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PACIFIC ISLAND ECONOMIES: SOME OBSERVATIONS ON THE ECONOMIC CONSEQUENCES OF NATURAL DISASTERS

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Pacific Island Economies: Some Observations on the Economic Consequences of Natural Disasters

The many difficult development problems faced by small resource-poor island countries such as those in the South Pacific, are all too familiar. Certainly, with small Pacific island countries the leading constraint is vulnerability to external shocks that can lead to economic collapse. Collapsibility can arise either from a sudden loss of export markets or a sharp decline in the terms of trade, and can lead to a drastic decline in GDP and export earnings and prolonged economic stagnation. Other major disturbances can arise from a political crisis (e.g., Fiji 1987); the exhaustion of a major non-renewable export product (e.g., Kiribati 1979); crop destruction by insects or viral disease (e.g., Western Samoa 1993). As well, economic collapse can arise from periodic natural disasters such as cyclones and prolonged drought.

Valuable insights into the economic collapsibility of small island countries in the Pacific can be found in recent works by Tisdell (1985), Kakazu (1985) and Fairbairn (1987). By means of simple growth models, these authors show that small island countries are incapable of sustainable growth because of vulnerability to external shocks, particularly a collapse in export demand combined with population growth. The analyses come out in favour of development policies that, among other things, encourage subsistence production as a sheet-anchor for these economies.

The aim of this paper is to address another potential source of economic collapsibility - natural hazards particularly in the form of highly destructive tropical cyclones. The paper focuses on the recent incidence of tropical cyclones in the South Pacific, the severity of the devastation to these economies, and the impact on growth and policy responses. Particular attention is given to the consequences of a recent cyclone in Western Samoa and a simple theoretical model is presented showing the effects of cyclone devastation. The paper is essentially an exploratory study aimed at highlighting some of the major economic costs to small resource-poor island economies.

Natural disasters in the South Pacific: general observations

By virtue of geography and climatic characteristics, the South Pacific is susceptible to periodic and highly destructive tropical cyclones. While data are inadequate, the available evidence shows that particular zones and countries are especially vulnerable. This appears to be true of the oceanic zones around Guam and the Northern Marianas in the Northern Pacific and those around Tonga, Western Samoa and Vanuatu in the south. Data compiled by the World Bank (1991, p. 21) show that among its Pacific member countries, during the 1980s, Fiji experienced at least five major cyclones, Vanuatu three, and Western Samoa three.

The cyclones reported by the World Bank refer to those that have been most destructive for economic infrastructure, social and economic facilities and natural resources. Among the most damaging of the recent cyclones were those experienced by Solomon Islands,

Vanuatu and Western Samoa. Thus in Solomon Islands, the 1986 cyclone killed 101 persons, rendered 60,000 persons homeless and wrought heavy damage to crops and infrastructure. This cyclone had particularly destructive effects on a number of small outer islands including Makima, Rennell and Bellona. In the case of Vanuatu, a cyclone in 1987 caused heavy damage to crops and utilities both in the main island (Efate) and several outer islands. A total of 48 persons were killed while the overall damage to those affected came to an estimated US$2 million[1].

Western Samoa has been devastated by two major cyclones over the 1990-91 period. The second of these - Cyclone Val - stuck in December 1991 and is described in detail in the next section. The first - Cyclone Ofa - was experienced in 1990 and killed 11 persons, affected 80,000 and left total damage estimated at US$140 million. Destruction was widespread and severe damage was inflicted on housing, infrastructure (especially port and roads) and agriculture. Productive capacity suffered heavily with and estimated 70 per cent loss of crops and 50 per cent of livestock.

The nature and extent of the damage caused by periodic cyclones to small Pacific island countries deserves close and systematic analysis. However, with reference to the recent experience of Fiji, Western Samoa and Vanuatu, the evidence indicates that, leaving out loss of life, the major areas of damage are:

o   agriculture, both commercial (including exports) and subsistence, with tree crops suffering the greatest damage

o   inshore fisheries, arising from storm damage to coral and lagoonal habitats

o   infrastructure, particularly power, port and road facilities

o   social facilities including housing and schools

o   natural resources, including indigenous and exotic forests and coastal zones

Regarding agriculture, the damage can be especially severe, and it is not uncommon for almost total destruction of such crops as bananas, breadfruit and coconuts.

The consequences - both direct and indirect - of cyclone devastation on these small economies can be both traumatic and prolonged. The overnight destruction of crops and inshore fisheries results in an immediate shortage of domestically produced foodstuff. It also results in the collapse of the export sector which is heavily dominated by primary products such as copra, taro and coconut oil. If domestic consumption levels are to be maintained, the local food supply will have to be supplemented by imports and donations from overseas agencies and voluntary groups. Industrial production as well as service industries will also decline as a result of both direct damage to premises and disruption to power, transport and telecommunications. The end result is a dramatic fall in productive

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[1]   One US dollar exchanged for 2.30 Western Samoan tala in (end) 1989; 2.44 tala in 1990; 2.40 tala in 1992 and 2.60 tala in 1993 (Central Bank 1994 p.54).

capacity and, in turn, GDP. A consequential fall in real GDP of up to 10 per cent can occur.

Cyclone devastation will also have far reaching macroeconomic implications. A major adjustment to macroeconomic policy will be called for in the light of economic collapse and human welfare considerations. Key areas that need to be addressed include the deterioration in the balance of payments that will inevitably follow from reduced exports and increased import demands and the consequent drain on foreign reserves. Significant changes will also be called for in fiscal and monetary policy in order to accommodate emergency needs and rehabilitation. The sudden pressure on public funds will inevitably result in deficit spending (or enlargement of existing deficits) in the recurrent budget and accommodating borrowing activity. Monetary policy will have to be eased to provide personal and business credit for rehabilitation purposes. The shortage of locally produced foods combined with government spending and credit expansion will inevitably create inflationary pressure - a trend that will need to be carefully monitored.

From recent regional experience, the official response to cyclone devastation has embraced emergency and rehabilitation efforts at the national, regional and international levels. Nationally, governments have launched major programs aimed at economic rehabilitation and rebuilding. This has usually involved a significant diversion of budgetary resources away from budgeted capital works to immediate rehabilitation of infrastructure and the productive base. This invariably calls for aid donors to revise their aid priorities to accommodate rehabilitation needs. It has also involved institutional changes, usually the establishment of an emergency body responsible for assessing the damage and for advising on the distribution of emergency assistance.

International agencies and countries have usually provided considerable support and assistance. Apart from emergency relief, these have provided technical assistance and financial assistance to carry out rehabilitation work. As well, valuable assistance - usually in the form of food, shelter and materials - are given by overseas voluntary groups, while assistance in the form of remittances from overseas kinsmen is another important source of support.

The impact of natural disasters, especially tropical cyclones, on economic growth in small Pacific island countries needs to be analysed in detail. All in all, the actual performance of many of these countries has been disappointing, with growth in real GDP no more than around one per cent per annum - well below population growth. However, these can be no doubt that much of the recent weaknesses (and volatility) experienced by these countries can be attributed to the effects of periodic cyclone devastation (World Bank 1991, p.20).

Cyclone damage in Western Samoa, 1991

As mentioned above, Western Samoa has been devastated by cyclones twice over the past few years - Cyclone Ofa in 1990 and Cyclone Val in 1991. Cyclone Val, striking over a four day period (6th - 9th December) was said to be the most destructive in over 100 years with winds reaching speeds of over 150 miles per hour. The effects on natural

resources, agriculture, infrastructure, housing, health and education facilities were catastrophic. The damage caused to the economy and supporting infrastructure greatly affected growth prospects especially following so soon after Cyclone Ofa and caused a significant degree of macroeconomic instability.

Damage to agriculture and infrastructure was particularly severe. In relation to agriculture, the damage to basic subsistence crops, notably bananas, breadfruit and root crops, was almost total (damage was estimated at over US$20 million). Similarly, damage to tree crops including coconuts - an export staple - was estimated at between 90 and 100 per cent and equal to US$14 million)[2]. In the case of economic and social infrastructure, the destruction to buildings, ports, roads, water supply and power were the most severe.

The total cyclone bill was estimated at a huge US$300 million - or US$1,900 per capita - equal to three times GDP. The total cost by major sectors is shown in Table 1.

Table 1:   **Cyclone Val Damage Cost Estimates; Sectoral Summary, 1992.**

Sector	Estimated cost (WS$m)
Roads	31
Major bridges	3
Water supply	5
Apia surface drainage project	minor
Coastal protection works	6
Buildings and dwellings	330
airports	3
Ports	18
Sea transport	1
Power supply	11
Postal and telecommunications	4
Primary industry (agriculture)	201
Education	13
Health	20
Fire services	2
Environment, parks and reserves	65
Total	713

Source: Final Damage Assessment Report, National Disaster Council, Government of Western Samoa, 1992, p.33.

Note: In 1992, when these estimates were compiled, one Western Samoan tala was worth approximately US$0.41.

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[2]   These estimates were made by the National Disaster Committee formed to assess the final damage arising from the cyclone and to provide guidelines on the distribution of emergency relief.

In these estimates, damage to agriculture refers to the value of lost production and infrastructure and housing by replacement cost.

Recent data on GDP are not available, unfortunately, because these would allow cyclone damage to be measured more precisely both nationally and on a sector basis. Estimates made soon after the cyclone indicated that, as a result of cyclone devastation, GDP in 1992 would decline by four to six per cent (ADB 1992, p.2). GDP would also record negative growth in 1993, but at a more modest rate as economic recovery began to become apparent. Such an outcome represents a major setback to the national economy which had been recovering well after the onslaught of Cyclone Ofa.

Cyclone damage caused a more dramatic collapse in the country's export base, dominated by coconut and related products. This is reflected in total export earnings which declined from a level of around US$14 million in 1989 - a fairly normal year - to US$6 million in 1992 - a decline of nearly 60 per cent. Regarding the leading exports, coconut oil fell from a level of US$2 million in 1989 to nil (in 1992); cocoa from US$0.5 million to nil; copra from US$1.5 million to nil; and taro from US$2.8 million to US$2.1 million. In the case of taro, part of the decline was dues to a diversion of supply to the domestic market. Export earnings for another major export - coconut cream - had to rely on imported raw materials to sustain export production. The overall decline in the export of these products (other than coconut cream) fell from US$7.0 million in 1989 to US$2.4 million in 1992 - a 65 per cent decline.

Overall, the balance of payments suffered severely during the 1989-92 period, as reflected in a change in net foreign assets from a positive US$15 million to a negative US$9 million. Underlying this change is the decline in export earnings noted above and a substantial rise in imports from US$80 million (cif) in 1989 to US$130 million in 1992. Although there was a notable increase in the level of net private transfers (dominated by private remittance flows), the considerable imbalance in merchandise trade resulted in a substantial rise in the current account deficit - from a negative US$1.6 million to a negative US$50 million. A significant increase in proceeds from official loans in the capital account helped to offset the large current account deficit but this still left a major part of the current account deficit to be financed from external reserves.

The impact on domestic consumer prices was quickly felt. A month after Cyclone Val, the Consumer Price Index (CPI) surged by six per cent which predominantly reflected the sudden shortage of locally produced foodstuffs. By mid-year, the annual rate of inflation had climbed to 12 per cent which compares with virtually zero inflation during 1991 (as compared with a period of high inflation in 1990 caused by Cyclone Ofa). It might be noted that inflation has since moderated and, as at end 1993, was recorded at just over four per cent per annum.

Government's fiscal and capital works programs underwent drastic revision in response to emergency and rehabilitation needs of the economy. While the government remained committed to a policy of fiscal prudence, the need for economic rehabilitation led to significant diversion of budgetary resources away from planned development programs to rehabilitation activities. This inevitably led to a widening of the deficit on current account and substantially increased reliance on external development finance, especially from

international agencies such as the World Bank.

Reflecting the emphasis on rehabilitation, government's recurrent expenditure rose from a level of US$32 million in 1990 to US$46 million in 1991 - a 43 per cent increase - (compared with a 17 per cent increase in current revenues). At the same time, development expenditure increased by a more modest 20 per cent. Over the wider period - 1989 to 1992/93 - recurrent revenue expanded by 40 per cent but recurrent expenditure and development expenditure expanded by a corresponding 80 per cent and 160 per cent respectively. The resulting resource gap relied heavily on external savings, particularly in the form of concessionary loans.

Fiscal response was accompanied by an easing of monetary policy and related macroeconomic measures. A notable initiative was the introduction, by the central bank, of a temporary Emergency Credit Arrangement facility under which the commercial banks were granted approval to provide special loans needed for reconstruction and rehabilitation. Within several months, total loans granted under this scheme reached nearly US$3.0 million. Another major concession was a decision to considerably reduce the rate of import duty charged on building materials in support of residential and commercial building reconstruction work. Both these measures were aimed at providing temporary relief but it was inevitable that they would contribute to macroeconomic instability in the immediate term.

A number of regional and international organisations played a particularly key role in Western Samoa's rehabilitation effort. Technical assistance, for example by AIDAB, ADB and the World Bank, was provided to assess cyclone damage at national and sector levels and to identify priority rehabilitation needs (Government of Western Samoa 1992(a)). Donors pledged financial support (chiefly concessionary loans) for urgent rehabilitation work, including repair work on roads, port and power facilities and commitments were undertaken in accordance with rehabilitation needs.

Western Samoa's recent experience of cyclone devastation points to a number of 'lessons' that need to be heeded and acted upon if its capacity to cope with such natural diasters is to improve (Government of Western Samoa 1992(b) p.34). Among key measures that need to be addressed are the installation of a reliable early cyclone warning system; the adoption of an appropriate building code to ensure quality and durability; and the institution of a public education system on disaster preparedness. Agricultural patterns and techniques capable of minimising crop damage also need to be considered. An appropriate national body should also be established responsible for ongoing disaster preparedness work, and to coordinate relief and related disaster mitigation efforts.

Cyclone damage: a formal analysis

It will be apparent from what has been said above that, for small resource-poor island economies susceptible to natural disasters, the economic costs of cyclone devastation can be enormous. The damage to the productive base of these economies can be substantial, particularly through heavy destruction of crops, inshore fisheries, forests and a range of basic infrastructure facilities. Economic collapse can be significant while cyclone damage

can virtually wipe out much of an economy's export base. Although certain areas of agriculture can recover quickly, the rebuilding of the capital base of the economy will take time, and this will tend to impede the process of economic recovery. The loss of production can result in a significant decline in community welfare.

It may be useful to show the economic consequences of cyclone devastation on small island economies by means of a simple production model such as shown in Fig 1. Such a model shows how a small economy can collapse from severe cyclone damage to (potential) production (e.g., crops) and the capital base (e.g., power) of the economy. To facilitate the analysis the model relies on a number of simplifying assumptions. Thus, it is assumed that the island economy comprises two sectors - a monetary sector producing a single commercial crop and a non-monetary component producing a single subsistence product. The production function for the commercial product is assumed to be a conventional one, such as represented by the Cobb-Douglas production function, where output is a function of factor inputs. In the case of the subsistence good, production is assumed to be a function only of labour input. Further assumptions are that population (and the labour supply, N) remain unchanged and technical change is absent.

In Fig 1, the aggregate production function is represented by the curve EFG which shows rising levels of output (but at a diminishing rate) with increasing capital input (assuming constant labour input, $\overline{N}$, and no technical change). This production function is derived by superimposing the production function applying to the monetary sector to that for the non-monetary economy (shown by the line EE - which is perfectly inelastic to a change in capital stock). Assuming an initial capital stock of K_1 on the K axis, and given the aggregate production function (EFG), the resulting level of output (or income) is shown by Y_1 on the vertical axis. Y_1 represents total income that K_1 is capable of producing, and results in a level of per capita income equal to $Y_1/\overline{N}$

Suppose now that the economy is devastated by a tropical cyclone as damaging as those that have recently struck Western Samoa and other small Pacific island countries. This will result in economic collapse for (conceptually) two main reasons, namely loss of output potential on the one hand and destruction or damage to capital stock on the other. The loss of output takes place in both the monetary and non-monetary sectors, with the overall loss represented by a downward shift of the aggregate production function shown by curve ABCD. As may be seen from Fig. 1, other than at the origin, the extent of the collapse of the aggregate production function (as measured by the vertical distance between the two production functions) is greater than the distance between points E and A on the vertical axis representing the extent of the collapse in subsistence production. Set against the initial capital stock, K_1, the new production function would result in reduced output, equal to Y_2. This would also result in lower levels of output per capita $(Y_2/\overline{N}<Y_1/\overline{N})$.

Economic collapse also encompasses the effects of reduced capital stock due to the destruction of capital both natural and man-made - a factor that (by definition) affects only productive activity in the monetary sector of the economy. Thus if is assumed that capital stock is reduced to say, K_2 in the K axis, then, given the (collapsed) curve ABCD, the new level of potential output is given by Y_3 in the vertical axis. As can be seen from the

figure, the combined effects of a loss of output and reduced capital stock (OK_1 - OK_2), results in a significant collapse in the economy, specifically from point F to point B, and a decline in output equal to Y_1 - Y_3. At point B, the level of per capita income is significantly less than had prevailed at the pre-cyclone level of output - that is to say, $Y_3/\overline{N} < Y_1/\overline{N}$ by a considerable margin. The loss of per capita income is equal to $Y_1/\overline{N} - Y_3/\overline{N}$.

Figure 1:   Economic Collapse due to Cyclone Devastation

Total Output ($)

Y

Y_1 — F — G

Y_2 — C — D

Y_3 — B

E — E

A — A

O $K_2 \longleftarrow K_1$ K

Capital Stock
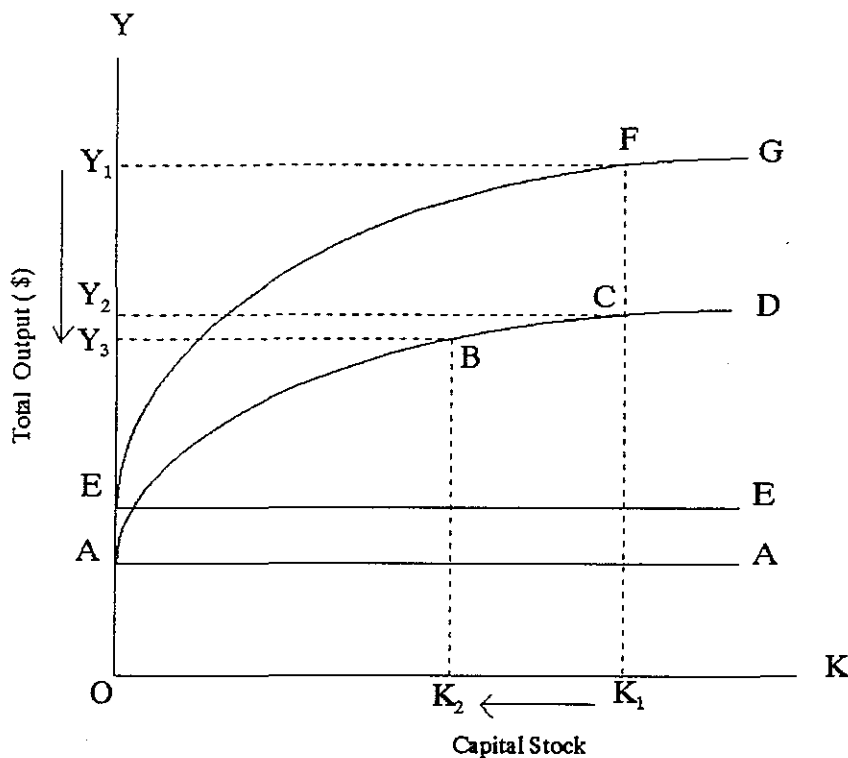
Possibilities for economic recovery

An important aspect of the above model is that the movement from point F to point B is instantaneous. Economic collapse can take place virtually overnight, depending on the duration (and movement) of a particular cyclone. This, in turn, will have a traumatic effect on the local population, and involve a significant welfare loss.

It is possible for a devastated economy to languish at the lower level of income - point B - for an extended period of time. While several crops (e.g., taro, bananas and breadfruit) can regenerate quickly, this is not true of other agricultural staples, notably coconut and cocoa which are basic export crops that take several years (as many as five) to recover. Reflecting a heavy dependence on agriculture, export activity will be slow to recover. As well, the rehabilitation of infrastructure and overall capital base is likely to be a slow

process, especially in the absence of significant external technical and financial assistance. A critical constraint is the lack of a domestic savings base to support the rehabilitation of the capital stock. In light of such possible constraints, the process of economic recovery (from point B to point F in Fig.1) and with it the restoration of per capita income can be a long drawn out process with a heavy cost in terms of output foregone.

The economic plight of these countries can be significantly aggravated by population growth. Allowing for population growth, economic collapse will be even more traumatic and economic recovery much harder to attain. It means that, even if the pre-cyclone level of output is reached (i.e. Y_1), income per capita will be lower than before, and may take a significant rise in output above Y_1 (depending on the rate of growth of population) for income per capita to exceed that originally associated with Y_1.

Previous models on the collapsibility of small resource-poor island countries, for example those of Kakazu (1985) and Tisdell (1985) show that deleterious effects on the economy of a loss of an export market or the depletion of a major non-renewable resource is permanent. By contrast, the damage to the economy through natural disasters is a temporary phenomenon. In time, the economy can recover to pre-cyclone levels through the natural regeneration of crops and rebuilding of capital stock and support infrastructure.

In practice, there are factors ensuring that these small Pacific island countries have been able to recover reasonably well from cyclone damage to the economy. A critical factor has been firm government commitment to economic rehabilitation and restoration as recently illustrated by the case of Western Samoa. A major factor has been the willingness to reorder government spending priorities in favour of economic rehabilitation. Another critical factor has been a substantial aid response to cyclone devastation in the form of technical assistance, finance, food and related items. Generous donor support has been particularly instrumental in the rebuilding of the capital base, and hence productive capacity. Other favourable factors have been a substantial upsurge in construction activity - commercial, infrastructural and residential - associated with cyclone reconstruction in some considerable measure underpinned by aid-supported projects. The relatively quick recovery of a number of food crops, as noted above, also contributes to overall recovery (including the restoration of price stability).

Economic recovery will therefore depend greatly on both domestic measures and the international response. Where government policy and international assistance have been responsive and well directed (and in the absence of other external shocks), the process of economic recovery can take place relatively quickly. The regional experience suggests that, under reasonably favourable conditions (with favourable aid-support particularly critical), the economy can return to pre-cyclone levels of income within a period of five to six years. This implies a restoration of the capital stock and output potential (but not necessarily income per capita if population has grown in the intervening period).

An illustrative time path for economic recovery is given in Fig. 2, showing an economic recovery over a four to six year period following economic collapse at point C. It is assumed that the economy collapses from a base year (real GDP for that year equals 100) by around five per cent, that is, from point C to D in Fig. 2. The economy will linger at the collapsed level of income, D, for some time and may even decline further as the after

effects of cyclone damage continue to be felt. The component DEF of the overall income curve, BCDEF, represents a hypothetical economic recovery scenario under favourable conditions, notably an adequate external aid response (here, year-to-year fluctuations in income levels are ignored.) As may be noted, the pace of recovery accelerates somewhat around years two and three as crop regeneration and capital rehabilitation take effect. By year five, the economy is back at the pre-cyclone level of income and, in the absence of further natural disasters, will then continue to grow.

However, without adequate external assistance, the recovery process will take a lot longer. The latter scenario is depicted by the broken segment DEG, which, in this hypothetical situation, shows a 10-year recovery period. This recovery scenario largely reflects the slow rebuilding of capital stock and infrastructure and point to the vital role played by external assistance in the overall rehabilitation process.

Figure 2:   Possible Economic Recovery Scenario

Year
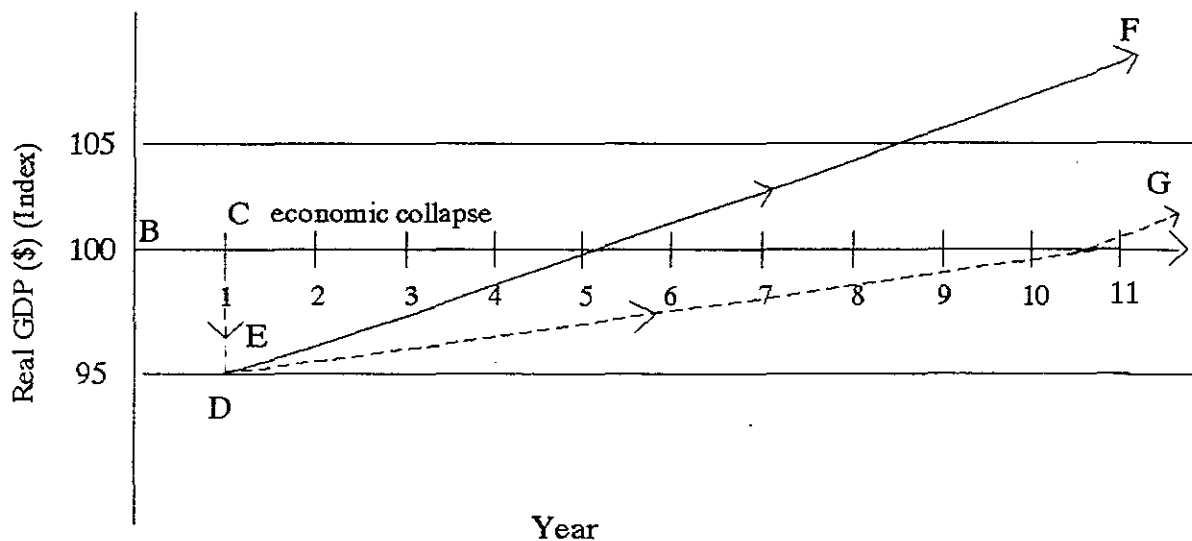
Conclusion

Many small island countries of the South Pacific are susceptible to periodic devastation by natural disasters, notably tropical cyclones. Economic collapse can occur as a result of cyclone devastation, particularly through the heavy destruction of crops, capital stock and support infrastructure. Damage to the economy, both monetary and subsistence sectors, can result in severe loss of production, much reduced levels of per capita income (and welfare) and a degree of macroeconomic instability. Recovery can be slow but much will depend on domestic policy stance and the commitment to economic rehabilitation and the response of the international aid community. A major challenge is to attempt to gain a

clearer understanding of the economic consequences of cyclone devastation in these small island countries, and to develop appropriate policy and institutional mechanisms - including international support programs - for coping with and mitigating the destructive effects of natural disasters.

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