM 2 is an impressive model. It is extensively disaggregated into 22 producing sectors, but the system can be simplified into five major sectors -- agriculture, industry, energy, construction, and services. These 22 sectors can also be aggregated into "formal" and "informal" activities. This distinction between formal and informal sectors is consistent with economic dualism which has long been a tradition in models of Asian economies. The formal sectors are investment driven (financial resources for accumulation are in perfectly elastic supply) and they face fixed nominal wages determined, at least in the medium term, by non-market forces. The informal sectors are saving-constrained (financial resources for accumulation are in perfectly inelastic supply) and they face variable nominal wages which respond to clear that labor market. Some commodity markets clear via quantity adjustment and some clear via price adjustment. Rubber, traded crops, fertilizers, and crude oil have their prices in local currency fixed by world market conditions (e.g., the "small country" assumption) and pegged nominal exchange rates. Gas, petroleum products, electricity, and government services have regulated prices, so they too are set exogenously. All other prices are determined
endogenously. These specifications all seem plausible to us, and characterize Thailand quite accurately.

There are nine informal sectors in SIAM 2: non-rubber crops (e.g., rice), rubber, other agriculture, some food processing, some (other) light industry, some energy extraction (e.g., wood), some transportation and communications, some trade, and some (other) market services. The remaining thirteen sectors are formal: mining and quarrying (e.g., tin), some food processing, fertilizers, some (other) light industry, heavy industry, some energy extraction (e.g., new gas production), electricity, petroleum products, construction, some transport and communications, some trade, some (other) market services, and all government services.

With the exception of gas and petroleum products, all sectors are characterized by sophisticated neo-classical production functions with substitution possibilities between primary inputs and intermediate composites.

The key supply characterizations can be quickly summarized. First, non-rubber crops this year are determined by last year's production decisions. Last year's production decisions in such crops are determined by endowments and expected relative prices so that crop mix decisions are fully endogenous. Second, electricity and government services offer perfectly elastic supplies at regulated prices. Third, all other activities (except gas and petroleum products) have conventional upward sloping supply functions, even if they face regulated prices.

Private consumption demand is determined by linear expenditure systems, although there are seven households exhibiting different parameters. Furthermore, demanders view commodities produced by the informal and the formal firms in the same sub-sectors as substitutes.
3. The Model: Some Innovative Components

One of the most innovative specifications in SIAM 2 has to do with labor supplies. Most, if not all, CGEs used in the Bank treat aggregate labor supplies by skill class as exogenous and inelastic with respect to wages and earnings. This is not true of SIAM 2, where labor supplies are determined endogenously. For example, skilled employees (blue and white collar) are assumed to be in perfectly elastic supply. Thus, any increase in demand for skilled labor in SIAM 2 will be revealed by increased employment, rather than by rising skill premia. Wages are exogenous for these skilled workers. Although not perfectly elastic, all other labor (including owner-operators on farms and the like) is also determined endogenously in the model, relatively elastic supplies helping clear labor markets that are shocked by shifting derived demands. The introduction of seven household types also makes it possible to explore income distribution implications of various external shocks and policy responses. The seven household types are: rubber farmers, non-rubber crop farmers, fisherman, etc., other own-account businesses, blue collar, white collar, and casual workers.

While world demands for Thai rubber and other export crops (excluding rice) are assumed to be perfectly elastic, all other traded commodities and services are assumed to be characterized by downward sloping demands. Thus, whatever serves to improve relative cost conditions in export- or import-competitive sectors will serve to have a favorable impact on the current account. Since a debate exists regarding the price elasticity of demand for Thai rice, analysis of rice price policy in SIAM 2 is assessed according to various assumptions about those elasticities.

The government's tax revenues are endogenous, coming from fixed direct and indirect tax rates on variable incomes. Government current
expenditures are determined exogenously, and the residual savings (current tax revenues plus transfers from abroad plus capital income minus current expenditures) is allocated to the "public saving pool." The public saving pool can also be augmented by revenue generated by indirect taxes on oil, a policy which produces a spread between low world prices and high domestic prices. This latter influence is central to much of the policy analysis which follows.

By far the most critical specification, however, involves capital markets. How are investment demands satisfied in SIAM 2? The answer turns out to be important in the policy experiments, so we should dwell on it here. First, the government has exogenous real investment targets and foreign (public) capital inflow targets. Given a public saving pool now augmented by (public) capital imports, the Thai authorities then ask whether the augmented pool can finance the public investment targets. If not, government requirements are satisfied by crowding out in the private saving pool (the "central saving pool"). The central saving pool is then allocated between informal and formal sectors, and this allocation is determined exogenously. Finally, if the formal sector wishes to augment the financing available to satisfy formal sector investment demand, they can do so by going to the private foreign capital market. Thus, any event which lowers government revenues automatically raises private sector borrowing from abroad, worsening the balance of payments. Furthermore, any event which raises the profitability of investment in the informal sector will be choked off by scarce funds. That is, the allocation of funds to the informal sector is completely inelastic with respect to profitability in that sector. This may serve to restrict severely any required structural adjustment in the output mix in response to price shocks.
4. Coping with a Drop in Energy Prices: A Closer Look at the Model

A drop in energy prices has basically two effects: First, a transfer from the rest of the world; and second, a favorable supply shock. The size of the supply-side shock on the domestic economy can be manipulated if the wedge between the world and domestic price is subject to government control. Since this is the case for Thailand, it is of some interest to explore the impact of various energy-price policies on resource allocation, the balance of payments, growth, and inequality. SIAM 2 is well equipped for that purpose through the impact of energy costs on supply price, especially in export- and import-competing sectors if the interest is structural adjustment. But what about the transfer effect? If the government chooses not to pass on the oil price drop, then the windfall stays with the government. We have already seen that such a windfall would serve to augment the public saving pool, thus cutting back the government's need to draw on the private central saving pool. This has two effects: it crowds in informal sector investment; and it diminishes the extent to which the formal sector has to go to private capital markets abroad. The investment rate will rise only to the extent that investment in the informal sector was constrained by available funds prior to the drop in energy prices abroad. If the government chooses instead to pass on all of the windfall by letting the domestic price drop by the same amount as the world price, what then? Consumers pay lower prices, and they can use their incomes for other purposes. What other purposes? Not household or corporate saving since saving rates out of those incomes are everywhere assumed to be fixed. Thus, they spend the windfall on consumption. Of course, there are still the cost-reducing effects which tend to foster an improved competitive edge in export- and import-competing markets.
Now that we understand how SIAM 2 will work in response to a drop in the world price of energy, we can consider the policy simulations themselves.

5. Coping With a Drop in Energy Prices: Simulation Results

The simulation analysis covers the period 1982-1989. After establishing a "reference path," SIAM 2 is then shocked by a drop in world prices of energy, while the domestic price of energy is left to behave as before. The drop in world energy prices considered is significant: prices drop by 31 percent in 1984, remain the same in 1985, and then rise by 9 percent per annum thereafter, re-establishing their 1982-83 levels by 1989.

Given our discussion above, the results are predictable: private investment (primarily in the informal sector) undergoes only a very modest mini-boom, growth rates hardly change, total employment growth hardly changes either, and income distribution remains almost totally undisturbed. What does change, however, is the current account deficit—which improves very sharply, and net private borrowing from abroad—which declines equally sharply. Thai competitive conditions in world markets are apparently unaffected since export growth remains unchanged. In short, SIAM 2 translates the drop in world energy prices into an equal drop in net borrowing from abroad. If the drop in world prices is also accompanied by a slowdown in the rate of world price inflation, then the macroeconomic effects of the drop in energy prices is dampened (since, of course, the relative price of energy drops by less). If world trade also expands in response to the world energy price decline, those effects are strengthened.

So far, the domestic price of energy has been assumed to behave just as with the reference path. This "conservative" policy may be motivated by an expectation that world energy prices are likely to surge again in the future, so authorities may hope to familiarize domestic users with high energy
costs. The "liberal" view would be to let domestic prices move exactly as world prices do. This view would be motivated on grounds of static efficiency. A "centrist" policy might be one in the middle. To repeat, the conservative policy minimizes the domestic supply shock and has the transfer accrue to the government, while the liberal policy maximizes the domestic supply shock and has the transfer accrue to consumers. What impact do these alternative policies have?

The liberal policy yields the surprising result that the relative price of consumption goods rises in the face of the decline in domestic energy prices, the Thai economy loses its competitiveness as domestic prices rise relative to foreign prices, the growth in exports slows while the growth in imports accelerates. Why this counterintuitive result? Because the windfall from the world energy price decline is passed on to consumers, and in SIAM 2 that implies that the government deficit swells, domestic saving available for private accumulation contracts, informal investment is choked off, and the formal sector must turn to foreign capital markets for more of its investment financing. Thus, the balance of payments deteriorates and private informal investment slumps. But the slump in informal sector investment is far smaller than the boom in private consumption (recall that private saving rates and formal sector investment are fixed), and the boom in private consumption puts pressure on prices. While these effects are not large, and while they are all concentrated on the first half of the 1982-89 period, they are worth noting nonetheless.

The balance of payments deteriorates more under liberal policies than under conservative policies. Distribution hardly varies at all between these policies, and aggregate growth performance varies very little as well.
6. Summary

SIAM 2 suggests that it is preferable not to change (in this case, drop) domestic energy prices with world market prices when the prime targets are improving the current account deficit and minimizing foreign debt accumulation. Growth and income distribution seem to be insensitive to alternative energy pricing policies.

This conclusion conflicts sharply with conventional wisdom that urges keeping domestic prices in line with world prices on static efficiency grounds. The conclusion is, of course, conditional on the premises underlying SIAM 2. While the premises underlying SIAM 2 appear to replicate the reality of contemporary Thailand, they may not replicate conditions elsewhere. Imagine instead economies where borrowing abroad in private capital markets is sharply restricted by policy. Imagine also economies in which private sector saving rates respond to income and profitability, especially in the informal sector. And imagine economies where capital markets are far less fragmented and where the informal sector has far better access to external finance.

Under these alternative conditions, the key findings which emerge from SIAM 2 might not be replicated. Private capital imports would be lower, and it also seems likely that a drop in domestic energy prices would have a far more striking impact on the current account by (1) helping choke off energy demands, and (2) improving the competitiveness of exports in world markets and manufactures in domestic markets. In SIAM 2 and Thailand, however, domestic energy pricing policies serve mainly to determine who gets the windfall from world oil price declines, and who gets the windfall tends to determine the size of the domestic saving pool and thus (private) foreign capital imports and eventually the balance of payments.
7. Addendum: Fiscal Restraint, Devaluation, and Wage Policy

Of course, SIAM 2 can also be used to assess the impact of other policies on the current account deficit. Vongpradhip’s paper assesses Thailand’s structural adjustment to three of these: fiscal policy, devaluation, and wage policy.

Vongpradhip first uses SIAM 2 to explore the impact of a rise in government expenditures. The counterfactual posed is the following: relative to the reference path for 1985-87, nominal government consumption expenditures are allowed to grow at 15 percent rather than 11 percent per annum, and government real investment growth rises from 3 percent to 8 percent per annum in 1985, and from 4 percent to 9 percent per annum in 1986 and 1987. All other exogenous variables are maintained at their reference path levels. The impact of this expansionary fiscal policy is striking. The current account deficit in the counterfactual is 48.1 billion baht by 1987 while the reference path figure is 35.7 for the same year. As a share in GDP, the current account deficit rises from 2.4 to 3.1 percent by 1987.

Although Vongpradhip uses SIAM 2 to explore the impact of a rise in government expenditures, it is a simple matter to infer the impact of fiscal restraint from those experiments. It appears that fiscal restraint would yield a significant improvement in the current account deficit. Furthermore, the improvement in the balance of payments is bought at very small cost since most of the changes induced by fiscal restraint seem to entail just a switching from public to private expenditures, and the favorable impact on the current account works primarily through the diminution in private capital inflows from abroad. The explanation follows directly from the discussion in previous sections, namely that fiscal restraint serves to reduce government demands on the national saving pool, thus reducing the need for the private
formal sector to seek investment finance abroad and augmenting the financial resources available for informal sector investment. Real GDP growth falls only very modestly, the same is true of real private consumption growth, but, as we have seen, the current account deficit undergoes a strong improvement. To the extent that the assumptions of SIAM 2 hold, fiscal restraint promises an impressive improvement in the current account at little cost to private sector income and consumption. Since total investment also changes but little (private informal sector investment fills the gap left by the reduction in government investment), long-run growth prospects remain much the same as well.

Devaluation and (formal sector) wage cuts serve to improve the current account deficit following conventional wisdom. Yet, the size of the impact is modest in both cases. For example, a 1 percent devaluation produces a 0.6 percent increase in the constant dollar value of exports and only a trivial fall in imports, the latter due to very strong and offsetting domestic inflationary pressure (the consumer price index rises 0.8 percent) as well as expansionary effects spilling over into import demand. As a result, SIAM 2 implies that to cut the 1985 reference path current account deficit of 37 billion baht in half would require a devaluation of almost 30 percent. Wage cuts would, of course, have a smaller impact on the current account deficit, in part because they effect a smaller share of total costs in export and import competing sectors and in part because only formal sector (blue and white collar) wages are subject to policy manipulation. Nevertheless, a 10 percent wage cut for formal sector workers would yield a 14 percent improvement in the current account deficit.
IV.4 A CGE Model for Indonesia /*

1. The Problem

Like other exporting countries, Indonesia experienced dramatic fluctuations in the terms of trade and in public revenues after 1973. The terms of trade gain between 1973 and 1978 (relative to 1970/72 levels) was equivalent to about 20 percent of nonoil GDP for most capital-deficit oil exporters. The second oil shock produced a similar gain. Since most of the increased oil income accrued to producer governments, the primary impact on producer economies was transmitted through an administered budget process rather than through the market. The benefits from accelerated public investment programs financed by oil revenues have turned out to be far smaller than anticipated, and the capital-deficit oil exporters have exhibited great vulnerability to the oil price downturn after 1981. The inflation, stress on traditional trade sectors, waste in public development spending during oil price booms, and the adjustment problems associated with the subsequent oil price busts, have all served to intensify the debate on what strategies are most appropriate for managing depletable oil incomes in capital-deficit oil exporters like Indonesia.

2. The Model: Standard CGE Components

Gelb's model of Indonesia is a sophisticated CGE framework in which capital accumulation is far more complex than is the case with other Bank short-run and medium-term models we have reviewed. The emphasis is certainly appropriate since Gelb is exploring questions about long-run resource management in an uncertain world of price instability. Most of his simulations, in fact, are taken over a period of two decades.

*/ Based on Gelb (n.d.).
The comparative static CGE model embodies economic dualism, much as does the Thai model, and the effort is certainly attractive for an economy where the term "economic dualism" was first applied. There are six commodities produced in the model, but there are eight sectors partitioned along dualistic lines. The "modern" or "formal" sectors are export agriculture (e.g., tree products, estates), mining (e.g., oil), modern manufacturing, modern services, and all construction. The "traditional" or "informal" sectors are traditional agriculture (e.g., rice), traditional manufacturing, and traditional services. There is dualism in production. While all modern sectors (with the exception of mining) are characterized by standard neo-classical production functions with substitutability between primary inputs, traditional manufacturing and services are not. Labor is the only primary input in the latter and fixed coefficients prevail there. Furthermore, factor rewards are determined differently in the modern and traditional sectors. While modern sectors normally obey competitive factor pricing rules, factor rewards in the traditional sectors are determined by fixed shares or average products.

Export agricultural products are tradeable at fixed world prices. Traditional agricultural product prices are set by (BULOG) policy and trade is regulated. Oil production faces an exogenous world market price, but the domestic price can be manipulated by policy. While imported manufactures have prices fixed by world market conditions, domestic manufactures have flexible prices since imports and domestic manufactures are not perfect substitutes. Construction and services are both non-tradeables and have endogenous prices. The real exchange rate is also endogenous.
All after-tax incomes accrue to the private sector, which saves at fixed but different rates out of labor and nonlabor income. Consumption demand follows the linear expenditure system.

3. The Model: Important Innovations

The previous section gave only a brief glimpse of what is a highly flexible and rich model of the Indonesian economy. What follows serves only to highlight some additional attributes of the model which have an important influence on the empirical results coming from the simulations.

The Indonesia model is "structuralist" in the sense that factor markets are imperfect, making it difficult for the economy to absorb the oil revenue windfall effectively. For example, while there is full labor mobility between the traditional sectors, labor mobility between the traditional and the modern sectors is beset by lags and constraints. Sectoral reallocation of labor in response to oil booms and busts is therefore constrained, and adjustment to external shocks is therefore limited. The more serious structuralist limitations, however, apply to investment absorption. Public investment allocation is unresponsive to sectoral needs and is allocated instead according to exogenous targets. Thus, sectors with rapid private accumulation face diminishing returns in the absence of accommodating public investment in infrastructure. Sectors with slow private accumulation face a glut of public investment and low returns to the latter. Furthermore, private investment is allocated across sectors by the proportional distribution of capital incomes (common to CGEs), implying heavy reliance on internal finance. Thus, those sectors favored by an oil price shock will be starved for investment funds, while those penalized will be embarrassed by a glut of investment funds. Absorption problems are further exacerbated by the inability of the capital goods sector (e.g., construction) to meet booming
demands for investment goods. As a result, investment goods prices tend to rise and choke off accumulation which the savings augmented by the oil revenue boom might otherwise have financed. In addition, "efficiency investment" is assumed to fall below actual investment during years of abnormally fast investment growth.

In summary, the Indonesian model describes an economy which finds it very difficult to absorb a windfall, one in which the productive impact of the accumulation response is inefficient and wasteful. The capital goods sector is so severely constrained that any public investment drive fails to increase capacity significantly since the rise in investment goods prices chokes off private investment. Private investment is crowded out by public investment. To make matters worse, the marginal efficiency of public investment is driven down to zero during the public investment drive. Thus, while the investment mix is changed by the public investment drive, aggregate investment is changed far less, and the productivity of investment at the margin is sharply diminished as public investment efficiency is driven to zero and the high marginal productivity of private investment is given far lower weight as private capital formation is crowded out.

This "structuralist" and "bottleneck-constrained" model is by far the most sophisticated that we have seen in a tradition which reaches back to the Domar-Feldman-Mahalanobis Soviet-type models of the 1950s and to the two gap models of the 1960s.

4. Results: A Base Scenario

The empirical content of the model leans heavily on an Indonesian Structural Adjustment Model for 1975. It is also validated over the period 1972-80.
Like all of the Bank models, this one first establishes a base scenario, in this case over a twenty-year period. The problem is to shock the model with a "windfall" close to actual Indonesian experience for the decade or so up to 1983. Thus, world oil prices (relative to the price of imported manufactures) double in the first four years and decline over the next four so that the initial level is restored. This path—sketched out below—is that

![Diagram of Real Oil Price and the Oil "windfall"

experienced from 1975 to 1983, especially when allowance is made for reduced OPEC volumes. In addition, public borrowing from abroad in the base scenario is set at actual observed patterns. Net private borrowing from abroad is also set at its observed pattern: when public spending speeds up and the real exchange rate starts to rise, capital rushes to Indonesia; when public spending slackens and the real exchange rate starts to decline, private speculators become concerned that there may be a devaluation, they rush capital abroad, domestic private investment falls below private saving, and the contractionary effect of lower world oil prices is strengthened.

When world oil prices rise, the windfall reaches the equivalent of some 17 percent of nonoil GDP in the base scenario. Some 3 percent is absorbed by increased remittances by foreign companies but the government borrows abroad to almost compensate. The public sector then invests its
revenues causing the real exchange rate to appreciate by 25 percent. Consumer prices rise by less, so that about 30 percent of the windfall is consumed in the end. The remainder is used to expand domestic public investment and so to raise future output. Unfortunately, and as we have already pointed out, the magnitude of the public investment drive causes some resources to be wasted. The modern sector benefits most from the boom and the income distribution becomes more skewed. Real modern wages rise by 20 percent while traditional wages remain stable, primarily since the surge in public spending spills over into food imports rather than into increased demand for domestic food. Import quotas would, of course, change all of that at the expense of urban wages.

The windfall has only a small impact on long-run growth in the base scenario. This is because most of the underlying forces driving growth are unaffected by the windfall—in the structuralist and bottleneck-constrained view of Indonesia, private investment, technical change and migration out of the traditional sectors respond hardly at all to the oil boom. After twenty years, real nonoil output is higher by only 2 percent with the windfall than without it.

5. Results: Coping with an Oil Revenue Windfall

In an economy which is characterized by severe absorptive capacity problems, and whose public authorities know with confidence the future path of price booms and slumps, what is the optimal domestic investment rate, or what is the optimal net capital import pattern, or what is the optimal debt pattern? These are all basically the same question in terms of the Indonesia model. "Optimal" is defined according to a social valuation function of the private consumption stream discounted at 3 percent, or according to a private valuation function where the discount rate is 14.5 percent. These valuation functions are used to find good policy and to assess the cost of institutional
or political restrictions which lead to poor outcomes. Which policies and which institutional restrictions?

What does the model suggest, for example, about domestic energy pricing policies? In the base scenario, the government is faced with exploding revenue and installs progressively less efficient public investment which serves to lock the economy into an inferior pattern of resource allocation. Later the public sector comes under severe fiscal stress. Why not simply transfer some of the windfall to the private sector? One way to do so is through low domestic oil prices even though world prices are rising. Indeed, the Indonesia model shows that it is better to transfer public income to the private sector via subsidies in the boom phase even though energy subsidies entail a large allocative distortion loss (2 percent of GDP in the model). If governments find it politically impossible to restrain spending, then the Bank's usual advice to "get domestic oil prices right" may be quite inappropriate.

The Indonesia model is also simulated under a variety of rigidities. For example, if modern sector wages are sticky downwards, unemployment opens up; if prices are sticky downwards, excess capacity opens up. These adjustment problems on the downside of the oil price cycle tend to erode the growth and output gains on the upswing. When simulated under sticky wages, the adjustment problems of the nonoil economy eliminate between 23 percent and 32 percent of the value of the windfall. When simulated under sticky wages and prices, the figures rise to 29 percent and 41 percent. Indeed, in the combined sticky wages and sticky prices scenario, output in the nonoil economy is about 5 percent smaller in year 10 than in the base scenario. These experiments offer a strong argument for moderating the rate of public expenditure expansion.
This conclusion is borne out when the Indonesia model is simulated where the government is allowed to borrow and lend optimally over the oil price cycle. Even in terms of the private valuation function, it is not optimal to borrow heavily when oil prices are high, because the return on that investment is low and because it is necessary to retain borrowing capacity to prevent a severe recession when oil prices decline. What do we mean by "heavily"? About three quarters of the oil windfall should be saved abroad: this raises the value of the windfall to the economy by 60 percent.

What about private capital flows? Should they be restricted? Since unrestricted private capital flows tend to be very responsive to world prices on the key export staple—providing strong signals of likely shifts in exchange rates—destabilizing flows may result. Because fiscal and exchange rate adjustments tend to lag movements in oil prices, there may be a good argument for capital-deficit oil exporters to use capital controls to prevent sudden large outflows on the downside of the cycle. Assuming wage and price stickiness, when the model allows free (speculative) capital flows the value of the oil windfall falls by 88 percent, as defined by the private valuation function, and actually becomes a net cost in terms of the social valuation function.

In 1981, the Bank projected a 3 percent real growth in world oil prices. Mexico based its plans on a 6 percent real increase, and borrowed abroad the equivalent of about 66 percent of the value of the oil windfall. The model explores the implication of such optimism. When the 6 percent projection is used to motivate optimal public borrowing, 66 percent of the windfall actually is the optimal borrowing rate suggested by the model. Debt mounts and the boom is then shattered by falling oil prices. Under assumptions of wage and price stickiness, the unemployment rate reaches 20
percent in the modern sector, and the loss in real income on the downside is three times as great as the benefit it would have gained from the temporary rise in oil prices correctly anticipated. After twenty years, the nonoil economy is 6 percent smaller than it would have been with no oil boom.

Caution is a virtue. But if the oil exporters are urged to adopt a pessimistic view of future price shocks, what if these pessimistic expectations are unfulfilled? This important issue is discussed at greater length in Section VI.

IV.5 A CGE Model for Turkey */

1. The Problem

Real GDP in Turkey increased by 7.3 percent per annum over the 1970-77 period. In 1977, however, a severe foreign exchange crisis brought this period of bright economic performance to an end. In early 1980, reforms were instituted which changed the focus of Turkey's development strategy from inward-looking import substitution to export expansion. The economic situation brightened in 1981 and growth resumed. While external shocks were at the heart of this instability, what role did policy play in exacerbating or moderating this go-stop-go growth performance?

2. The Model

Lewis and Urata use a computable general equilibrium model to analyze Turkey's 1978-81 foreign exchange crisis as well as to study several aspects of Turkey's growth prospects in the 1980s. The model is a descendent of the Turkey Growth and Trade (TGT) model developed by Dervis and Robinson for the World Bank mission to Turkey in 1979. The model distinguishes

*/ Based on Lewis and Urata (1983).
thirteen sectors of which ten are assumed to produce tradeable goods. The domestic price of import substitutes are determined by the combined influence of world price, tariff rates, the premium rate on imports, and the exchange rate. The domestic price of export goods depends on the world price of the good, export subsidies, and the exchange rate. The quantity of exports is taken to be exogenous in the model. Foreign exchange availability depends on export earnings, net remittances, net factor service income, foreign borrowing net of amortization and interest payments, and changes in official exchange holdings. Capital inflows are also taken to be exogenous.

One of the most important features of the Turkey model is its treatment of disequilibria in the foreign exchange market. The model allows simultaneous fixprice and flexprice mechanisms to deal with exchange rate disequilibria. In addition, the model allows for the inefficiency generated by the rent seeking behavior which is associated with exchange control. These features allow the Turkey model to be used to study the results of various policies in the context of a country where the exchange rate is determined by official policy.

The Turkey model makes an explicit distinction between the patterns of private and public investment. In most simulations, the model is investment-driven, in the sense that savings adjusts to a predetermined level of investment. Alternative closures are allowed by the model, but they are not used in the simulations. Exercises involving alternative closures would be quite instructive.

Production functions are specified in a way which takes petroleum and other imported intermediate goods into account. This is done by allowing substitution between coal and petroleum in the production of energy and by allowing substitution between capital and labor on the one hand, and capital and intermediate inputs on the other.
The model distinguishes between three types of income recipients: firms, households, and the government. A set of accounting and behavioral rules indicate how income is distributed to various agents and how these agents, in turn, spend their incomes. These rules are now fairly standard in CGEs and for this reason they will not be discussed here.

3. Results: Looking at the Recent Past

For comparative purposes, the CGE model was run over the 1978-81 period, with the following variables set exogenously at their observed values: the nominal exchange rate, workers' remittances, net capital inflows, changes in reserves, the dollar value of exports by sector, changes in the dollar prices of exports and imports by sector, nominal tariff rates by sector, growth rates of labor supply by type, input-output coefficients, private investment shares by destination, government investment shares by destination, tax rates on institutions and households, private consumption shares, government consumption shares, the aggregate investment/GDP ratio, and savings rates of institutions and households. Total factor productivity growth and import quantity rationing rates by sector were "adjusted so that the model 'validates' Turkish economic performance for 1978-81 period" (p.24 and p. 26). This simulation is called the Historical Base Run.

Four counterfactuals were performed. In the first experiment, all premia and quantity rationing mechanisms relating to the foreign exchange market were eliminated and the market-clearing exchange rate was determined endogenously. All other data in the Historical Base Run were maintained. The second experiment repeats the first but with no increase in the relative price of oil. The third experiment repeats the second, but with no differential in the rates of inflation between Turkey and its trading partners. The results of these three experiments can be seen in Table 6.
Table 6  Actual and Simulated Turkish Exchange Rates  
(Turkish Lira/US Dollar) 1978-81

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
<th>Experiment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>24.3</td>
<td>38.3</td>
<td>38.3</td>
<td>38.3</td>
</tr>
<tr>
<td>1979</td>
<td>36.4</td>
<td>72.4</td>
<td>60.0</td>
<td>40.4</td>
</tr>
<tr>
<td>1980</td>
<td>76.4</td>
<td>103.9</td>
<td>57.3</td>
<td>25.1</td>
</tr>
<tr>
<td>1981</td>
<td>108.9</td>
<td>112.6</td>
<td>63.0</td>
<td>19.7</td>
</tr>
</tbody>
</table>

Source: Lewis and Urata (1983), Table 3.13, p. 40.

The first two rows in Table 6 indicate that the Turkish lira was consistently overvalued in the 1978-81 period although the degree of overvaluation was considerably reduced in 1981. Experiments 2 and 3 allow a rough decomposition of the causes of the depreciation which, according to Experiment 1, would have taken place had the foreign exchange market been allowed to clear without interference. While the oil price shock was critical, it appears "that the inflation differential played the most significant role in the depreciation of the exchange rate in the 1978-1981 period" (p. 41).

In the fourth experiment, the dollar value of exports, net capital inflows, and reserve accumulation are all assumed to have smooth upward trends over the four-year period while each of their cumulative totals over that period are constrained to equal their observed cumulative values. As in the first three experiments, a flexible market-clearing exchange rate is also assumed. In other words, the authors are considering a counterfactual policy reform which would have removed all direct governmental influences in the foreign exchange market combined with a more stable external environment with
a smooth growth of exports, net capital inflow and exchange reserves. The result of such counterfactual events is quite spectacular. It is roughly equivalent to increasing the annual GDP growth rate by one percentage point. Unfortunately, the authors do not tell us what proportion of this increase is due to the removal of foreign exchange distortions and what proportion to the smoothing of the three series.

4. **Results: Looking at the 1980s**

The medium-term growth prospects for Turkey are analyzed using a Forward Base Run (FBR) and four alternative scenarios. The computation of the FBR, which covers the interval 1981-90, requires projection of the model's exogenous variables over that period. Among the assumptions made concerning the future are: Turkish inflation is reduced from its level of 35.1 percent in 1981 to 15 percent by 1986; a constant inflation adjusted rate of exchange is maintained throughout the 1982-90 period; tariff rates are reduced by 5 percent a year; the share of private investment allocated to manufacturing rises from 25 percent to 40 percent over the period; the government's share of total investment falls from 60 percent to 42 percent; the ratio of fixed investment to GDP rises from 22 percent to 24 percent; real exports grow at 27.2 percent in 1982 with the export growth rate stabilizing at about 10 percent a year thereafter; and value-added in agriculture grows at 3.1 percent. With these (and other) assumptions, the model produces a scenario in which Turkish GDP grows at an annual rate of 5.6 percent over the 1981-90 period.

The first medium-term experiment retains all the assumptions of the FBR, but increases the rate of growth of total factor productivity in all the manufacturing sectors by 50 percent. The second medium-term experiment looks at the results of making some of the baseline assumptions more pessimistic.
In particular, 1982 exports are assumed to be 5 percent lower than in the base run, the rate of export growth in 1984-86 is assumed to be 8.5 percent (down from 10.2 percent) and the 1986-90 export growth rate is assumed to be 7.9 percent (down from 10.1 percent). Further, the world price of oil in this experiment is assumed to grow about one percentage point a year more rapidly than in the FBR. In addition, the government's share in total investment declines only to 50 percent in 1990 as opposed to 40 percent in the FBR.

The third experiment incorporates the lower export scenario of the second experiment as well as the more modest decline in public investment and adds to those a reduction in the exogenous rate of agricultural productivity growth from 3.1 percent to 2.5 percent a year and a reduction in the Investment/GDP ratio of about two percentage points by the end of the period. The fourth experiment begins with the assumption of the FBR, but alters the assumption that the real exchange rate will be held constant. Instead, it is assumed that the real exchange rate increases by 2 percent a year.

The four experiments yield a rich and instructive tapestry of results. We will focus on a few of them here. Table 7 presents the implied GDP growth rates for the FBR and for the four experiments for the 1981-90 period and the 1986-90 period. As can be seen, increasing the rate of growth of total factor productivity in manufacturing (Experiment 1) by 50 percent increases the GDP growth rate over the period by three-tenths of a percent. The more pessimistic scenario in Experiment 2 results in a GDP growth rate over the period which is two-tenths of a percent lower than in the FBR. Over the last half of the decade, however, the more pessimistic projection results in a four-tenths of a percent reduction in the growth rate. The results of the third experiment are very similar to those of the second because of
offsetting changes. Agricultural productivity growth and investment are lower in the third experiment than in the second, but oil prices rise more rapidly in the second experiment than in the third. In terms of GDP growth, the results of the fourth experiment are identical to the results of the second. In other words, a 2 percent per annum appreciation in the real exchange rate has the same effect on growth as the combination of the three more pessimistic assumptions made in Experiment 2.

Table 7 Simulated GDP Growth Rates: Turkey, 1981-90

<table>
<thead>
<tr>
<th>GDP Growth Rates Per Annum</th>
<th>1981-90</th>
<th>1986-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Base Run</td>
<td>5.6</td>
<td>6.1</td>
</tr>
<tr>
<td>Experiment 1</td>
<td>5.9</td>
<td>6.3</td>
</tr>
<tr>
<td>Experiment 2</td>
<td>5.4</td>
<td>5.7</td>
</tr>
<tr>
<td>Experiment 3</td>
<td>5.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Experiment 4</td>
<td>5.4</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Source: Lewis and Urata (1983), Table 4.6 p. 60.

Of the four experiments, the last is the one most clearly associated with a particular government policy. A 2 percent per annum appreciation in the real exchange rate clearly retards economic growth, but initially its effects are not very large. Subsequently, however, as the exchange rate becomes more and more overvalued, the effects on growth become larger.
Table 8  Measures of Foreign Exchange Shortage, 1981-90  
(percentage)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base Run</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import Premium Rate</td>
<td>3.8</td>
<td>0.0</td>
<td>10.0</td>
<td>7.5</td>
<td>3.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Import Rents/Total value added</td>
<td>0.4</td>
<td>0.0</td>
<td>2.0</td>
<td>1.6</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Experiment 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import Premium Rate</td>
<td>3.8</td>
<td>0.0</td>
<td>11.3</td>
<td>9.5</td>
<td>6.1</td>
<td>4.4</td>
</tr>
<tr>
<td>Import Rents/Total value added</td>
<td>0.4</td>
<td>0.0</td>
<td>2.3</td>
<td>2.1</td>
<td>1.4</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Experiment 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import Premium Rate</td>
<td>3.8</td>
<td>0.0</td>
<td>10.4</td>
<td>14.7</td>
<td>21.1</td>
<td>28.0</td>
</tr>
<tr>
<td>Import Rents/Total value added</td>
<td>0.4</td>
<td>0.0</td>
<td>2.1</td>
<td>3.2</td>
<td>5.0</td>
<td>7.1</td>
</tr>
<tr>
<td><strong>Experiment 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import Premium Rate</td>
<td>3.8</td>
<td>0.0</td>
<td>9.9</td>
<td>11.9</td>
<td>14.9</td>
<td>18.7</td>
</tr>
<tr>
<td>Import Rents/Total value added</td>
<td>0.4</td>
<td>0.0</td>
<td>2.0</td>
<td>2.6</td>
<td>3.4</td>
<td>4.6</td>
</tr>
<tr>
<td><strong>Experiment 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import Premium Rate</td>
<td>3.8</td>
<td>0.0</td>
<td>13.2</td>
<td>22.3</td>
<td>30.5</td>
<td>41.8</td>
</tr>
<tr>
<td>Import Rents/Total value added</td>
<td>0.4</td>
<td>0.0</td>
<td>2.6</td>
<td>4.5</td>
<td>6.4</td>
<td>9.0</td>
</tr>
</tbody>
</table>

**Source:** Lewis and Urata (1983), Table 4.8, p. 65.

**Definitions:**

(1) The Import Premium Rate is the rate required to equilibrate the foreign exchange market.

(2) Import Rents/Total Value added is the ratio of the value of import premia received by import users to total value-added in the economy.
Another perspective on this policy can be obtained from Table 8. Two measures of foreign exchange shortage are shown there: the import premium rate, which is the rate (in addition to existing tariffs) which is necessary to equilibrate the foreign exchange market; and import rents as a fraction of total value added, which measures the relative value of the transfer to users of imports due to the overvaluation of the exchange rate. In 1981 the premium rate is 3.8 percent in all the runs and import rents as a fraction of total value added is 0.4 percent. By 1990, the premium rate in the base run declines to 1.4 percent while the import rent-value added ratio remains at 0.4 percent. The constancy of the latter in the face of a declining import premium is due to the increase in the ratio of import rents to total value added.

How serious is this foreign exchange shortage in 1990? An interesting perspective on it can be obtained by looking back at the Historical Base Run. That run allows the computation of the import rent to value-added ratio in the context of both quantity rationing and import premia. In 1978, a year of foreign exchange crisis, that ratio stood at 12.4 percent and in 1979 it rose to 17.2 percent. In 1980, the year the recovery began, the ratio fell to 5.2 percent and in 1981, it fell even further to 0.4 percent. Judging from the time series of the import rent to value-added ratio by 1982 or so, the 2 percent real appreciation in the exchange rate would lead Turkey to an exchange crisis of the sort experienced in 1978.

5. Summary

The real strength of the Turkey model lies in its ability to analyze situations involving a disequilibrium exchange rate. Since many countries administer their exchange rates, this strength has quite general usefulness. The most important of the simulation results is based on this strength. The
model shows that even under quite favorable external conditions, a 2 percent per annum rate of appreciation in the real exchange rate would, within about a decade, bring Turkey back to the same sort of situation which generated the foreign exchange crisis of the late 1970s. The conclusion from the model that Turkey's economy is quite sensitive to the appreciation of the real exchange rate is supported by a piece of evidence from the period prior to the foreign exchange crisis. In the 1973-77 period, Turkey's real exchange rate appreciated by 13.2 percent (p. 10, fn. 1).

There is a general moral here for countries who use import rationing and import premia. On the basis of the Turkey model and the Turkey experience, there is reason to expect that economic performance is quite adversely affected by the overvaluation of the real exchange rate generated by such policies.

However, we are struck by the disparity between the potential interpretative richness of the Turkey model and the limited range of questions for which it has been used. For example, we believe that the Turkey model could be used to determine the economic costs or benefits to following various kinds of disequilibrium exchange rate policies as opposed to a flexible exchange rate policy. The Turkey CGE model is well equipped to supply answers to exactly these sorts of questions.

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for which it has been used. For example, we believe that the Turkey model could be used to determine the economic costs or benefits to following various kinds of disequilibrium exchange rate policies as opposed to a flexible exchange rate policy. The Turkey CGE model is well equipped to supply answers to exactly these sorts of questions.

**IV.6 A CGE Model for Yugoslavia */

1. **The Problem**

   In 1976, Yugoslavia was characterized by domestic recession in response to policy measures designed to ease the foreign exchange crisis of 1974-75. The combination of the recession and severe import restrictions in 1976 led to a small current account surplus. In 1977, authorities liberalized both monetary and import policy. When the deficit quickly rose to 5.4 percent of GDP, the authorities once again took steps to cope with the new foreign exchange crisis. These included a tight monetary policy and direct control over investment expenditures. These policies threw Yugoslavia into a new recession and the devaluation of the dinar followed in June 1980. A period of slow growth is now projected through the first half of the 1980s. Would alternative policies have done better in the past, and can they offer a better growth performance in the future?

2. **The Model**

   The Yugoslavia CGE was developed to investigate the impact on the economy's performance over the 1976-80 period from three sources: exchange rate policy, an anti-export bias, and capital market fragmentation. The model has made features similar to the Turkey model discussed in the previous

* Based on Bery, et. al. (1982), Yugoslavia mission report.
section; it is one of a family of models of the sort described in Dervis, de Melo and Robinson (1982). There are, however, two especially interesting features of the Yugoslavia model which should be noted here: specifications designed to capture the behavior of self-managed firms; and specifications of fixprice and flexprice import rationing mechanisms.

Instead of assuming that firms or sectors behave as in standard nonclassical economic theory, the Yugoslav model incorporates a set of behavioral rules designed to capture the major features of worker managed firms. To do this, the model distinguishes between two types of labor, fixed and variable. The amount of fixed labor hired by each sector in each year is treated as an exogenous variable. Given the project price for the sector, an "accounting" wage, the fixed stock of capital and the quantity of fixed labor, enterprises decide how much variable labor to employ by equating the value of the marginal product of labor with its wage. The accounting wage in the model is endogenous and is that wage level which clears the labor market for variable labor. The total supply of variable labor is determined exogenously, so that the accounting wage actually functions as a mechanism for allocating this fixed supply across sectors. A worker's income is assumed to have two components, an accounting wage component and a component which reflects his share of the firm's profits.

In the Yugoslav model, exports are exogenous, the real exchange rate is usually exogenous, and desired imports depend on the relative prices of foreign goods and domestically produced import substitutes. Capital flows are also taken to be exogenous. The model requires some mechanism to ensure consistency between the quantity of foreign exchange demanded and supplied when the exchange rate is fixed. Two rationing mechanisms are considered, fixprice and flexprice. Fixprice quantity rationing rules specify that
sectors are restricted to some fraction of their desired imports. These fractions differ by the type of import so the impact of these restrictions on the sectors of final use depends upon the import composition of their demands and the relative ease of substituting domestically produced goods for imports. The flexprice rationing mechanism presupposes a functioning secondary market for foreign exchange. A flexible premium in this market varies so as to clear the secondary foreign exchange market. The CGE allows for the coexistence of both rationing schemes, but requires that the relative importance of the two be specified exogenously. In a mixed fixprice-flexprice system, the premium is not allowed to rise high enough to clear the secondary foreign exchange market. The result is that some sectors cannot obtain all the imports they desire and are quantity restrained.

The existence of the import rents generated by the quantity constraints suggests that to a certain extent it would be profitable for firms to spend resources to obtain a share of those rents. The model assumes that the value of resources wasted in rent-seeking behavior is proportional to the value of the import rents accruing to each sector. Import rents also matter in the model through their influence on the behavior of exports. In Yugoslavia, exporters are allowed discretionary control over a certain fraction of their foreign exchange earning. They can use this foreign exchange to purchase imports or they can sell their foreign exchange at a premium. "In the Yugoslav case, where effective retention rates are limited and where the secondary market for foreign exchange is not extensive enough to produce a market-clearing premium rate, the net effect on the retention scheme is to reduce, but not to eliminate, the bias against exports in the system" (v.3, p. 15).
3. Results: Assessing the Recent Past

One advantage of a CGE is that sectoral rates of profitability can be computed on a comparable basis. Variability in the rates gives some indication of whether new investment tends to be allocated to those sectors with high rates of return. Table 9 shows rates of market profitability for sixteen sectors for the years 1976, 1978, and 1980, all relative to the industrial average rate of return for that year. All economies, even those with unrestricted capital markets, show differences in sectoral rates of return, especially those undergoing external shocks or even internal shocks associated with rapid development and structural change. Thus, a simple comparative assessment of the figures in Table 9 with those from other countries is unlikely to be very revealing. Nonetheless, central to any assessment of Yugoslavia's ability to adjust to external shock is her ability to quickly shift resource capacity from less promising to more promising sectors. Since the divergence in sectoral rates of return in Table 9 suggests that capital allocation was becoming worse, not better, between 1976 and 1980, it would have been a useful experiment to explore the cost of the misallocation of capital, especially during a period when there appears to have been a "growing politicization of investment decisions" (v. 2, p. 64). Were increasing capital market imperfections an important contributor to Yugoslavia's short-run economic problems in 1980? The Yugoslav CGE could have been used to answer that question by exploring her experience under counterfactual conditions of capital market efficiency where sectoral rates of return tended to equalize. Unfortunately, the model was not used for that purpose, but we hope that such an exercise might be included in future work with the model.
Table 9  Indicators of Relative Market Penetration  
(industrial average = 1.0)

<table>
<thead>
<tr>
<th></th>
<th>1976</th>
<th>1978</th>
<th>1980</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>0.120</td>
<td>0.093</td>
<td>0.917</td>
</tr>
<tr>
<td>Coal</td>
<td>1.203</td>
<td>1.293</td>
<td>1.542</td>
</tr>
<tr>
<td>Oil and gas</td>
<td>1.504</td>
<td>1.267</td>
<td>1.001</td>
</tr>
<tr>
<td>Ferrous metallurgy</td>
<td>0.795</td>
<td>0.613</td>
<td>0.582</td>
</tr>
<tr>
<td>Nonferrous metallurgy</td>
<td>0.668</td>
<td>0.435</td>
<td>0.375</td>
</tr>
<tr>
<td>Nonmetallic minerals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and construction</td>
<td>1.878</td>
<td>2.344</td>
<td>2.882</td>
</tr>
<tr>
<td>materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery</td>
<td>1.632</td>
<td>1.799</td>
<td>1.525</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>1.510</td>
<td>1.702</td>
<td>1.359</td>
</tr>
<tr>
<td>Shipbuilding</td>
<td>1.978</td>
<td>2.123</td>
<td>1.942</td>
</tr>
<tr>
<td>Electrical equipment</td>
<td>1.170</td>
<td>0.804</td>
<td>0.772</td>
</tr>
<tr>
<td>Chemical and paper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>textiles, leather</td>
<td>1.412</td>
<td>1.585</td>
<td>1.963</td>
</tr>
<tr>
<td>rubber, wood, wood,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and miscellaneous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>industries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food processing</td>
<td>1.560</td>
<td>1.396</td>
<td>1.389</td>
</tr>
<tr>
<td>Construction</td>
<td>4.324</td>
<td>4.866</td>
<td>3.979</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>0.617</td>
<td>0.703</td>
<td>0.761</td>
</tr>
<tr>
<td>Trade</td>
<td>1.960</td>
<td>2.277</td>
<td>2.666</td>
</tr>
<tr>
<td>Other productive service</td>
<td>1.358</td>
<td>1.690</td>
<td>2.046</td>
</tr>
</tbody>
</table>

The Yugoslav CGE can also be used to determine the overall bias resulting from the entire set of foreign trade policies. The bias of the incentive system refers to the effects that the system has in altering the relative profitability of producing for the home market rather than for exports as compared to a free trade situation (v. 2, p. 67). In the Yugoslav economy, as in many others, the bias is the result of many separate policies which often have conflicting influences. A CGE model is capable of merging these policies and informing us about their net effect. The Yugoslavs used a complicated set of rationing devices to allocate foreign exchange among users. The CGE model incorporates both fixprice and flexprice allocation mechanisms to represent both formal and informal import control policies. Exports, on the other hand, were encouraged by credit given at favorable exchange rates, tax reductions and discretionary control over a fraction of the foreign exchange earned by exporters. The CGE incorporates Yugoslavia's import and export policies.

The trade bias is measured using a concept called the "domestic resource cost (DRC) of earning or saving a unit of foreign exchange in each sector" (v. 2, p. 79). For each sector these DRCs have the same dimensionality as an exchange rate. In other words, a DRC is the amount of domestic resources measured in dinars needed to earn or save one dollar's worth of foreign exchange. These computations are reported in Table 10. The results are quite striking. For all sectors, it takes more resources to save a dollar's worth of foreign exchange than it takes to earn a dollar's worth of foreign exchange through exports. In most cases, the differences are quite substantial. For example, to earn one dollar of foreign exchange through import substitution in the nonferrous metallurgy sector requires 45.2 dinars worth of domestic resources.
Table 10 Estimated Sectoral Domestic Resource Costs, 1980 1/

<table>
<thead>
<tr>
<th>Sector</th>
<th>Market Prices 2/</th>
<th>Shadow Prices 3/</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Export (1)</td>
<td>Import (2)</td>
</tr>
<tr>
<td>Agriculture</td>
<td>29.1</td>
<td>33.6</td>
</tr>
<tr>
<td>Electricity</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Coal</td>
<td>28.3</td>
<td>32.0</td>
</tr>
<tr>
<td>Oil and gas</td>
<td>14.2</td>
<td>31.0</td>
</tr>
<tr>
<td>Ferrous metallurgy</td>
<td>22.8</td>
<td>35.0</td>
</tr>
<tr>
<td>Nonferrous metallurgy</td>
<td>25.6</td>
<td>43.4</td>
</tr>
<tr>
<td>Nonmetallic minerals and construction materials</td>
<td>26.7</td>
<td>33.1</td>
</tr>
<tr>
<td>Machinery</td>
<td>25.3</td>
<td>51.7</td>
</tr>
<tr>
<td>Transport equipment and shipbuilding</td>
<td>23.9</td>
<td>59.5</td>
</tr>
<tr>
<td>Electrical equipment</td>
<td>25.3</td>
<td>54.7</td>
</tr>
<tr>
<td>Chemicals and paper</td>
<td>22.7</td>
<td>42.9</td>
</tr>
<tr>
<td>Textiles, leather, rubber, wood and miscellaneous manufacturing</td>
<td>22.5</td>
<td>63.3</td>
</tr>
<tr>
<td>Food processing</td>
<td>26.4</td>
<td>31.9</td>
</tr>
<tr>
<td>Construction</td>
<td>26.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>27.8</td>
<td>29.7</td>
</tr>
<tr>
<td>Trade</td>
<td>19.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Crafts and other productive services</td>
<td>27.1</td>
<td>35.2</td>
</tr>
</tbody>
</table>


1/ Domestic Resource Cost, measured in Yugoslav dinars, is defined as the total (direct and indirect) cost, in terms of domestic labor and capital, of earning or saving one dollar of foreign exchange through exporting or import substitution.

2/ Equivalent to effective rates of protection.

3/ Shadow prices for labor were estimated using the CGE model for Yugoslavia.
The third use to which the CGE was put was to investigate Yugoslavia's exchange rate policy was over the 1976-80 period. In one sense, the policy followed by the National Bank of Yugoslavia was a complete success. The explicit policy was to maintain a constant real exchange rate, that is one where nominal rate changes offset differences in inflation rates between Yugoslavia and its main trading partners. For the 1976-79 period this policy was successfully carried out. In 1980 a foreign exchange crisis arose anyway and forced a substantial devaluation of the dinar. This aspect of the Yugoslav experience is especially instructive because many countries follow a similar policy of fixing the real value of their exchange rate. In the Yugoslav case, the policy of fixing the real exchange rate was a success, but an exchange crisis arose and the economy failed.

The CGE model was used to gain an understanding of why the constant real exchange rate policy did not keep Yugoslavia from a foreign exchange crisis. The model was run using Yugoslavia's actual experience over the 1976-80 period and maintaining actual sectoral tariff and export subsidy rates, but with the assumption of a flexible market-clearing exchange rate instead of the combination of fixed real exchange rate and import restrictions. The actual and the market clearing exchange rates are shown in Table 11. According to the CGE, the dinar was overvalued by 23 percent in 1976. The overvaluation fell to 10 percent in 1977 but it rose sharply again over the next two years. By 1979 the dinar was overvalued by 42 percent. The exchange rate crisis began in 1979 and the devaluation midway through 1980 still left the dinar overvalued by 44 percent.
Table 11  Actual and Market-clearing Exchange Rates, 1976-80  
(dinars per US dollar, period average estimates)

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Exchange Rate</th>
<th>Market Clearing Exchange Rate</th>
<th>Ratio of Market Clearing to Actual (percentage rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>18.19</td>
<td>22.33</td>
<td>1.23</td>
</tr>
<tr>
<td>1977</td>
<td>18.30</td>
<td>20.40</td>
<td>1.10</td>
</tr>
<tr>
<td>1978</td>
<td>18.64</td>
<td>22.55</td>
<td>1.21</td>
</tr>
<tr>
<td>1979</td>
<td>19.00</td>
<td>26.91</td>
<td>1.42</td>
</tr>
<tr>
<td>1980</td>
<td>24.91</td>
<td>33.47</td>
<td>1.34</td>
</tr>
</tbody>
</table>

Source: Bery, et. al. (1982), vol. 2, Table 4.12, p. 89.

These results point clearly to the conclusion that proper foreign exchange policy has to take more into account than just differential rates of inflation. The second oil price shock came in 1979, and with the increase in the price of oil came a slowdown in exports and a contraction in net remittances. These shocks implied that Yugoslavia's real exchange rate needed a devaluation before June 1980. Even without the second oil price shock, however, the figures in Table 11 hint that the dinar would have become progressively more overvalued after 1977. The combined effects help explain the seriousness of exchange crisis.

The authors of the Yugoslav report make quite clear what the CGE model has taught us: "Inappropriate exchange rate policies seem therefore to have been among the most critical contributory factors to the foreign exchange crisis of 1980" (v. 2, p. 93).

4. Results: Looking at the 1980s

The CGE model was used to investigate the implications of two scenarios for Yugoslavia's economic future. Under Plan I, it is assumed that Yugoslavia can finance a cumulative current account deficit of $5 billion
during the 1981-85 period. In Plan II, that figure is reduced to $1.9 billion. In Plan I it is assumed that the Yugoslav officials will hold the real exchange rate constant at its mid-1980 level, while in Plan II officials are assumed to maintain a real exchange rate which is 12 percent lower (roughly the 1981 real exchange rate level). In addition, Plan II makes a more favorable projection of Yugoslavia's terms of trade than is used in Plan I.

The annual growth rates of selected economic indicators are shown in Table 12. The somewhat surprising result of the simulation is that Yugoslavia does better under Plan II where the capital account restrictions are considerably tighter, than under Plan I where the capital account restrictions are considerably looser. The superior performance of Plan II is due to the assumption made about the terms of trade. Given the assumptions of the model, the real value of Yugoslavia's exports plus capital imports is greater under Plan II than in Plan I. This allows the quantity of imports to be greater under Plan II than under Plan I and that in turn stimulates output growth and investment. GDP growth is 4.6 percent under Plan II as opposed to 4.0 percent per annum under Plan I.

The two plans also imply differences in the magnitudes of import rents derived from Yugoslavia's foreign exchange rationing schemes. Table 13 shows import rents as a percentage of total value added for the years 1980 to 1995 for the two plans as well as the percentages computed by the CGE for the period 1976-80. Note that in the crisis years of 1976, 1979, and 1980, the percentage of import rents to total value added exceeds 8 percent. Under Plan I, the ratio of import rents to total value added rises to 16 percent in 1975. That level is more than twice the average value of that percent over the 1976-80 period, above the level previously associated with crises, and above the value which caused a serious foreign exchange crisis in Turkey.
Table 12 Projected Growth of Macroeconomic Aggregates, 1981-85

<table>
<thead>
<tr>
<th>Experiment</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan I</td>
<td>Plan II</td>
<td></td>
</tr>
<tr>
<td>*Import prices ($)</td>
<td>11.6</td>
<td>8.0</td>
</tr>
<tr>
<td>*Oil prices</td>
<td>14.6</td>
<td>13.7</td>
</tr>
<tr>
<td>*Export prices ($)</td>
<td>9.7</td>
<td>8.5</td>
</tr>
<tr>
<td>*GDP deflator (dinars)</td>
<td>20.5</td>
<td>20.2</td>
</tr>
<tr>
<td>*Nominal exchange rate</td>
<td>8.8</td>
<td>14.0</td>
</tr>
<tr>
<td>*Agricultural output</td>
<td>4.7</td>
<td>3.0</td>
</tr>
<tr>
<td>*Net workers' remittances ($bn.)</td>
<td>9.3</td>
<td>7.7</td>
</tr>
<tr>
<td>Consumption</td>
<td>2.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Gross fixed investment</td>
<td>1.9</td>
<td>2.9</td>
</tr>
<tr>
<td>*Exports (GNFS)</td>
<td>8.1</td>
<td>7.7</td>
</tr>
<tr>
<td>Imports (GNFS)</td>
<td>1.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Gross domestic product (GDP)</td>
<td>4.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Gross material product (GMP)</td>
<td>4.2</td>
<td>4.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experiment</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan I</td>
<td>Plan II</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>1985</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>1985</td>
<td></td>
</tr>
<tr>
<td>2. Ratios</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports/GDP</td>
<td>24.7</td>
<td>23.4</td>
</tr>
<tr>
<td>Imports/GDP</td>
<td>27.0</td>
<td>24.0</td>
</tr>
<tr>
<td>Investment/GDP</td>
<td>28.7</td>
<td>31.7</td>
</tr>
<tr>
<td>Consumption/GDP</td>
<td>54.7</td>
<td>51.4</td>
</tr>
<tr>
<td>Foreign savings/total investment</td>
<td>7.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Marginal national savings rate (gross national savings)</td>
<td>29.9</td>
<td>33.2</td>
</tr>
</tbody>
</table>

3. Cumulative dollar flows: 1981-85

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Plan I</td>
<td>Plan II</td>
</tr>
<tr>
<td>*Exports of goods and nonfactor services</td>
<td>+113.6</td>
<td>+117.8</td>
</tr>
<tr>
<td>Imports of goods and nonfactor services</td>
<td>-119.1</td>
<td>-117.9</td>
</tr>
<tr>
<td>*Current account deficit ($bn.)</td>
<td>-5.0</td>
<td>-1.9</td>
</tr>
</tbody>
</table>

Note: Asterisks indicate exogenously specified variables.

a. Estimated from Plan II Run.

Source: Bery, et. al. (1982), vol. 2 Table 5.2, p. 109.
It seems likely, therefore, that Plan I could worsen Yugoslavia's economic problems. Plan II implies a more modest ratio of import rents to total value added, but even there the ratio stands at or above crisis level through 1984.

Table 13 Import Rents from Foreign Exchange Rationing as a Percentage of Total Value Added, 1976-85

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Plan I</th>
<th>Plan II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1979</td>
<td>8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>8.6</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>1981</td>
<td>11</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>13</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>14</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>15</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>16</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>


5. Summary

The Yugoslav CGE is very instructive both methodologically and substantively. On the methodological side, it provides a good example of how a CGE can take into account complex and subtle institutional detail. On the substantive side, it teaches two important lessons. First, it shows how a fixed real exchange rate policy can fail, and second, it offers an example of a country in which import substitution policies had been pushed so far that saving a dollar's worth of foreign exchange through import substitution costs
between two and three times as much in terms of domestic resources as earning that dollar's worth of foreign exchange through exports.

The first lesson is clearly an important one, but it raises a whole host of additional questions. If the fixed real exchange rate policy led to problems in Yugoslavia in 1979 and 1980, what policy would have been preferable? This question was clearly beyond the scope of the Yugoslavia report, but it is of substantial importance to Yugoslavia's future. If Yugoslavia continues to fix its real exchange rate, it remains vulnerable to a repetition of past crises. The Yugoslav CGE could perhaps help supply advice on how to avoid these problems in the future, but it has not yet been asked to do so. We hope it will by an explicit examination of alternative policies.

Economies like that of Yugoslavia often adopt complex and contradictory sets of policies. The CGE shows how the interactions of these policies can be studied and assessed. In the case of Yugoslavia, the model shows that trade policies were substantially biased against exports. It appears that a relatively simple way to reduce this bias, however, would be to give exporters effective control over a greater share of their foreign exchange earnings. It would be interesting to ascertain by how much such relatively simple policy measures could have aided the Yugoslav economy.

IV.7 A Preliminary CGE Model for Chile */

1. The Problem

The application of CGE models to understanding the Chilean Depression of 1982 has just begun. The full research plan by Cordon, Corbo, and de Melo calls for the merging of a CGE model which is based on relative prices with an

*/ Based on Condon, Corbo, and de Melo (1983).
econometric model that links real and nominal quantities. The merged model will allow for the analysis of a far richer variety of policies than could be studied in either model separately. The model discussed here is not the final version of the CGE which is to be used, but only a preliminary first step.

While the Chilean CGE model is only preliminary, we include it here since it will be used to confront a singularly important set of events which need far better understanding. These events started in 1974 and end with the Depression of 1982. Between 1974 and 1981 Chile recovered from a serious economic crisis. The recovery was slow at first, but between 1976 and 1981 real GDP grew at a rate of over 6 percent per annum. The rate of inflation, which had been over 600 percent in 1973, was reduced to 13.2 percent in 1981. The improvement stemmed from what might be considered a rather orthodox economic stabilization program in which economic regulations were gradually relaxed. An important aspect of this liberalization involved the external capital account. In 1977, it was still virtually closed while by 1979 it had been substantially opened. In June 1979, the government instituted a reform which, in retrospect, seems to have been important in bringing the period of growth to an end. The reform had two components: first, the future course of the nominal exchange rate in terms of dollars was preannounced; second, the wages of workers was indexed to provide full compensation for past changes in the CPI. After the policy was instituted, the real value of the Chilean currency began to appreciate, exports fell, imports rose, and the current account deficit widened. The current account deficit was financed for a while by substantial capital imports, but in 1982 the capital imports turned into capital exports and the economy collapsed. In mid-1982, the stabilization based on a preannounced rate of devaluation of the nominal exchange rate was abandoned.
2. The (Incomplete) Model

The Chile CGE model is comprised of six sectors, all of which, with the exception of construction, produce tradeable goods. Domestic goods and imports are treated as imperfect substitutes for one another in production of a composite good desired by the public. The degree of substitutability of the import good for the domestically produced good is specified separately for each sector. This specification allows the world price of the import good, the tariff rate, the exchange rate, and domestic supply and demand conditions to determine jointly the domestic prices of import substitutes. The domestic prices of export goods are determined exogenously by world prices and the exchange rate. Copper exports are taken to be exogenous, but the exports of the other sectors are connected to sectoral output, by a composite good formulation similar to that used for imports.

Corresponding to the Chilean situation, most simulation runs take the nominal wage rate to be exogenous. Balance of payments equilibrium is then ensured through a very unusual device. All potential reserve losses are assumed to be financed by foreign capital inflows. To put the same matter in different terms, the model assumes that foreign savings is exactly equal to the current account deficit.

Technology in each sector is represented by a CES production function in labor and capital inputs. Fixed input-output coefficients are assumed with no substitution allowed between intermediate and primary inputs. This specification is quite appropriate for a model which is meant to investigate the behavior of an economy over a relatively short time period.

Sectoral capital stocks are fixed within each period. There are two types of labor in the model, primary and organized. Primary labor is used only in the primary sector while secondary labor is distributed across the
remaining five sectors in such a fashion that sectoral marginal value products are equal to an exogenously determined wage. Changes in this exogenous wage have quite powerful effects on both employment and profits.

Wage income is distributed in the model between taxes and consumption. Profits are distributed among taxes, consumption, and savings. Policies that shift income away from wages and toward profits increase savings.

Total investments in the model are savings-determined where total savings is the sum of domestically generated savings and "foreign savings defined as the negative of the current account balance" (p. 27). The assumption that the entire current account deficit adds to total savings is critical for some of the model's implications.

3. Some Early Results

In order to understand the process and policies which brought on Chile's economic problems (hopefully so as not to repeat them in the future) the authors produce a baseline run which reproduces the main features of the Chilean economic experience between 1977 and 1981. The authors then consider four counterfactual experiments. The first investigates the effects of a more favorable external environment. The second is designed to shed light on the effects of backward wage indexation. The third deals with the effects of the observed foreign capital inflows and the fourth combines various elements of the first three.

In the baseline run, the authors specified the model so that it roughly tracked the observed behavior of the Chilean economy over the 1977-81 period. Among the exogenous variables and trends used in the base run are: the observed values of capital flows; the observed values of the GDP deflator, nominal exchange rates, and real exchange rates; observed world prices for
Chile's imports and exports; the nominal wage pattern; and an assumed pattern of total factor productivity growth by sector. The nominal wage series assumes that real wages were constant from 1977 through 1979, while from 1980 and 1981 wages were indexed on the previous year's change in the CPI.

Table 14 Actual and Base Run GDP Growth and Current Account Deficit: Chile, 1977-81

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP growth (percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>--</td>
<td>8.2</td>
<td>8.3</td>
<td>7.8</td>
<td>5.7</td>
</tr>
<tr>
<td>Base run</td>
<td>--</td>
<td>9.4</td>
<td>8.7</td>
<td>6.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Current account deficit (billion US$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>0.55</td>
<td>1.08</td>
<td>1.19</td>
<td>1.97</td>
<td>4.81</td>
</tr>
<tr>
<td>Base run</td>
<td>0.25</td>
<td>1.30</td>
<td>2.23</td>
<td>3.65</td>
<td>5.54</td>
</tr>
</tbody>
</table>

Source: Condon, Corbo, and de Melo (1983), Table 13, p. 40.

Table 14 compares Chile's economic performance and the CGEs predictions in two important dimensions, real GDP growth and the current account deficit. It is interesting to note that the model shows a much more pronounced decline in the real GDP growth rate over the 1977-81 period than was actually experienced. The model initially grows more rapidly than the Chilean economy, but subsequently grows less rapidly. The change in the real GDP growth rate in the model between 1977/78 and 1980/81 is 6.1 percentage points, while the observed figure is only 2.5 percentage points. It appears that the model was anticipating the severe economic difficulties that Chile
was to face in 1982. The same sort of pattern can be seen in the figures for
the current account deficit. The model begins by being somewhat more
optimistic than the observed figures and ends the period being more
pessimistic. The model produces clear evidence that the real exchange rate
rose significantly over the 1977-81 period.

The first counterfactual simulation deals with the consequences of a
more favorable external environment on the Chilean economy. In every
simulation experiment the GDP deflator series is held constant, although the
authors plan on endogenizing the GDP deflator in future work. The external
economic environment is made more favorable by assuming a 15 percent per year
increase in the world price of copper, a 5 percent nominal exchange rate
devaluation in 1980, and a further 10 percent devaluation in 1981.

The result of this more favorable external economic environment is a
slowdown in the real annual GDP growth rate (1977-81) from 7.0 percent to 6.8
percent. The paradoxical reduction in the rate of growth can be traced to one
critical assumption in the model already discussed--foreign savings. Recall
that the model assumes that foreign savings exactly covers the current account
deficit. Thus, the impact of a counterfactual increase in the price of copper
combined with devaluation is to reduce the current account deficit and, by
assumption, to decrease foreign savings. It is this decrease in foreign
savings which causes the reduction in real GDP growth via a fall in investment
and in the rate of accumulation. The reduction in real GDP growth is
mitigated, however, by the shift in resources from relatively low
productivity, nontradeable goods sectors to more productive, tradeable goods
producing sectors.

The second counterfactual simulation focuses on the effects of
backward wage indexation. Instead of full backward wage indexation assumed in
the base run for the years 1980 and 1981, the counterfactual assumes that
indexation throughout the period is linked to current cost of living
increases. The results are quite striking. In particular, real GDP growth
rises from 7.0 to 8.8 percent per annum. Substituting current for past wage
indexation in 1980 and 1981 results in a substantial decrease in real wage and
a substantial increase in employment and investment (because of the increase
in profits and in the current account deficit). The interesting and important
connection between nominal wage growth and inflation is not implemented in the
current version of the model. If this connection were implemented, removing
the backward wage indexation would also have reduced Chile's rate of inflation
and reduced the real appreciation of the peso. The effects of the elimination
of the backward wage indexation, then, could have been even more powerful than
shown here.

In the third counterfactual experiment, exogenous capital inflows are
reduced and a flexible exchange rate is allowed to clear the foreign exchange
market. As a result, the current account deficit, foreign savings, and
therefore the rate of GDP growth are all reduced. The model operates here
much as it did in the first experiment.

The fourth counterfactual experiment has two parts. The first
combines the experiments 2 and 3. In other words, it assumes the elimination
of backward wage indexation in 1980 and 1981, a flexible exchange rate
throughout the period, and exogenous capital imports somewhat lower than
actually observed. As in the previous runs the time profiles of the rate of
inflation and the volume of exports are considered to be exogenous. The
second part of the simulation experiment adds to these the assumption that the
domestic savings rate is doubled from 12 percent to 24 percent of after-tax
profits. The result of the first part of the experiment is that real GDP
growth rises from 7.0 to 7.5 percent per annum. When the counterfactual
doubling in the savings rate is added, real GDP growth increases to 8.4
percent per annum. Essentially what is happening in the first portion of the
experiment is that the positive effects of the lower real wage on employment
and investment more than offset the effects of the reduction in foreign
savings due to the decreased capital inflow. The additional savings in the
second part of the simulation has the expected effect of increasing
accumulation and economic growth.

4. Summary

It is important to understand the causes of the current Chilean
economic crisis so that other countries can avoid falling into the same
abyss. An intuitively appealing story concerning these causes hinges on the
conjunction of three factors: large temporary capital imports, the backward
indexation of wages, and the preannounced nominal exchange rates. The
backward indexation of wages in a period of decelerating inflation drove up
real production costs while temporary capital imports served to keep aggregate
demand high. This increase in production costs coupled with the fixed nominal
exchange rate led to a serious decline in Chile's international competitive
position which served to widen the current account deficit. Eventually this
deficit became sufficiently large that foreign investors became pessimistic
and capital imports evaporated. Without the capital imports, a foreign
exchange crisis ensued.

We believe that the authors have posed an interesting and important
problem and have very good insights into it. The next version of the model
should allow them to assess these insights in a more comprehensive manner.
IV. 8 A Preliminary CGE Model for the Ivory Coast */

1. The Problem

Until recently, the economic performance of the Ivory Coast has been spectacular. In its first two decades after independence its GDP grew at a 7.5 percent annual rate. In 1981 per capita GDP in the Ivory Coast stood at US$1,200, the highest among the sub-Saharan developing countries. Over the past decade, however, the Ivory Coast suffered the same set of shocks that rocked oil-importing countries everywhere. In addition, the Ivory Coast experienced a coffee and cocoa boom in 1976-77 followed by a 40 percent decrease in its terms of trade when the boom ended in 1978. These recent shocks have generated a rapid financial deterioration and a severe economic slowdown, ending most recently in recession in 1981 and 1982.

Ironically, Ivory Coast's economic problems appear to have begun with the coffee and cocoa boom. Under the favorable domestic and foreign conditions engendered by the boom the government embarked on an ambitious investment program financed in part through foreign borrowing. When the boom ended, the investment program continued, and the government increasingly relied on foreign borrowing to cover its deficit. By 1980 net foreign assets of the Central Bank were exhausted. In 1981 the government initiated a drastic policy of financial stabilization, and economic growth came to an end.

The government investment program appears to have had a number of inadvertently pernicious effects on the economy in addition to the direct financial drain. The rapid increase in government investment appears to have resulted in a sharp deterioration in the quality of investment projects leaving the Ivory Coast with much capital stock which is currently

*/ Based on Michel and Noel (1984).
unprofitable to operate. In addition, the rapid investment build-up led to
domestic inflation and a substantial overvaluation of the CFA Franc, causing
the imposition of quantitative import restrictions. The result of the
overvalued currency and the import restriction was a bias against exports
which further aggravated the Ivory Coast foreign exchange problem.

2. The Model

The Ivory Coast project is being pursued by Gilles Michel and Michel
Noel at the time this report is being written up. The results of comparative
static simulations with an Ivory Coast CGE are not available. These involve
the assessment of various policies, the results of which might be very helpful
in guiding future policy. Dynamic simulations will also become available
shortly. We expect that when the results of the dynamic version of the Ivory
Coast CGE are available, there will be material for rich comparative country
analysis. Because of the coffee and cocoa boom and bust, the Ivory Coast has
experienced many of the same sorts of adjustment problems that have been faced
by oil exporters such as Indonesia and Nigeria, already discussed above.

The Ivory Coast CGE is in the tradition of Dervis, de Melo, and
Robinson (1982). It has three novel features: fixed agricultural prices and a
Stabilization Fund mechanism, quantitative restrictions on some imports, and a
large share of government investment in total investment.

The Stabilization Fund is an institution designed to protect
producers of certain agricultural export crops from large year-to-year changes
in their income because of changes in world market conditions. In the model,
the nominal prices of those crops are set exogenously. The difference between
the nominal prices producers are paid and the prices at which the government
can sell the crops result in surpluses or deficits which then become part of
the government budget. This makes the government budget grow rapidly when
export crop prices increase rapidly and shrink just as rapidly when those prices fall.

Quantitative import restrictions are sector-specific quotas, some of which are currently binding, some of which are not. These restrictions produce a rent which is separately accounted for in the model and distributed to 'urban high-income' households, which are assumed to include all license holders. (p. 28).

In 1980 public investment accounted for over three-fourth of total investment. As a result, investment and savings balance can be treated like a public policy decision. In the Ivory Coast CGE the government has the choice of implementing a given public investment program and altering its savings rate consistently or the alternative of tailoring the level of public investment to the quantity of savings in the economy.

3. Some Early Comparative Static Results

The Ivory Coast is a member of the West African Monetary Union (with Benin, Niger, Senegal, Togo, and Upper Volta) which centralizes foreign currency reserves and issues a single currency, the CFA Franc, overvalued from the point of view of the Ivory Coast.

One set of experiments performed with the Ivory Coast CGE focuses on the effect of a devaluation. The basic simulation takes as a target a reduction by half in the balance of payments deficit and asks what magnitude of devaluation and GDP decrease could be necessary to get there. The answer is that a halving of the deficit could take a 9.5 percent real devaluation and a decrease in GDP at market prices of 2.0 percent. Private consumption, however, must fall by 4.8 percent. Extensive sensitivity analysis suggests that a reasonable range for the likely exchange rate adjustment would be between 8 percent and 10 percent.
A second set of experiments involves maintaining a fixed exchange rate, but reducing the balance of payments deficit by half through a policy of increasing tariffs, providing export subsidies, and equalizing the Corden measure of effective rates of protection across industrial sectors. The model shows that the desired effect can be achieved through an increase in the average tariff level of 77.9 percent and a 57.8 percent subsidy on industrial value-added. Under this policy GDP falls by 2.1 percent and private consumption by 4.0 percent. As in the previous experiments, extensive sensitivity analysis is also performed.

Two sorts of experiments were undertaken to ascertain the effects of eliminating quotas in the textile sector. Once again, both start with the goal of halving the balance of payments deficit. In the first experiment quotas on imports are replaced by import surcharges adjusted so that textile imports remain unaffected and the exchange rate is allowed to adjust freely. In this case a devaluation of 10.9 percent is required, real GDP at market prices falls by 1.4 percent and private consumption falls by 4.8 percent. In the second experiment everything is the same as in the first case except that the quotas are not replaced by import surcharges. Under this scenario, the exchange rate must depreciate by 10.7 percent, real GDP at market prices falls by 0.9 percent, and private consumption falls by 4.0 percent.

Of the policies reviewed here to reduce the balance of payments deficit, devaluation coupled with the removal of textile quotas appears to be the most preferable in terms of its impact on GDP and on private consumption. There appears to be no way to reduce the deficit without decreasing living standards, but a devaluation coupled with a simultaneous removal of various policy distortions seems likely to cause the least pain.
4. Summary

The Ivory Coast CGE project is very promising. The careful comparative static analyses done thus far is certainly to be applauded. The recent history of the Ivory Coast seems to indicate that poor economic policies can turn the good fortune of two years of high export prices into an economic disaster. Something quite similar happens in Gelb's model of Indonesia. Hopefully, the comparative dynamic runs should tell us whether Gelb's prescription in such cases—to invest a substantial fraction of the short-term windfall abroad temporarily—would have led to better economic performance.

V. External Shocks and Adjustment Policies: What Have we Learned?

The World Bank models discussed in this report provide a variety of interpretations and assessments of adjustment policies to external shocks. Some of these interpretations confirm conventional wisdom, some reject conventional wisdom, and some appear to contradict one another. The time has come to make an overall assessment.

Perhaps the best place to begin is to establish "conventional wisdom," and for this purpose it might prove helpful to return to a World Bank document discussed in Section III. Balassa and McCarthy (1983) list seven policy actions that can be undertaken to adjust to adverse external shocks: devaluation, restrictive monetary policy, fiscal restraint, raising real interest rates, raising domestic energy prices, trade policy, and modifying domestic agricultural price policies. The authors assign numerical scores to particular policy actions taken by individual countries using a scale of +2 ("good" policy) and -2 ("bad" policy). No explicit macro-models underlie
these policy scores, but an implicit conventional wisdom has guided the assessment. How do these eight countries score according to World Bank conventional wisdom.

Table 15 reports the Balassa/McCarthy policy scores. In terms of overall policy performance between 1979 and 1982, Thailand and Turkey look "very good"; Korea, Ivory Coast, and Yugoslavia look "good"; Chile and Indonesia look "bad"; and Nigeria looks "very bad." Furthermore, there is a positive association between small shocks and good policy among the oil importers, although Chile is an exception. Finally, while monetary, trade, energy price, and agricultural price policy get relatively good scores for the oil importers, exchange rate, fiscal, and interest rate policy get relatively bad scores.

There are, of course, limitations to the policy assessments summarized in Table 15. The size and the character of the shocks should influence the policy assessment. By their very nature, some policies yield longer lags between shock, action and impact. Policies are interdependent and the net impact of various packages can be quite different even though average scores may turn out the same. Different policies have very different quantitative impact depending on the policy itself as well as the structure of the economy, and the scores in Table 15 make no explicit effort to weigh each of the policy actions accordingly. And, of course, there is no explicit model underlying the assessment.

There is another association which the data in Table 15 invites. What about the correlation between good policy and high growth rates? Among the six oil importers, the correlation between good policy and high growth rates is even weaker than between good policy and small shocks, but there is the suggestion.
Table 15  Adjustment Policy Performance Scores According to World Bank Conventional Wisdom, 1979-82

<table>
<thead>
<tr>
<th>Country</th>
<th>External Shock Share in GDP (percent)</th>
<th>GNP Growth Rate (percent per annum)</th>
<th>Overall Policy Performance Score 1/</th>
<th>Exchange Rate Policy</th>
<th>Monetary Policy</th>
<th>Fiscal Policy</th>
<th>Interest Rate Policy</th>
<th>Energy Price Policy</th>
<th>Agricultural Policy</th>
<th>Trade Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>9.0</td>
<td>3.2</td>
<td>+1</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>+2</td>
<td>0</td>
<td>+1</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>7.2</td>
<td>2.6</td>
<td>+1</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>+1</td>
<td>+1</td>
<td>+1</td>
<td>0</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>3.6</td>
<td>2.3</td>
<td>+2</td>
<td>+1</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>+2</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.4</td>
<td>5.6</td>
<td>+4</td>
<td>0</td>
<td>+1</td>
<td>-1</td>
<td>-1</td>
<td>+2</td>
<td>+2</td>
<td>+1</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.7</td>
<td>1.8</td>
<td>+6</td>
<td>+2</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>+1</td>
<td>+1</td>
</tr>
<tr>
<td>Chile</td>
<td>1.8</td>
<td>1.7</td>
<td>-1</td>
<td>-2</td>
<td>-1</td>
<td>+1</td>
<td>0</td>
<td>-2</td>
<td>+2</td>
<td>+1</td>
</tr>
<tr>
<td>Average: oil importers</td>
<td>4.6</td>
<td>2.9</td>
<td>+2.2</td>
<td>-.2</td>
<td>+.5</td>
<td>-.2</td>
<td>-.2</td>
<td>+.7</td>
<td>+.8</td>
<td>+.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-7.8</td>
<td>6.3</td>
<td>-1</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>-1</td>
<td>+1</td>
</tr>
<tr>
<td>Nigeria</td>
<td>-10.2</td>
<td>-0.3</td>
<td>-6</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>+1</td>
<td>-1</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>Average: oil exporters</td>
<td>-9.0</td>
<td>3.0</td>
<td>-3.5</td>
<td>0</td>
<td>-.5</td>
<td>-1</td>
<td>+.5</td>
<td>-1</td>
<td>-1.5</td>
<td>0</td>
</tr>
</tbody>
</table>

1/ The sum of all seven policy scores.

Source: Balassa and McCarthy (April 1983), Tables 2 and 4.
How can we sort out the influence of policy action, the character of external shocks, and other influences on economic performance in these eight countries? The eight macro-models reviewed in this report can provide an answer to that question, and what follows is an overall assessment of what those models have to say about the same seven policies listed by Balassa and McCarthy.

Exchange Rate Policy

All of the countries in the sample followed some sort of managed exchange rate policy over the 1970s and early 1980s. These policies included fixing the nominal exchange rate with respect to some reference currency, fixing the real value of the exchange rate with respect to the country's main trading partners, and announcing the future course of the exchange rate between the domestic currency and the reference currency. While all of the country models deal with exchange rate policy in some way, six provide simulation analyses of various aspects of exchange rate policy. On the basis of these models, two issues are addressed below: (1) the relationship between economic performance and currency overvaluation, and (2) the extent to which an overvalued exchange rate can in fact be corrected by a nominal devaluation.

The models suggest that overvalued currencies have indeed played a role in contributing to economic difficulties. That conclusion is tentative, however, since none of the models reviewed provide any simulations of economic performance under alternative exchange rate policies. Such simulations are necessary to provide more confident answers.

The available quantitative information on currency overvaluation and economic performance is summarized in Table 16. Three CGE models have been asked precisely the same question: How large a real devaluation would have been required to clear foreign exchange markets given the existing structure
### Table 16 The Extent of Currency Overvaluation and Economic Performance

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Turkey</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Currency Overvaluation 1/ (in percent)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Real GDP Growth Rate 2/ (in percent per year)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Yugoslavia</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Currency Overvaluation 3/ (in percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real GDP Growth Rate 4/ (in percent per year)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Ivory Coast</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Currency Overvaluation 5/ (in percent)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real GNP Growth Rate 6/ (in percent per year)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1/ Lewis and Urata (1983), Table 3.13, p. 40. Currency overvaluation is calculated using actual exchange rates and the market clearing rates computed from the Turkey CGE model ("Experiment 1").

2/ Lewis and Urata (1983), Table 3.4, p. 23. GDP growth rates refer to the growth between the given year and the subsequent year.

3/ Bery et al (1982), vol. 2, Table 4.12, p. 89. Currency overvaluation is calculated using actual exchange rates and the market clearing rates computed from the Yugoslavia CGE model.


5/ Michel and Noel (1983), Table 3.2, p. 47. Currency overvaluation is calculated using the actual exchange rate and the market clearing rate computed from the Ivory Coast CGE model.

of tariffs and subsidies? The resulting estimates along with GDP growth rates are provided in the Table. The correlation is certainly suggestive.

Turkish economic growth was interrupted by a foreign exchange crisis which began at the end of 1977. In 1978, the Turkish lira was overvalued by 58 percent and real GDP growth between 1978 and 1979 was -0.6 percent. In 1979, the lira's overvaluation grew significantly worse and economic performance deteriorated even further. The devaluation and other reforms in 1980 markedly reduced the lira's overvaluation and economic growth resumed.

Yugoslavia's experience was similar. The economic policies of 1977 stimulated GDP growth—it was 8.4 percent between 1976 and 1979 and 8.3 percent between 1977 and 1978. The dinar became progressively more overvalued after 1977 reaching 42 percent by 1970, a foreign exchange crisis ensued, and economic growth sagged.

Table 15 reveals that external shocks were of similar magnitude for Turkey and Yugoslavia over the 1979-81 period. Table 16 shows that similarity in these shocks did not imply similarity in the magnitude of foreign exchange disequilibrium. Turkey's currency was far more overvalued in the late 1970s than was Yugoslavia's. We also learned from Table 15 that Turkey had a higher exchange rate policy score than did Yugoslavia. The data in Table 16 suggest that greater policy efforts were indeed in order for Turkey since their exchange rate problem was more severe.

The Ivory coast offers only a single observation concerning the extent of the overvaluation. Around 1980, the CFA franc was overvalued by 20 percent and real GNP growth was 3.2 percent per annum. It is interesting to note that in 1980, before the Ivory Coast's more serious economic problems emerged, the overvaluation of the CFA franc had not yet reached a level which was associated with foreign exchange crises in Turkey and Yugoslavia.
The quantitative evidence available for Chile is not comparable to the three countries just discussed, but the evidence we do have suggests that exchange rate policy contributed to Chile's economic problems. Among all eight countries in our sample, Chile experienced the worst economic difficulties—a 12.9 percent reduction in GDP in 1982. Starting in June 1979, Chile maintained a policy of preannounced devaluations. With nominal exchange rates fixed in this manner, combined with a newly deregulated capital market, there ensued a massive capital inflow. Strong aggregate demand effects resulting from these capital inflows, and backward wage indexation combined to generate substantial cost of production increases. The overvalued peso did so much damage to Chilean producers of tradeable goods that imports increased by 14.8 percent in 1981 while exports actually fell by 5.2 percent. When capital inflows decreased dramatically in 1982, Chile was left with an inflexible exchange rate and a level of production costs which was suddenly much too high. Either nominal level of production costs or the exchange rate had to adjust, but neither did until it was too late. The economy collapsed before the fixed nominal exchange rate policy was abandoned.

While currency overvaluation seems to have played some role in the economic difficulties experienced by a number of countries, can overvaluation be corrected by nominal devaluation? A real devaluation can, by definition, eliminate overvaluation, but the ability of a nominal devaluation to achieve that end is not so clear. A nominal devaluation causes inflation which in turn leads to higher nominal wages. This, combined with the increased price of imported intermediate goods, causes the nominal price of domestically produced goods to rise offsetting the effect of the devaluation. If the dynamic adjustment process is such that most of the effects of the nominal
devaluation are eroded, then it may take an unrealistically large nominal
devaluation to achieve any significant effects on the current account.

Most of the models here cannot be used to assess the dynamic effects
of a nominal devaluation since they were designed to deal only with real
variables and therefore cannot capture the effects of past inflation on
changes in future wages and prices. The Nigerian model, however, considers
both real and nominal variables and offers a quantitative assessment of the
dynamic effects of a nominal devaluation. The structure for the Nigerian
economy cannot be taken as representative, of course, but the results of the
model are still instructive.

One experiment performed with the Nigeria model explores the impact
of a 30 percent devaluation in 1984 on economic performance in 1986. The
devaluation increases the rate of economic growth from 2.8 percent to 3.6
percent and reduces the current account deficit by 24.1 percent. The overall
cost of the devaluation appears to be small. Real wages are about 3 percent
lower by 1986 than they would have been without the devaluation, although the
short-run effect on real wages is far larger.

The Thai model assesses nominal exchange rate policy more
obliquely. The change in the nominal wage rate is not linked explicitly to
changes in the price level, but policy packages are explored which combine
devaluations and wage rate changes. One policy package assumes a 5 percent
devaluation in 1986 with a 5 percent increase from 1986 onwards in the nominal
wages of normal sector workers and a 5 percent increase in direct taxes. This
policy increased the rate of GDP growth in 1989 from 8.1 percent to 8.7
percent per annum and decreases the current account deficit by 11 percent. An
alternative policy package envisions the same devaluation, but only a 2
percent increase in real wages and direct taxes. In this case, GDP growth
goes up to 8.9 percent per annum and the current account deficit decreases by 19 percent.

The models reviewed here offer results consistent with conventional wisdom. Nominal devaluations of a feasible size seem likely to augment growth while serving to diminish current account deficits.

**Trade Policy**

Three of the models consider trade policy. The Yugoslav model merges the effects of tariffs, export subsidies, and informal import rationing devices in computing the domestic resource costs of earning one dollar of foreign exchange through exports and of saving one dollar of foreign exchange through import substitution. The results are striking. In many sectors it costs two to three times as much in domestic resources to obtain foreign exchange through import substitution than it does through exports. Clearly, Yugoslavia could obtain foreign exchange at much lower cost if it were to reorient its trade policies in a direction less biased against exports. Even more striking, however, is the domestic resource cost of saving a unit of foreign exchange through import substitution in comparison with the value of that foreign exchange. The Yugoslav CGE model shows that in many sectors it costs more to save the foreign exchange than the foreign exchange is worth. Continued import substitution in those sectors decreases rather than increases the economic welfare. It also follows that any effort to remove these distortions would serve to improve the current account and thus ameliorate problems of structural adjustment to external shock.

Two other models deal with the effects of changing trade policy on problems of structural adjustment. In the Ivory Coast model various policies are considered which would reduce the balance of payments deficit by half. One such policy is a pure devaluation while another is a set of trade
policies--increases in tariffs and export subsidies--which serve to equalize rates of effective protection across sectors. The trade policy has virtually the same effect on GDP as the devaluation, but reduces private consumption by less and investment by more. A third policy which reduces the balance of payments deficit by half involves devaluation coupled with the removal of textile import quotas. This policy is the best of the three considered in terms of its effects on GDP, private consumption, and investment. In light of this result, it would be interesting to investigate whether it is generally true that devaluations coupled with the removal of quantitative import restrictions is a superior policy to devaluation alone.

The Nigeria model has been used to study the effects of three sorts of changes in trade policy: an increase in tariffs on capital and intermediate goods, an increase in tariffs on consumption goods, and an increase in export subsidies. The increase in tariffs on capital and intermediate goods increases the rate of growth of real GDP, but also increases the current account deficit. The increase in tariffs on consumption goods has no effect on output growth and reduces the current account deficit. The increase in export subsidies increases real GDP growth and improves the current account deficit. In Nigeria, as in other economies with overvalued currencies, export subsidies provide a useful substitute for devaluation if the latter is politically infeasible.

**Monetary and Interest Rate Policy**

Among the eight models reviewed in this report, only the Korean quarterly model is equipped to assess monetary and interest rate policy. While the results confirm conventional wisdom regarding the impact of such policy on the current account deficit, the model shows that improvements in the deficit are purchased at very great cost.
According to the Korea model, restrictive monetary policy by itself has a relatively conventional impact: the policy produces a current account improvement, an investment contraction, but upward pressure on the price level. Then the restrictive monetary policy is combined with a policy of increasing regulated rates on bank time deposits, all of these influences are reinforced: the policy package produces an even greater current account improvement, a far sharper investment contraction, more growth slowdown, and greater pressure on the domestic price level.

Is a monetary and interest rate policy package of this sort "good" adjustment policy to external shock when the cost is so great? We think not.

Energy Pricing Policy

When faced with an oil price shock, what is the best policy response in terms of the domestic price of energy? The World Bank's usual advice is to get the domestic oil price right." "Good" policy, therefore, is to let the domestic price follow world market prices as closely as possible. Three of the models reviewed in this report confront this conventional wisdom, two reject it, and one confirms it.

In the case of one oil exporter, Indonesia, the model suggests that it is better to transfer public income to the private sector via energy subsidies in the boom phase, even though the policy action may entail a large allocative loss. In the case of one oil importer, the moral is exactly the same. Faced with a rise in energy prices, the best policy for Thailand is to hold firm on domestic energy prices. The net result is to moderate the first-order impact on the current account deficit since private capital inflows decline. Thus, the Thai model suggests that following the World Bank's advice to "get the prices right" would exacerbate current account adjustment problems. In the case of Nigeria, however, the Bank's advice is vindicated:
a rise in the domestic price of energy improves the current account deficit, but at the cost of some growth slowdown.

The policy of "getting energy prices right" may or may not be a good structural adjustment policy. It depends on the economy being considered.

**Fiscal Policy**

Three of our eight models, Thailand, Nigeria, and Korea, deal with the impact of fiscal policy on structural adjustment to external shock. Two of them confirm conventional wisdom, one rejects conventional wisdom, and they all offer a rich variety of insight. The current account is most responsive to fiscal restraint in the Thai model, the Nigerian model offers an intermediate case, and the Korean model suggests that fiscal restraint may even serve to worsen the current account.

The experiments performed with the Thai model actually involve expansionary fiscal policy. The policy serves to worsen the trade balance, but it also generates powerful crowding-out effects; and since foreign capital inflows are allowed to fill the financial gap, the current account deficit worsens still further. It follows that restrictive fiscal policy in Thailand would improve the current account deficit, and at no cost to investment. The Nigerian case is more conventional and less fortuitous. While an equivalent cutback in federal investment expenditures (government consumption expenditures tend to be inflexible downwards) improves the current account deficit by an amount roughly equal to a 30 percent devaluation, investment does suffer, with unfavorable implications for Nigeria's ability to adjust to external shock over the long run. The Korean case is least conventional. Expansionary fiscal policy serves to crowd out private investment, and since capital inflows are not allowed to fill the financial gap, private investment declines roughly one-for-one with the fiscal expansion. Since private
investment is more import-intensive than government expenditures, the current account improves. It follows that in the Korean case fiscal austerity would serve to worsen the current account (although the effect is small), but investment would be fostered.

Is fiscal austerity a good structural adjustment policy? It depends.

Agricultural Pricing Policies

Agricultural pricing policies receive critical attention in two of the models reviewed in this report, those of Korea and Thailand. The cases are certainly interesting and relevant. Both deal with rice pricing policies and both consider the implications of "getting the prices right." While rice production is important in both, one (Thailand) is a net exporter and the other (Korea) is a net importer.

In the case of Korea, the domestic price of rice has been maintained above world market prices for some time in an attempt to subsidize the farm sector. In the case of Thailand, export taxes augment government revenues and lower domestic prices while the price support program burdens the government with expenditures and raises domestic prices. How could the removal of these price distortions affect the current account deficit? The problem is sufficiently complex in the Thai case to make the application of a CGE model essential for any numerical answer, even to assess whether the impact is positive or negative. The problem is less complex in the Korean case but it still requires an economy-wide model to make the assessment.

The following question is asked of the Korean model: How would the current account be affected by the gradual elimination of the differential between high domestic and low foreign rice prices? The decline in domestic rice prices reduces inflation rates and augments the real stock of money, thus having a strong positive impact on investment. In addition, since rice
consumers tend to have higher marginal propensities to consume than producers, the transfer to consumers has a strong positive impact on aggregate consumption as well. The net impact of these expansionary aggregate demand forces is to cause a substantial deterioration in the current account. In Korea, therefore, "getting agricultural prices right" would serve to exacerbate problems of structural adjustment to external shock.

The Thai case is more complex, not only because two policies must be assessed, but also because the elasticity of demand for Thai rice in world markets matters, as does the fact that the policies have an impact on the size of the government deficit, crowding out, and thus foreign capital flows. However, a diminution in the rice buying program has an unambiguous effect on the current account regardless of the price elasticity of demand for rice in world markets—the current account improves markedly. A reduction in the export tax on rice has an impact on the current account which hinges on those price elasticities in world markets. If the elasticity is as low as unity—a case which strikes us as unlikely, then the current account deteriorates. If the elasticity is somewhat higher—say three or ten, then the current account improves. In Thailand, therefore, getting the agricultural prices right is most likely to ameliorate problems of structural adjustment to external shock.

A policy of getting agricultural prices right may or may not be a "good" structural adjustment policy. It depends on the economy being considered.

VI. Unresolved Issues and Future Modeling Efforts

While these World Bank models have contributed much to our understanding of structural adjustment to external shock, they are almost mute
on a number of questions. Three questions seem to us critical in any assessment of effective or optimal policy. First, who pays for the adjustment? Second, what are the intertemporal aspects of the adjustment problem? Third, are our views of what makes good policy altered in a world of uncertainty?

Who pays for the adjustment to external shocks? While some policies clearly perform better than others in terms of balance of payments or growth targets, they may also embody quite different distributional implications. That statement is hardly novel since such distributional issues have been at the heart of most Third World debates for some time. However, it seems odd to us that most of these reports make little effort to assess the distributional implications of various policies even when the models are equipped to supply explicit answers. While the Korea model was not designed to offer distributional insights, and while the Nigeria model is capable of supplying insight into changes in only the most limited functional distribution, the remaining CGE models are capable of supplying considerable distributional detail. Yet, only the Thai and the Indonesian documents offer any assessment of "who pays." Whose real consumption is cut most by austerity measures? When government expenditures suffer, aren't the items first to go specific to certain income classes, certain locations, and certain age groups? When domestic relative prices are changed dramatically by a truly effective policy of structural adjustment, which consumers find their consumption baskets rising in price most? We need some answers.

What are the intertemporal aspects of the adjustment problem? Under which policies is an improvement in the current account today purchased at the expense of current account deficits tomorrow? Low rates of investment and capital accumulation today may make it far more difficult to undergo
structural adjustment in the longer term. While this issue is often raised in
the modeling efforts we have reviewed in this report, it deserves a far more
comprehensive attack. True, most of these models were developed to assess
short-run or medium-term adjustment problems, but they all pay explicit
attention to investment. The contrast between them on this issue is
striking. Expansionary monetary policy is judged to be good policy in the
Korean quarterly model, not because it improves the current account (on the
contrary, it causes a deterioration), but rather because it raises investment
while holding down inflation. Investment and a current account improvement
are clearly in conflict. The same is true of the Chile model, but for
entirely different reasons. According to the Chile model, any effort to choke
off foreign capital inflows imparts a sharp reduction in domestic investment.
In contrast, the trade-off seems to be finessed in the Nigerian model. True,
an equivalent cutback in federal investment expenditures yields a balance of
payments improvement roughly equal to a 30 percent devaluation, but fiscal
restraint of that sort does not turn out to be the optimal policy. Instead,
the Nigerian model suggests that sector-by-sector intervention is the best way
to implement short-run structural adjustment, and the intertemporal trade-off
issue does not seem to be central in this case. In the Turkey and Yugoslav
models investment is determined exogenously, so by assumption the inter-
temporal trade-off issue never arises. In the Thai model the issue never
arises either since private formal sector investment is exogenous while
changes in government and informal sector investment tend to offset each other
one-for-one in almost all counterfactual experiments. In a sense, the issue
is assumed away in this case as well. The Ivory Coast model is an
exception. Here adjustment policies are assessed under two views of the
world, one where investment is exogenous and one where it is not. We need
more careful assessment of adjustment policies under alternative assumptions about "closure" in the saving-investment market. Which adjustment policies are most sensitive to alternative assumptions about saving and investment behavior? We need some answers.

Are our views of what makes good policy response to external shocks altered in a world of uncertainty? All of these models are equipped to assess past policy performance given that price shocks are known with certainty. However, the future is not known with certainty in 1984 nor was it known with certainty in 1974. How are we to assess good policy adjustment to external shocks in the past when the full magnitude and permanence of the shocks were unknown? Nowhere is this issue more apparent than in the Indonesian model. Here an oil exporter model offers superb insight into optimal long-run policy under assumptions of certain knowledge of the price of oil over two decades. But are we to offer such advice to Indonesia, which faces uncertain oil price conditions up to the year 2000? Caution may be an excellent rule of thumb under uncertain conditions, but can we do better with these models by exploring their implications in a stochastic price environment? We need some answers.
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