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POLICY IMPLICATIONS OF AN OIL SHOCK IN FIJI, TONGA, AND VANUATU

by

Mark Sturton
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January 1992

Pacific Islands Development Program
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## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Tables</td>
<td>iv</td>
</tr>
<tr>
<td>List of Figures</td>
<td>v</td>
</tr>
<tr>
<td>Foreword</td>
<td>vi</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>vii</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>The Potential Magnitude of an Oil Shock</td>
<td>4</td>
</tr>
<tr>
<td>Stabilization and Adjustment to an Oil Shock</td>
<td>8</td>
</tr>
<tr>
<td>A Reduction in the Demand for Tourism</td>
<td>20</td>
</tr>
<tr>
<td>Conclusion</td>
<td>23</td>
</tr>
<tr>
<td>Appendix: The SAM Based Models</td>
<td>25</td>
</tr>
<tr>
<td>References</td>
<td>33</td>
</tr>
</tbody>
</table>
List of Tables

Table 1. GDP by activity (% change on pre-oil price shock levels) 9
Table 2. Price indexes (% change on pre-oil price shock levels) 10
Table 3. Expenditure on GDP (% change on pre-oil price shock levels) 15
Table 4. Government budget (% change on pre-oil price shock levels) 16
Table 5. Balance of payments (% change on pre-oil price shock levels) 18
Table 6. Monetary survey (% change on pre-oil price shock levels) 19
Table 7. Impact of reduction in tourism on GDP (% change on pre-oil price shock levels) 20
Table 8. Impact of reduction in tourism on budget (% change on pre-oil price shock levels) 21
Table 9. Impact of reduction in tourism on balance of payments (% change on pre-oil price shock levels) 22
List of Figures

Figure 1. Comparison of crude oil prices with Fiji fuel import prices c.i.f.: 1970=100, 1970-78 4

Figure 2. Comparison of crude oil prices with Fiji and Tonga fuel import prices c.i.f.: 1970=100, 1970-78 5

Figure 3. Tourist arrivals into Fiji, 1970-90 7

Figure 4. Rates of inflation in Australia, Japan, and selected Pacific islands, 1971-90 13
Foreword

This report is the third in a series of country reports relating to the Pacific island economies. The series is intended to fill the existing gap of available material about economic performance, policy, and prospects in the region. Because the economic survey reports issued by international agencies often have a restricted circulation and are not in the public domain, PIDP's new series is designed to improve the awareness of the economic problems and circumstances facing the Pacific island countries today.

This report in the series focuses on the impact of an oil shock on the Pacific island economies and discusses appropriate policy responses. The research arose out of the concern expressed by the Pacific island leaders during the January 1991 Standing Committee Meeting about the consequences of the gulf crisis during the second half of 1990. While the crisis has now passed, the potential volatility in oil markets makes the issues raised in this report relevant for the future.

Sitiveni Halapua
Director
Pacific Islands Development Program
Executive Summary

The rapid rise in oil prices and the uncertainty that followed the Middle East crisis after the invasion of Kuwait raised the questions of what would be the implications for the Pacific island economies and what would be an appropriate policy response. Although the urgency of an answer to these questions has been overcome by the resolution of the crisis, the potential volatility of oil markets nevertheless means the issues remain pertinent.

This report begins by defining the characteristics of an oil shock from a Pacific island perspective and continues by exploring its impact. An oil shock is defined as a rapid rise in oil prices, accompanied by accelerating inflation, but stagnation in primary commodity prices. Tourism is an important component of many Pacific island economies, and a reduction in visitors is considered a major component of an oil shock.

The impact is examined of an oil shock on three Pacific island economies: Fiji, Tonga, and Vanuatu. All three economies would experience a deterioration in the terms of trade, reduced incomes, deterioration in the balance of payments, worsening of the public sector deficit, inflation, and loss in competitiveness. The results suggest the impact is greater in the Pacific islands than in the developed metropolitan economies, which is largely due to the dependence of the farmer on oil as the main source of energy. There is little the island economies can do to avoid these consequences, given their resource endowments, although recent petroleum discoveries in Papua New Guinea and hydro-electric power in Fiji can ameliorate the situation.

This analysis suggests that the overall response should be flexible and market oriented, incorporating elements that augment the thrust of existing reforms. Stabilization is investigated through a deflationary monetary policy. Equilibrium in the external account is restored but is accompanied by a reduced rate of investment and further deterioration in the public sector deficit. This situation is not satisfactory, and fiscal policy is seen as a necessary and major companion in the adjustment process. The increased level of domestic costs, but stagnant prices for primary commodities, infers a loss in competitiveness. Exchange rate depreciation is considered but, given labor market rigidity, not recommended.
The analysis is conducted using a series of economic models as the means to investigate the impact of the increased price of petroleum products, declining demand for tourism, and adjustment policies. The economic models use the Social Accounting Matrix (SAM) as the basic database around which they have been constructed. However, the orientation of these models is short term in nature, and although containing many elements of the standard Computable General Equilibrium (CGE) framework, they do not fully conform to the standard. Experiments are conducted using comparative static techniques.
This paper analyzes the impact of an oil shock on three economies of the South Pacific, Fiji, Tonga, and Vanuatu, and discusses appropriate policy responses. The main consequence of an oil shock is a rise in the price of petroleum and accelerated inflation in the developed countries. Given a dependence on a narrow range of primary commodity exports—with prices that are determined in the metropolitan nations and that are unlikely to rise after an oil shock—the Pacific islands will face a deterioration in their terms of trade. The reduction in the terms of trade will be associated with falling real incomes, and if it becomes permanent, economic adjustment to the new conditions will be required. If the change in the external environment is only temporary, adjustment may be avoided, but such a policy incurs the risk of more painful adjustment at a later stage should this assessment prove incorrect.

The initial impact of an oil price hike will be a deterioration in the balance of payments and an increase in the public sector's deficit. The balance of payments deterioration may be counterbalanced through restrictive monetary policy to restrain demand. However, much of the additional demand for credit will arise from the public sector's increased borrowing requirement as revenue falls short of expenditures. If the burden of adjustment is to be shared equally between the public and private sectors, expenditure reduction and fiscal policy will be an important component of the response. In economics where it is recognized that the public sector is over-inflated and new policies of economic reform emphasize private initiatives, it is critical to design a response that dovetails with existing initiatives.

With increases in costs of production associated with an oil shock, but weak anticipation of a favorable improvement in export prices, a loss of competitiveness must be expected. A potential policy response to this outcome would include currency depreciation, which would reduce domestic costs, particularly of labor, and improve profitability. However, the success of this initiative would depend critically on the extent to which labor could be influenced to accept reductions in real living standards. Labor market conditions have been particularly inflexible in the Pacific island economies, although reforms are now taking place in Fiji and Papua New Guinea. Before exchange rate adjustment can be seriously included in the policy response to an oil price shock or terms of trade deterioration, successful implementation of these reforms is essential.
In this paper the impact of an oil shock on the Pacific island economies is initially examined without any adjustment. It is then assumed that adjustment to the terms of trade deterioration is accomplished through monetary policy and credit constraint, effectively reducing the rate of investment. The consequences for the public sector deficit and the impact on prices and the exchange rate are discussed. Although changes in fiscal and exchange rate policy are not projected, discussion indicates that they would need to form part of any actual adjustment package applied in the Pacific island economies.

The definition of what constitutes a typical oil shock, such as occurred in the 1970s or more recently after the invasion of Kuwait, is problematic. The two crises that occurred in the early and late 1970s were accompanied not only by a substantial rise in the price of petroleum products but also by global recession. In the more recent crisis the price effect was short-lived, but the ensuing recession became entrenched. In this paper interest is restricted to (1) the impact of a typical oil shock on rising oil prices and (2) the recessionary consequences of a reduced demand for tourism on the selected economies.

The focus on only two consequences of an oil shock is necessarily limited. Past crises have had important implications for foreign investment, foreign aid, and demand for island exports. Given the difficulties in quantifying the potential size of the impact on any of these factors, they have been ignored in the following analysis. Clearly, inflation in the metropolitan nations has been the major implication of oil crises in the past. For the Pacific islands tourism has also been a sector highly susceptible to the international economic climate and has experienced falling demand during the earlier oil shocks. The extreme sensitivity of demand for tourism to variation in world incomes (high income elasticity), while providing a strong generator of growth in times of prosperity, renders the island economies vulnerable in times of international recession. The remoteness of the island economies means that these economies are particularly susceptible to changes in air fares due to changes in the price of aviation fuel, as well as to fear of international terrorism. While the discussion limits interest to only two elements of a shock, it is hoped that this will provide a general reference point for further analysis.

The following analysis uses a set of economic models (Sturton 1989a, 1989b, and 1991a) to investigate the impact of the increased price of petroleum products and the decline in demand for tourism. The economic models use the SAM as the basic database around which they have been constructed. However, the orientation of these models is short term in nature; although containing many elements of the stan-
standard CGE framework, they do not fully conform to the standard. The reader can refer to the Appendix for a qualitative discussion, while greater analytical detail will be found in the texts cited above.

At the time of writing the urgency to explore the potential impact of an oil shock has been overcome by the resolution of the crisis, but the potentially volatile nature of petroleum markets makes the subject one where interest may well arise at any time in the future. In particular, it is useful to have on hand a considered discussion of the policy options open to the governments of the island economies that can be quickly brought into use when necessary.

The first section of this paper gives a brief discussion of the impact of previous oil shocks on the Pacific island economies. The purpose is to define the magnitude of a potential oil shock, and the appropriate size of the exogenous variables to which the economic models should be subject. The second section investigates the impact of the shock on oil prices. The discussion assumes Pacific island governments adopt two different responses: the first assumes that governments make no attempt to adjust to the deterioration in the external terms of trade, while the second assumes governments attempt to stabilize the external account through monetary restraint. The third section of the paper repeats the analysis based on the added assumption of a decline in the demand for tourism.
The Potential Magnitude of an Oil Shock

Three assumptions can be made about the impact of an oil shock on international prices. The first is the impact of increasing crude prices on fuel import prices; the second is the generated world inflation, which increases the prices of manufactured imports in the Pacific island economies; and the third is the effect on other commodity prices such as sugar, copper, fish, and timber.

Background

Not all of the rise in crude prices will be transmitted into the price of fuel imports c.i.f. due to the inclusion of refining, distribution, and freight in the total cost of fuel imports. Figure 1 indicates the relative movement of crude and import prices c.i.f. into Fiji after the 1973 shock. Figure 2 indicates similar movements after the 1979 shocks for both Fiji and Tonga. The two graphs show accord in the movement of crude and c.i.f. prices and indicate the extent to which domestic fuel prices followed changes in crude prices after the two oil shocks of the 1970s.

Dampened response in fuel prices in 1973

After the 1973 oil shock, crude prices rose tenfold while import prices rose between four and five times. This reflects the relatively low proportion of crude in the total value of fuel imports before the first oil shock. After the 1979 shock, crude prices trebled, but Figure 2 reveals that fuel import prices adjusted immediately in both Fiji and Tonga.

Figure 1. Comparison of crude oil prices with Fiji fuel import prices c.i.f.: 1970=100, 1970-78
and that there was no dampening effect due to the non-fuel components in the structure of refined products. This difference, as shown in Figures 1 and 2, could arise from various factors. First, it would be reasonable to assume that the cost of crude in refined products had already risen substantially by the second oil shock, thereby making adjustment more rapid. Second, the data are consistent with profit taking by the oil distribution companies supplying the Pacific islands; an immediate upward adjustment occurs in prices beyond that required to compensate for the rise in crude.

However, both Fiji and Tonga put in place elaborate price controls during the 1970s (effectively markup regulation), which could also have generated the observed response. If this is indeed the case, it provides a clear example of regulation leading to an undesirable outcome.

Assumption 1: increasing oil prices

The first assumption is that any oil shock would be matched by an immediate and proportionate rise in refined c.i.f. import prices. As a typical rise in crude prices after an oil shock, the impact of a 100 percent increase is investigated.
Assumption 2: world inflation

In a consideration of the impact on world inflation, the second assumption is that non-fuel non-commodity import prices will rise by 2 percent. The U.S. Federal Reserve was reported in the *Economist* magazine of late 1990 as stating that a rise in the price of crude from $17 to $30 a barrel would increase inflation in the United States by 1 and 1/2 to 2 percent. In line with the assumption of a doubling of oil prices, it would be fair on this basis to allow for a 2 percent increase in the cost of imports of manufactures into the Pacific islands.

Assumption 3: unchanged commodity prices

The third assumption is that non-fuel commodity prices of Pacific island exports remain unchanged. After the 1973 oil shock, primary commodity prices rose relative to manufactured exports in line with the worldwide commodity price boom experienced at that time. Subsequently, the boom in commodity prices subsided, and by 1976 relative prices were the same as before the crisis. After the second crisis in 1979 there was again a hiccup in commodity prices, but by 1982 and 1983 commodity prices were down 15 percent relative to manufactured prices. During the 1970s and 1980s the Pacific island terms of trade deteriorated (Sturton 1991b), and the prices of primary commodity exports of the Pacific islands stagnated, in accord with this assumption.

Declining terms of trade

Given the economic structure of the Pacific islands as primary commodity exporters and importers of oil and manufactures, this set of three assumptions translates directly into a situation of declining terms of trade.

Oil shocks and tourism

Limited evidence exists of the oil shocks of the 1970s on tourism in the selected Pacific island countries. Although data exist for Tonga and Vanuatu, the tourism market for these countries is thin, and it would not be appropriate to draw conclusions from the available statistics. Fiji has developed a more mature and sizable tourism sector, and analysis is on firmer ground. Figure 3 provides movements of tourist arrivals into Fiji during the 1970s and '80s. In the case of the first oil shock the ensuing international recession had a pronounced effect on the demand for tourism, and arrivals fell by 13 percent in 1985 compared with those in 1973. The second oil shock had a much more limited impact, and the trend in visitor arrivals flattened without any fall in numbers.
Interestingly the trend in arrivals after the 1990 gulf crisis showed little impact on the demand for Fiji's tourism during the later part of 1990 and the first quarter of 1991 when the crisis was the most severe. Only during subsequent months did the demand fall significantly with the figures for April and May dropping 17 percent from the same months of the previous year. The drop in arrivals in this period was strongly associated with the recession in Australia. In the case of Vanuatu, Sturton and McGregor (1991b) suggest that there was no downturn in tourism subsequent to the recent gulf crisis. Although Vanuatu is wholly dependent on Australia for the generation of its tourists, a degree of product differentiation exists insulating demand. This said, a 10 percent decline has been chosen as the benchmark to examine the impact of a reduction in tourism on the island economies. The above discussion suggests that only a very severe recession of the type experienced after the early oil shocks of the 1970s is likely to generate this degree of severity. However, it serves as a reference point in the following analysis.

The choice of the size of the simulated oil price shock on the model economies is necessarily arbitrary but in line with what might occur. The main emphasis in the paper is, however, to frame the consequences that would occur regardless of the actual size of an oil shock and to generate a discussion of the appropriate policy response.
Stabilization and Adjustment to an Oil Shock

Scenario 1: no adjustment
In this section the model economies will be subjected to a doubling of oil prices and a 2 percent rise in the prices of imports of manufactures. The economies will be compared before and after the shock. Two different simulations will be presented. The first assumes that private enterprise sticks to its investment plans and that governments do not reduce real outlays in the face of a deteriorating economic climate. The inflationary impact of the rising fuel prices will reduce consumers' real incomes and consumption outlays, but other expenditures are assumed unaltered. In this scenario the rising level of imports is moderated by a fall in consumer demand, but one that is insufficient to ward off a deterioration in the balance of payments. It is assumed that monetary policy is accommodating and validates the rising demand for credit in both the private and public sectors.

Scenario 2: adjustment
In the second scenario a policy of economic stabilization is adopted, and the economy is adjusted to the deterioration in the terms of trade. The original level of foreign reserves and the current account balance are maintained through credit constraint. The economic model is medium term in orientation and adopts a monetary position with regard to the external account. It assumes that in a small open economy with fixed exchange rates and undeveloped capital markets, the demand for money determines supply. Of course, in the short-term a reduction in foreign reserves (as in this case) leads to a fall in money supply, but in the medium-term as firms and households attempt to rebuild lost money balances, aggregate demand falls short of supply and leads to an improvement in the external account, and foreign reserves rise restoring monetary equilibrium. The model does not attempt to cover these short-term dynamics but only the medium-term equilibrium position.

The second scenario thus assumes that there is no deterioration in the balance of payments. A tight monetary position is adopted constraining credit and forcing private enterprise to adjust its investment plans. This variant of the model assumes adjustment occurs through revision of private sector investment plans rather than any reduction in government expenditures. The cost of maintaining external equilibrium is obtained through falling investment and lower economic growth. Macroeconomically the closure of this variant of the model is neoclassical in spirit as investors are not allowed to exceed savings availability, whereas the first scenario is Keynesian. In the Keynesian scenario investors maintain their investment targets in the face of a deteriorating economic environment through credit expansion.
The impact on production and GDP

Table 1 indicates the effect of rising fuel prices on output and GDP in the three countries according to the two different policy reactions. If attention is initially focused on the case that assumes no adjustment is made, output falls in all three countries in all economic sectors reflecting reduced real incomes. However, different results are revealed between the countries reflecting differences in economic structure. Constant price GDP falls by 1.1, 3.0, and 4.3 percent in Vanuatu, Fiji, and Tonga, respectively. These differing results represent the degree of integration of the three economies and the extent to which a shock in one part of the system is transmitted throughout the economy. Economically, this is measured by the size of the “multiplier”—the ratio of the initial impact of a shock to the total change. Fiji has the most developed industrial structure and a correspondingly larger multiplier. The reduction in real incomes generated through the rise in oil prices causes a greater fall in GDP compared with the Vanuatu case.

The case of Tonga represents an unusual one in that although its economic structure is less developed than that of Fiji its multiplier is larger. This results from the structure of supply. In Tonga the production of traded goods—commodities that compete in international markets and include primary commodities—plays a relatively minor role and is about half the level of either Fiji or Vanuatu. A large proportion of disposable income is made up from workers remittances and replaces the higher degree of traded goods production that exists in both Fiji and Vanuatu.

Table 1. GDP by activity (% change on pre-oil price shock levels)

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<th>Activity</th>
<th>Without adjustment</th>
<th>With adjustment</th>
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<tr>
<td></td>
<td>Fiji</td>
<td>Tonga</td>
</tr>
<tr>
<td>Export agriculture</td>
<td>-0.4</td>
<td>-1.0</td>
</tr>
<tr>
<td>Domestic agriculture</td>
<td>-6.5</td>
<td>-6.6</td>
</tr>
<tr>
<td>Other primary</td>
<td>-1.7</td>
<td>-7.0</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>-3.3</td>
<td>-5.5</td>
</tr>
<tr>
<td>Construction</td>
<td>-1.1</td>
<td>-0.3</td>
</tr>
<tr>
<td>Tourism</td>
<td>-0.7</td>
<td>-0.3</td>
</tr>
<tr>
<td>Private services</td>
<td>-4.4</td>
<td>-5.8</td>
</tr>
<tr>
<td>Public administration</td>
<td>-0.9</td>
<td>-0.4</td>
</tr>
<tr>
<td>GDP (constant factor cost)</td>
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<td>-4.3</td>
</tr>
<tr>
<td>Real income (terms of trade adjusted GDP)</td>
<td>-6.4</td>
<td>-6.6</td>
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During the last two decades the structure of the Tonga economy has changed substantially with the exportation of labor replacing primary production. The reduced level of traded goods production has been accompanied by a relative rise in significance of production for the home market or production of non-traded goods. Because it has been assumed that primary production and prices are unaffected by the oil shock, output levels will be unaffected in this compartment of the island economies. Under these circumstances those economies with proportionately greater non-traded goods production, such as Tonga, will suffer a higher reduction in GDP in the aftermath of an oil shock.

The sectoral results reveal a variety of different outcomes between the countries that represent the different structures of the economies, different patterns of demand, and the responsiveness of demand to changes in income. In the table an indicator of real income, defined as GDP adjusted for changes in the terms of trade, has also been included. Real income measures the change in purchasing power of a nation's exports due to variation in the terms of trade. In the case of Tonga the loss in real income is about 50 percent larger than the loss in GDP. In Fiji and Vanuatu the fall is much larger. Table 2 indicates that the deterioration in the Pacific island terms of trade is relatively similar in all three economies. The divergence of the results currently being examined can be explained through the relative importance of exports in total supply. In Fiji and Vanuatu exports of goods and services represent a higher proportion of economic activity, and accordingly any given deterioration in the terms of trade will result in a proportionately larger decline in real income.

Reduced credit and investment

Regarding economic adjustment, the results indicate output is reduced as demand diminishes so that external equilibrium is maintained. It has been assumed that this is achieved through monetary policy by restricting credit and hence investment until the balance of payments current account equilibrium is restored. Investment demand is predominantly composed of construction and imports of

<table>
<thead>
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<th></th>
<th>Fiji</th>
<th>Tonga</th>
<th>Vanuatu</th>
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<tr>
<td>Consumer prices</td>
<td>5.0</td>
<td>5.7</td>
<td>3.5</td>
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<tr>
<td>Value added prices</td>
<td>0.7</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Rural-urban terms of trade</td>
<td>-1.7</td>
<td>-0.6</td>
<td>-8.4</td>
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<tr>
<td>Real exchange rate</td>
<td>-2.9</td>
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<td>Commodity terms of trade</td>
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<td>-7.0</td>
<td>-7.0</td>
</tr>
<tr>
<td>Terms of trade (including services)</td>
<td>-6.1</td>
<td>-5.5</td>
<td>-6.1</td>
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capital goods, and the brunt of adjustment is thus likely to be felt in a slumping building industry and reduced imports.

Table 1 indicates significant differences between the countries. In Tonga and Vanuatu GDP falls by an additional 40 percent compared with the case where no adjustment is attempted. In Fiji the fall is larger and the deflationary impact rises by 60 percent. This result stems from Fiji’s greater use of fuel imports compared with the other two economies. The rise in fuel import prices requires a proportionately larger deflationary effort to restore external equilibrium and hence requires a larger fall in output. (In the early 1980s Fiji commenced hydro-electric power generation, but even after this substitution Fiji’s imported energy usage is greater than that of the other two economies.)

Adjustment effort greatest in Fiji

At the sectoral level the results reflect a further reduction in output but with the construction sectors revealing the largest declines. This follows directly from the link between investment and construction activity. The relative decline in construction output between the three economies reflects the level of deflation needed to restore equilibrium. Because the impact of an oil shock is the least in Vanuatu, the required reduction in investment and hence construction activity is the smallest. While the “unadjusted” impact of the oil shock is the greatest on the Tongan economy, the proportion of domestically produced capital goods is highest in Fiji. If this observation is combined with the greater imported energy usage in Fiji, a relatively larger adjustment is needed.

The impact on prices

The structure of the various models for each of the island economies assumes that producers pass on variations in cost and attempt to maintain a constant rate of profit. This assumption implies that prices are independent of demand conditions and will not be influenced either by the fall in real incomes or by the depressing impact of adjustment policies. Under these circumstances the results are the same in the with and without adjustment scenarios. In a CGE model prices would respond to falling demand and equilibrium prices would be lower. There are thus two counter-prevailing movements in prices subsequent to an oil shock: the inflationary impact of higher fuel prices and the deflationary consequences of reduced real incomes. In reality, however, the inflationary consequences of the oil shock will far outweigh the weaker deflationary forces, and the model results should realistically reflect the likely impact.
Table 2 provides a variety of interesting price indicators on the impact of an oil shock on the island economies. Given the importance of both imports and imported fuel in the island economies, the results should come as no surprise. In Fiji imports are approximately 50 percent of GDP, in Vanuatu 59 percent, and in Tonga 65 percent. Fuel imports presently represent about 13 percent of total imports in Fiji, 10 percent in Tonga, and 9 percent in Vanuatu. Following the model assumption that producers pass on cost increases, the projected changes in consumer prices are in approximate accord with expectations. Given that average household energy consumption is proportionately higher in Fiji and Tonga (with the lower per capita income levels in Vanuatu), the relatively lower rise in consumer prices in Vanuatu would also be expected.

If the initial assumption is recalled that a doubling of fuel prices would lead to an approximate 2 percent increase in international inflation, it can be seen that the Pacific islands are likely to experience a proportionately higher rate than the metropolitan economies. Given the almost total dependency on oil products for energy use, the anticipated larger impact on the Pacific islands should be expected. While the developed economies have reduced their dependence on oil products, only Fiji has replaced a sizable proportion of its imports through the production of hydro-electricity.

Comparison with crises in 1970s

How do the model figures compare with the historical experience during the oil shocks of the early and late 1970s? Figure 4 indicates inflation rates during the last two decades in the three island economies and in two major trading partners, Australia and Japan. The graphs clearly indicate the sizable increase in inflation experienced after the two oil shocks, both in the Pacific islands and internationally. If attention is restricted to the more recent oil shock of 1979, inflation rose by 7.5 and 11 percent in Japan and Australia, respectively, at the peak of the crisis. In the Pacific islands inflation rose to 15 percent in Fiji and nearly 30 percent in Tonga and Vanuatu.

Clearly the Pacific islands experience has been stronger than in the more developed economies, which accords with the model results. Given that oil prices trebled during the oil shock of the late 1970s and that accordingly the model figures would need doubling for comparison, the results for Fiji would appear to be overstated while those for Tonga and Vanuatu understated. However, a variety of other forces existed at the time, and comparisons of this nature are not entirely appropriate.
Figure 4. Rates of inflation in Australia, Japan, and selected Pacific islands, 1971-90
Regarding the discussion of Table 2, value added prices rise by a relatively small and similar proportion in all the economies. Value added prices measure the cost of factors used in production, which includes wages and profits. Given the adoption in the model of the small country assumption in the production of exports—that prices are determined in overseas markets over which the typical island economy has no influence—profits get squeezed as intermediate costs rise. However, in other parts of the economy value added prices will rise as producers pass on cost increases. The model assumes that producers of commodities destined for the home market (or non-tradables) are able to pass on increases in cost. Accordingly, the figures presented represent an average in which some have fallen and some have risen. On average value added prices rise marginally.

The rural-urban terms of trade represent a ratio of value added prices between rural and urban activities. Rural production is predominantly agricultural in nature, in which the production of exports and tradables dominates. Conversely, urban production predominantly includes the production of non-tradables, whose prices are free to rise as input prices rise. It should be anticipated that the rural-urban terms of trade will fall subsequent to an oil price shock. The figures in Table 2 show a significant variation throughout the island economies, reflecting the relative importance of export and domestic agriculture in production. In Vanuatu export agriculture dominates marketed production, compared with Fiji and Tonga where there is a higher proportion of agricultural production for the home market. In Fiji and Tonga rural producers are protected from adverse terms of trade movements, and the decline in the rural-urban terms of trade is ameliorated.

The real exchange rate measures the ratio of traded to non-traded goods prices. If domestic prices rise relative to world prices a nation loses its competitive edge, and this is conveniently measured by the ratio of traded to non-traded goods prices. The real exchange rate is accordingly a measure of international competitiveness. As with the earlier discussion of the rural-urban terms of trade, it would be expected that the real exchange rate will appreciate. Non-traded goods prices rise as producers pass on costs. By assumption traded goods prices either remain static as in the case of primary products or rise by 2 percent in the case of manufactures. The country results show the reverse pattern to the rural-urban terms of trade, with Fiji and Tonga experiencing the highest rates of appreciation.

Earlier discussion has indicated that the choice of variation in world prices after an oil shock implies a deterioration in the terms of trade. This ranges between 7 and 8 percent for the selected island econo-
mies. The models incorporate two measures of the terms of trade: the first measure relates to movements in the commodity terms of trade, while the second includes services or more explicitly tourism. Because tourism is a composite activity, which in the main includes the production of activities classified as non-traded, the deterioration in this measure of the terms of trade is less severe.

Final Demands

In Table 3 the impact of the oil shock and adjustment policies is examined by the final demand components of GDP. In the first scenario (the Keynesian without adjustment case) the impact of the oil shock is felt through a reduction in real incomes. With investment demand, public expenditure, and exports all held constant (exogenous), the fall in real incomes is reflected in a reduction in private consumption. This reduction in aggregate demand leads to a sympathetic reduction in imports and indirect taxes (the remaining unconstrained or endogenous variables). The varying country results reflect the intensity of import usage, the magnitude of the multiplier, and the differences in island economic structures.

In the second scenario economic adjustment policies are implemented to bring the external account back into equilibrium. Under the assumptions of the models this is achieved through monetary policy, and a tightening of domestic credit, which reduces investment demand. As discussed in the section on GDP, there is substantial country variation in the size of the reduction in real investment outlays, and the figures reflect the reductions in construction output shown in Table 1. The fall in Fiji and Tonga is the greatest, and a reduction of about 12 percent of investment is required while the adjustment necessary in Vanuatu is 8 percent and less severe. In line with the fall of investment, consumption demands are reduced still further with the

<table>
<thead>
<tr>
<th>Table 3. Expenditure on GDP (% change on pre-oil price shock levels)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Without adjustment</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Private consumption</td>
</tr>
<tr>
<td>Public expenditure</td>
</tr>
<tr>
<td>Investment</td>
</tr>
<tr>
<td>Exports</td>
</tr>
<tr>
<td>Imports</td>
</tr>
<tr>
<td>Less indirect taxes</td>
</tr>
<tr>
<td>GDP (factor cost)</td>
</tr>
</tbody>
</table>
magnitude of the impact reflecting inter-country multiplier differences. The induced reduction in aggregate demand reduces the demand for imports to the extent necessary to restore external equilibrium.

The discussion in this section raises the question of the most appropriate policy response to restore external equilibrium. The second scenario has assumed that adjustment is achieved through reduction in investment via monetary constraint. In developing economies where the rate of investment is held as a key variable to future growth, economic policy may place the burden on other less critical variables. The present discussion has assumed there is no reduction in public expenditures as part of the adjustment package. However, the particularly adverse impact of monetary policy on private investment suggests that fiscal policy should also be considered as a major adjustment mechanism.

Consequences for the Government Budget

The impact of an oil price shock and adjustment policies on the government budget are shown in Table 4. The magnitude of the country responses reflect the changes in GDP and the prices noted in Tables 1 and 2. They can be analyzed as a combination of price and income effects—the rise in fuel and import prices increases ad valorem tax collections, but the reductions in real incomes works in the opposite direction reducing revenue. In Fiji and Tonga the price effect dominates, and total collections rise by 1 and 0.5 percent, respectively. In Vanuatu the income induced demand effect dominates, and the collection of indirect taxes falls by nearly 1 percent.

Because the assumptions of the present investigation subject the island economies to a deterioration in the terms of trade, the effect on direct taxes will be unambiguously negative. While nominal wage rates remain unaffected and profit rates at best remain unchanged,

Table 4. Government budget (% change on pre-oil price shock levels)

<table>
<thead>
<tr>
<th></th>
<th>Without adjustment</th>
<th>With adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fiji</td>
<td>Tonga</td>
</tr>
<tr>
<td>Indirect taxes</td>
<td>0.9</td>
<td>0.4</td>
</tr>
<tr>
<td>Direct taxes</td>
<td>-3.0</td>
<td>-3.0</td>
</tr>
<tr>
<td>Expenditure</td>
<td>2.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Deficit*</td>
<td>-2.7</td>
<td>-2.4</td>
</tr>
</tbody>
</table>

Note * Change in deficit expressed as percent of total revenues
production falls and gross incomes will fall. Hence a reduction in income tax collections. (Profit rates remain unaffected in the production of commodities destined for the home market by assumption but will get squeezed in the production of primary commodity exports.) Due to Vanuatu's tax free haven status there are no direct tax collections.

The rise in expenditures is a wholly price dominated effect because real government outlays are assumed to remain constant. The magnitude of the country results reflects the overall inflationary impact of the oil price shock and the sectoral composition of government expenditures. Under general revenue reducing and expenditure increasing conditions, deficits deteriorate (measured as percent of total revenues.)

With economic adjustment to the new external environment a further reduction in demand is induced to the extent that indirect tax collections become negative in all three island economies. As expected, direct taxes fall still further, but nominal expenditures remain unchanged due to the pricing assumptions of the class of models used. The combined impact of these effects results in a further deterioration in the deficit.

The magnitude of the results in the adjustment scenario indicates that the deterioration of the government deficit would almost certainly require adjustment in fiscal policy, at least in Fiji and Tonga. While the impact of monetary policy corrects the external disequilibrium, it increases the fiscal deficit. Thus a more balanced response should involve a stabilization package with both monetary and fiscal objectives that are designed to restore external equilibrium and improve the public deficit.

The impact on the balance of payments

In Table 5 the consequences for the balance of payments are indicated. In the without adjustment scenario the initial impact of an increase in oil and import prices will clearly be an increase in the value of imports. While the rise in imports in Vanuatu is 4 percent, the increase in Tonga and Fiji is substantial and is 6 and 7 percent, respectively. The specific country results occur from different rates of import and imported fuel usage.

Although the model economies assume the quantity of exports remains constant, the figures in Table 5 show small increases. This arises from the assumptions of the impact of the oil shock on international prices. Although primary commodity prices were assumed to remain constant, prices of manufactures were allowed to rise by 2
Table 5. Balance of payments (% change on pre-oil price shock levels)

<table>
<thead>
<tr>
<th>Without adjustment</th>
<th>With adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiji</td>
<td>Tonga</td>
</tr>
<tr>
<td>Exports</td>
<td>1.3</td>
</tr>
<tr>
<td>Tourism</td>
<td>5.3</td>
</tr>
<tr>
<td>Imports</td>
<td>6.8</td>
</tr>
<tr>
<td>Current account balance*</td>
<td>-3.7</td>
</tr>
</tbody>
</table>

Note * Change in recurrent balance expressed as percent of exports of goods and services

percent. The rise in the value of exports thus reflects the level of primary commodity exports in the Pacific island exports. In recent years both Fiji and Tonga have diversified their export structure significantly with Fiji exporting an increasing proportion of garments and Tonga exporting niche agricultural products. Vanuatu remains a predominantly primary commodity exporter, and the figures reflect these results.

Table 5 also indicates the level of tourism receipts, which are an important component of the external account in the island economies. The figures reflect two important assumptions: first, that real demand remains unaffected by an oil shock and, second, that tourist operators are able to pass on cost increases. In effect it is assumed that island tourism is a differentiated product and enjoys insulation from world competition. The increase in tourist receipts in the balance of payments thus reflects only the change in prices because demand is not changed. These assumptions are unrealistic, and to permit greater realism the impact of falling tourist demand is investigated in the next section.

The clear outcome of these results is a deterioration in the current account of the balance of payments, which has been measured as the increase in deficit as a percentage of imports. In the adjustment scenario it is assumed that the deterioration is considered permanent and that the island economies are stabilized to restore equilibrium. In effect the island economies are deflated until such time as the level of import demand falls sufficiently for the balance of payments equilibrium to be restored. This outcome is revealed in the second set of country data in Table 5.

**Variation of Monetary Conditions**

In Table 6 the monetary consequences of an oil price shock are examined, and discussion first considers the pre-adjustment case. The model for Vanuatu contains no financial intermediation component
and is excluded from the analysis. As elsewhere the discussion can be conveniently divided into a real and price effect. The rise in inflation reduces the value of real money balances, which are subsequently rebuilt in an attempt to maintain their value. However, the oil price shock also imparts a loss in real incomes, which reduces the demand for real money balances. In Fiji the net impact is a rise in nominal balances, but in Tonga the direction is negative because the loss in real incomes dominates the price movement. Based on the information in Tables 1 and 2, the loss in real incomes was larger in Tonga than in Fiji, while the price effect was roughly equivalent.

The need to finance the increased costs of investment plans generates an additional demand for credit, which in Fiji arises mainly from the private sector. (In Tonga data did not permit a disaggregation of credit demands.) The small change in the demand for money coupled with a relatively larger increased demand for credit results in a compensating reduction of foreign assets and a deterioration in the external account.

The second set of figures describing the impact of the adjustment scenario indicates that there is no loss of foreign reserves—this is the objective of adjustment. This result is achieved through restricting domestic credit creation and consequently real investment. In Fiji the reduction in credit is 5 percent compared with the situation before adjustment, whereas in Tonga domestic credit is restrained by 8 percent. The reduction in real demand for investment has an income reducing effect via the normal multiplier process, and the demand for money falls in both economies. The negative income effect dominates the inflationary impact of the oil shock, and the demand for money now falls unambiguously in both economies.
A Reduction in the Demand for Tourism

In the previous discussion the level of demand for tourism was held constant after an oil shock. However, tourism is a sector particularly responsive to variation in the international economic climate and the price of fuel, and this assumption is inappropriate. This section shows the consequences of a 10 percent reduction in the level of tourism demand combined with a doubling of oil prices. The economic analysis is similar to the earlier discussion only in the tourism case a particular industry is subject to a negative shock. A reduction in output occurs in the tourist sector, which is transmitted to the rest of the economy through a reduction in real incomes. While the economic analysis is not new, the magnitude of the shock is of interest. Discussion is brief and attention restricted to GDP by expenditure, the government budget, and balance of payments. Investigation of the impact on the sectoral composition of GDP is not attempted because it reveals no new insights. The impact on prices is also ignored because the reduction in tourism demand leaves prices unaltered under the present model formulations.

Tourism and GDP

Table 7 shows the magnitude of the impact of the reduction in tourism demand on GDP and final demand components. As before two cases are considered: the first without adjustment and the second with. In all of the economies there is a further reduction in GDP compared with the case shown in Table 3 (the oil price effects considered in isolation). The reduction in tourism has the largest impact on the

<table>
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<tr>
<th></th>
<th>Without adjustment</th>
<th>With adjustment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Fiji</td>
<td>Tonga</td>
</tr>
<tr>
<td>Private consumption</td>
<td>-7.8</td>
<td>-7.8</td>
</tr>
<tr>
<td>Public expenditure</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Investment</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Tourism</td>
<td>-10.0</td>
<td>-10.0</td>
</tr>
<tr>
<td>Exports</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Imports</td>
<td>-2.7</td>
<td>-3.6</td>
</tr>
<tr>
<td>Less indirect taxes</td>
<td>-5.4</td>
<td>-4.8</td>
</tr>
<tr>
<td>GDP (factor cost)</td>
<td>-4.7</td>
<td>-5.3</td>
</tr>
</tbody>
</table>
Fiji economy followed by Vanuatu and Tonga, which reflects the significance of tourism in the three island economies. The reduction in GDP is translated directly into a fall in consumers incomes, which is reflected in a reduction in consumers expenditures. With the various combined economic forces reducing demand, imports and indirect taxes also fall.

Table 7 presents the results that are achieved through further credit restraint and reductions in investment, assuming the Pacific island governments attempt to stabilize the external account. This is not necessarily the appropriate policy response, but it is used as a starting point for analysis. While the reduction in the terms of trade implied by an oil shock may be permanent, the associated reduction in tourism demand has usually been short-lived. In this case it would be advisable to explore the possibility of adjustment to the fall in the terms of trade but to take a cautious position with regard to adjustment to the reduction in tourism. Further deflation incorrectly pursued would have further expensive consequences for growth, output, and employment.

Table 8 describes the impact on the government deficit. While the level of expenditure remains constant by assumption, tax revenue falls further compared with the data presented in Table 4. The result is a further deterioration in the deficit. Restoration of external equilibrium (the adjustment scenario) is achieved through further deflation to reduce imports, but this has further undesirable consequences for the government budget.

Table 9 shows the implications for the balance of payments. The real demand for tourism falls by 10 percent by assumption, but because tourist operators are allowed to pass on the ensuing inflation to consumers, the value of tourist receipts in foreign exchange falls by a

Table 8. Impact of reduction in tourism on budget (% change on pre-oil price shock levels)

<table>
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<tr>
<th></th>
<th>Without adjustment</th>
<th>With adjustment</th>
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<tbody>
<tr>
<td></td>
<td>Fiji</td>
<td>Tonga</td>
</tr>
<tr>
<td>Indirect taxes</td>
<td>-1.9</td>
<td>-0.6</td>
</tr>
<tr>
<td>Direct taxes</td>
<td>-4.8</td>
<td>-3.7</td>
</tr>
<tr>
<td>Expenditure</td>
<td>2.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Deficit*</td>
<td>-4.9</td>
<td>-3.4</td>
</tr>
</tbody>
</table>

Note * Change in deficit expressed as percent of total revenues
Table 9. Impact of reduction in tourism on balance of payments (% change on pre-oil price shock levels)

<table>
<thead>
<tr>
<th></th>
<th>Fiji</th>
<th>Tonga</th>
<th>Vanuatu</th>
<th>Fiji</th>
<th>Tonga</th>
<th>Vanuatu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>1.3</td>
<td>1.2</td>
<td>0.7</td>
<td>1.3</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Tourism</td>
<td>-5.6</td>
<td>-5.5</td>
<td>-7.7</td>
<td>-5.6</td>
<td>-5.5</td>
<td>-7.7</td>
</tr>
<tr>
<td>Imports</td>
<td>5.1</td>
<td>4.6</td>
<td>1.8</td>
<td>-0.9</td>
<td>0.3</td>
<td>-0.8</td>
</tr>
<tr>
<td>Current account balance*</td>
<td>-5.4</td>
<td>-4.4</td>
<td>-2.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Note * Change in recurrent balance expressed as percent of total revenues

lesser proportion. With the reduction in tourism, the demand for imports also falls in comparison with Table 5 (the oil price effects considered in isolation.) The combination of these effects is an overall deterioration in the current account.
Conclusion

The present investigation has been an attempt to estimate the likely impact of an oil price shock on three selected Pacific island economies. The discussion highlighted two policy responses to the deterioration in the external terms of trade. The first was to do nothing, but the consequence was a deterioration in the external account. The failure to adjust, which was the policy response adopted by many developing countries to the oil shocks of the 1970s, resulted in an untenable balance of payments positions. Eventual adjustment could not be avoided for long, and in many cases a stabilization package had to be implemented through the international agencies. As the model results show, adjustment is painful and incurs reduction in real incomes.

Balanced adjustment

Although adjustment may be unavoidable the island governments have at their disposal a variety of different policy options. The discussion implied that the overall response to an oil crisis would need to be flexible and market oriented incorporating elements that augmented the thrust of the current market-oriented reforms. The discussion analyzed only the case of monetary restraint, which on its own was clearly an inadequate response. A well balanced response would need to incorporate monetary, fiscal, and exchange rate policies.

The analysis indicated that adjustment achieved through monetary policy, which implied credit constraint and reduction in investment, would have negative consequences for long-term growth. The analysis also indicated that although a monetary response can solve the external problem, it results in a deteriorating fiscal position. Governments could increase their domestic borrowing (given sufficiently developed domestic financial markets), but this would be achieved through "crowding out" and at the expense of the private sector. With current emphasis in the Pacific island economies on reducing the role of the public sector, a more balanced approach spreading the cost of adjustment between the private and public sectors would incorporate a major role for fiscal policy.

The results also indicated that the rising cost of production associated with higher fuel bills and imported inflation coupled with stagnating primary commodity prices results in a loss of competitiveness and a real appreciation of the exchange rate. The discussion did not include analysis of devaluation, but as was indicated in the introduction this would not be appropriate until the labor market reforms currently
Dependence on oil causes income loss

The results indicated that an oil shock is likely to impart a considerable reduction in real living standards to the island economies. The analysis suggested the magnitude of the impact will likely be greater than that experienced in the developed nations. This is largely due to the dependence of the island economies on oil as the main source of energy. There is little the island economies can do to avoid these consequences given their resource endowments, with the exception of the recent petroleum finds in Papua New Guinea. Fiji has developed a hydro-electric power supply, which has reduced its dependence on import fuel by about a third. This option is probably not available to most other island economies, and substitution of other potential fuels for oil is not economic at today's prices. Given these characteristics there is little that can effectively be done to avoid the unpleasant repercussions that have been analyzed in this paper.

A last word of caution is warranted in the interpretation of the results. First, there is considerable difficulty in defining what constitutes an oil shock. In the present analysis this has been confined to a deterioration in the terms of trade and a reduction in tourist demand. There are many other components of an oil shock that have not been considered. Second, the weakness of the data and the restricted assumptions of the models should be noted. Data in all Pacific islands are weak, and results based on these types of analysis must be used carefully. Although it is not possible to attach any measure of statistical significance to the results, the comparison between the country data and, where possible, with international information should build confidence in the analysis.
Appendix: The SAM Based Models

The models presented in this appendix conform to the class of economic models based on the Social Accounting Matrix (SAM). Discussion of the SAM is not given in the Appendix; it is assumed the reader is already familiar with the main concepts of social accounting, which are described in detail in the main texts, Stone and Brown (1962), United Nations (1968), and Pyatt, Roe, et al. (1977). The economic models also conform to the class of Computable General Equilibrium Models (CGE), although the models presented in this paper depart from this norm in certain important respects. The following discussion describes the models in a qualitative manner to give the reader an indication of the main functional relationships; a rigorous mathematical exposition is not given. An excellent guide to CGE modeling can be found in Dervis, DeMelo, and Robinson (1982).

The models described in this appendix were built for a variety of purposes. The Tongan (Sturton 1991a) and Vanuatu (Sturton 1989a) models were initially constructed as part of the standard five-year planning exercise, but the Vanuatu case was later refined to examine the appropriateness of the use of various macroeconomic tools in the Pacific island economies. In the Fiji case (Sturton 1989b) emphasis was on building a short-term financial program, but the model was later updated to investigate the introduction of a value added tax.

The emphasis was on the construction of models that incorporated the main policy instruments available to Pacific island governments and was directed toward problems of a short- to medium-term nature. This led to the exogenous specification of variables, which in models with a longer-term horizon would generally be endogenous. Greater exogeneity also gave the model user greater control over the model results. It was felt that the models should remain as simple as possible and avoid specifications where Pacific island estimates were unavailable. Because the models developed were also built with the intention of being used by Pacific island economists, it was felt that the models should be easily tractable and in tune with local modeling capacity.

The implication of these requirements was that the standard CGE model was not appropriate. The emphasis ruled out price sensitive profit-maximizing entrepreneurs allowing factor substitution. Models permitting factor substitution require greater sophistication and need statistical estimates of parameters that are not available in the Pacific islands. However, while the models were restricted on the supply
side, substitution was incorporated in demand. A standard demand system was incorporated for consumption, and product differentiation was included between domestic products and competing imports. This latter formulation breaks the desire for simplicity but provides a more acceptable modeling specification.

The need for the typical planning exercise to specify domestic and external resource requirements meant that the models had to detail the sources and methods of funding the government deficit and the balance of payments. It was not adequate simply to describe the productive sectors and the commodity flows in the economy, which is the usual emphasis of SAM-based models. A detailed analysis of the institutional and financial sectors in the economy was needed with a flow of funds specification.

The SAM was adopted as the primary database for the modeling exercises. The solution procedures attempt to reproduce the accounts of the SAM for each time period investigated. Each of the individual country models provides solutions over a period of years, although in the present investigation of the impact of an oil shock only a single period was needed. Different rules and procedures were adopted for modeling the different accounts of the SAMs. This following section discusses each of these rules and procedures consecutively and starts with production and turns to income and consumption. Discussion proceeds to savings, investment, and financial intermediation and concludes with the commodity accounts and a discussion of the solution process.

Production and Prices

In the productive side of the economy two main categories of commodities have been included: competitive and non-competitive. Competitive commodities comprise heterogeneous groups of traded commodities that compete with products produced overseas. There are three relevant prices in the model: domestic, import, and export. For import and export prices the small country assumption is adopted, and prices are determined in international markets over which the Pacific island economies are assumed to have no influence. However, export prices may differ from import prices due to the heterogeneous nature of the SAM commodity groups. The domestic product is differentiated from the competing imports, and the price is determined at home on the assumption that producers maintain a constant real rate of profit.

The second category of commodities is non-competitive and comprises items such as fuel or specialized capital goods that are not pro-
duced in the Pacific islands. Domestic prices are world prices plus tariffs.

From a modeling perspective competitive commodities are treated identically. In practice, in interpreting the model results it is helpful to consider this group as comprising the production of three types of commodities, which reflect the structure of the Pacific island economies. The first group is composed of traded primary commodities that are almost entirely exported and whose prices are set entirely overseas. The group includes copra, sugar, copper, etc. In the past the structure of the typical Pacific island economy has been dominated by the production of these traditional primary commodities, where output tends to be supply rather than demand determined.

A second group includes primary and secondary products of a differentiated kind that are either consumed at home or are exported to niche markets. These products are becoming increasingly important in the island economies not only in import substituting industries, for which there is little potential, but also in commodities like garments, which are being produced in growing volume in Fiji, and like squash in Tonga. Economically, these categories are differentiated, the small country assumption does not strictly apply, and a different modeling specification is needed.

The third category of competitive commodities is the production of tertiary or service commodities, which are often referred to as non-traded. However, the classification as non-traded is not entirely satisfactory as many services are either imported or exported: wholesaling, transport, tourism, and business services are all traded activities. It was thus decided in the modeling specification that no division between traded and non-traded production should be made, and all competitive commodities should be treated identically.

The output of activities is constrained by demand and is endogenous in the model. The level of production is sufficient to meet the sum of both domestic and export demand, and the latter has been projected exogenously. Production occurs with fixed factor production functions, and for a given level of output, fixed inputs of labor and capital are required. However, the model assumes that both capital and labor are in infinite supply and that output is not constrained by factor scarcity. This assumption may be made with some justification in the case of labor; in the case of capital it is assumed either that last period's investment was appropriate to this period's needs or that excess capacity exists.
While production levels are determined by demand requirements, consumers may substitute between domestic products and competing imports depending on the relative cost differences. It is assumed that imports are differentiated from their domestic counterparts, and consumers choose a combination of the two goods to minimize their total expenditures (see Armington 1969). Thus, while supply is not responsive to relative prices and is not part of the formulation, production is sensitive to relative prices through demand. As domestic prices rise consumers will substitute imports, and demand for home products and production will fall.

The structure of this system is such that prices can be solved, given an assumption about the ratio of exports to domestic production, for competitive commodities, without solving other parts of the model because supply is not price responsive. The system of equations determining prices is non-linear and is solved through an iterative procedure, which takes on the average about 15 iterations for the required level of accuracy.

Given an assumption about the proportion of exports to domestic production, a solution for prices is derived and the solution process proceeds to specify the accounts of the SAM item by item. The solution procedure to solve for a consistent SAM is also iterative and must start somewhere. Accordingly, an initial guess at gross output levels of domestic activities is made.

The Factor and Institution Accounts

Factor incomes are split into two parts: wages and profits. In the Vanuatu and Fiji models wages are split into different skill categories, although the models do not permit skill substitution. Wage payments by activity are determined through the multiplication of output levels by fixed labor output ratios and the corresponding wage rates. Aggregate profits in each activity are determined residually through deduction of all costs from the value of outputs. The sum of factor rewards accumulated for the entire economy by labor group, and ownership of capital is then mapped into institutions. Wages are mapped into households depending on the origin of the activity (for example, agricultural wages are mapped to rural households). Profits are mapped into institutions assuming capital is owned by institutions in fixed proportions: the standard treatment for SAM-based models.

Regarding the income and outlays of institutions, the SAM constructed for the Pacific island economies includes a set of accounts for income flows. This treatment was adopted for two reasons. First, income flows such as interest, dividends, rent, etc., are functionally re-
lated to the ownership of assets. The identification of these flows allows an explicit modeling formulation, which would otherwise be merged with transfers and be specified in an ad hoc fashion. Second, the modeling emphasis on fiscal and external equilibrium requires a detailed and accurate specification of these payments. Specification of the government budget or balance of payments can be attempted only if the main components are themselves specified.

Together with rewards from factors, institutions receive income from the ownership of assets. Interest, dividends, and land rent payments are included in the models. Interest receipts are calculated as the product of the rate of interest and the value of securities held. Dividend receipts are related to the ownership of capital, and land rentals are related to value of rent payments. Direct taxes have also been included in this set of accounts and are collected on nominal taxable income at marginal rates.

Income payments are specified analogously to receipts. Interest payments are the product of the interest rate and the value of the liability. Dividend payments are calculated as a fixed percentage of profits. Land rent payments are indexed to inflation and agricultural incomes.

Transfers between institutions are ad hoc in nature and are usually indexed to institutional rewards from factors or some such convenient indicator to drive the model.

At this stage total outlays are summed and deducted from total institutional receipts to derive disposable income. Disposable income can be either consumed or saved. In the models only the public sector, private non-profit institutions, and households consume. Public sector consumption is projected exogenously, and aggregate household consumption is determined by a simple linear consumption function. Private non-profit institutions are not assumed to save, and consumption is equal to disposable income. Both public sector and households savings are determined residually.

The discussion of the institution and factor accounts is now complete. At this point discussion turns to how savings are allocated among institutions for investment. The flow of funds is specified with the treatment of financial intermediation.

Financial Intermediation

The Fiji and Tongan models contain a full specification of the capital accounts of the SAM, while in the case of Vanuatu no specification was attempted. While the Tongan financial system is simpler than the
Fiji equivalent, the main functional relationships are the same in both economies and discussion is based on the Tongan case. Two different closures or specifications were adopted for the determination of investment in the models. In the first case investment was exogenous or Keynesian in nature and corresponds to the model experiments before adjustment to the oil shock. Shortfalls in domestic savings needed to achieve the investment rates specified were made up through increased foreign indebtedness. In the second case the pool of domestic savings together with foreign capital inflow determines the rate of investment. The closure is neoclassical, and a given rate of foreign capital inflow (the pre-oil shock level) together with domestic saving determines the rate of investment.

In the discussion of the flow of funds, institutions can largely be categorized as either savers, investors of real capital, or financial intermediaries. The intermediaries usually do not generate savings or make investments in real capital. Instead they raise funds from savers and invest them with productive enterprises. Two main financial intermediaries are considered: the commercial banks and the development bank (Fiji includes greater financial depth with insurance companies, a national provident fund, and home finance institutions.) The non-financial institutions include households, private and public enterprises, and the government.

While the closure employed in the experiments was either described as Keynesian or neoclassical, at the micro or institutional level a corresponding closure also exists. Sectoral investment can be either constrained or unbounded. A macroeconomic closure that is Keynesian does not require that investment is unbounded for each institution or in the neoclassical case that investment is constrained for every institution. Rather, a macroeconomic closure may have elements at the institutional level from both categories. However, at the macro level one form of closure will dominate and describe the basic behavior of the model.

The main source of funds for the commercial banks is deposits. The models formulate a standard demand for money function that determines additions to banks' funds. Monetary policy in the model is conducted through a loans-to-deposit ratio, whose primary function is to protect the level of foreign reserves. However, it also specifies the rate of domestic credit creation, which is rationed to households, private, and public enterprises, according to fixed proportions determined through commercial banking practices. The development bank raises funds offshore and together with periodic capital injections from the government lends to the private enterprise sector.
In the case of the pre-adjustment oil shock the macroeconomic closure is Keynesian. For private enterprises domestic resources include own savings and commercial and development bank borrowing. Any shortfall needed to fund investment and inventory accumulation is made up through foreign borrowing. For households demand for investment in housing is constrained by their own savings and bank borrowing—the closure is always neoclassical. For public sector enterprises, investment is given exogenously, and the deficit in funds is lent or injected by the government—closure is always Keynesian. In the case of the government foreign borrowing is determined residually after accounting for outlays for investment, equity injections in public enterprises and the development bank, and the government's own savings and aid receipts.

In the adjustment to the oil shock scenario, alterations are needed to the closure of the private enterprise and government institutions to achieve a macroeconomic closure that is fundamentally neoclassical. In the case of the government, closure remains Keynesian, but savings shortfalls are raised from the domestic banking system instead of overseas. In the case of private enterprise, access to overseas finance is denied and any shortfall frustrates investment. Allowing the public sector first call on the domestic banking system effectively "crowds out" private sector investment. The closure of the private sector has now switched from Keynesian to neoclassical, and this shift alters the basic closure of the model macroeconomically.

In the neoclassical case monetary policy is determined through the rate of the loans-to-deposit ratio. This ratio allocates the money supply between domestic credit creation and the accumulation of foreign assets. Monetary policy thus determines the balance of payments outcome and is consistent with the "monetary approach to the balance of payments" (see IMF 1977.) In the Keynesian closure both the government and private enterprise sector are allowed to borrow offshore. In a monetary sense this is equivalent to an accommodating policy of abandoning the loans-to-deposit rate, expanding domestic credit, and running down the foreign reserves. The increased foreign borrowing or reduction in foreign assets economically amounts to the same thing.

The Commodity Accounts and Solutions

Discussion has now come full circle, and it remains to specify the demand and supply of commodities. In the introduction to the factor accounts a guess at commodity production or domestic supply was attempted. It is now necessary to specify commodity demands, which
include intermediate demands, private and public sector consumption, investment and inventory demands, and export demand.

Intermediate demands are required for production and relate to the usual Input-Output matrix of the SAM. Public sector consumption and investment are both exogenous, while consumption of private non-profit organizations is determined residually. In the case of households an aggregate consumption was specified, but a system is needed to allocate total consumption among commodities. Various and differing approaches have been adopted in the literature, but the Linear Expenditure System (LES) is used here (see Stone 1954). In principle, households have a subsistence level of consumption by commodity, which occurs regardless of the level of income and prices. As income rises, however, households allocate additional income among commodities according to their relative prices and incomes.

Inventory demands are exogenous, and investment demands are determined through the flow of funds. In either case a means is needed to split investment and inventory demands by commodity of origin. In the models a set of aggregate coefficients derived from the SAM are used for this purpose. Because the specification does not detail investment by activity of destination, it is not possible to be more precise about the exact composition of investment by commodity. However, investment is largely composed of construction or imports, and any misspecification is unlikely to have a significant impact on the model results.

The remaining items needed to complete the specification of the commodity accounts are exports, tourism, and foreign mission expenditures. Exports have been projected exogenously in line with private sector expectations and development programs. Tourism has also been specified exogenously in line with industry expectations. Foreign embassies and international agencies make certain outlays in the Pacific islands, which although small need accounting in the system. These are specified exogenously.

Finally, regarding the solution of the model, a guess at the gross outputs levels of activities is initially made, and the rest of the accounts are determined following the circular flow of the SAM. Both the demand and supply of commodities can be added up, and the output levels of activities can be adjusted according to excess demands, thereby improving the guess. The solution of the model is thus iterative, but in practice it nearly always solves within 10 or so iterations.
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Pacific Islands Development Program

The purpose of the Pacific Islands Development Program (PIDP) of the East-West Center is to help meet the special development needs of the Pacific islands region through cooperative research and training. PIDP conducts specific research and training activities based on the issues and problems prioritized by the Pacific Islands Conference of Leaders, which meets every three years. The Standing Committee, composed of eleven island leaders, reviews PIDP's research projects annually to ensure that they respond to the issues and challenges raised at each Pacific Islands Conference. This unique process enhances the East-West Center's capability in serving the Pacific.

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