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THE ECONOMIC IMPACT OF NATURAL DISASTERS IN FIJI

Charlotte Benson

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Charlotte Benson

March 1997

Overseas Development Institute
Portland House
Stag Place
London SW1E 5DP

Preface

Figures on the 'cost' of natural disasters abound. Such figures are generated by, for example, governments as part of their relief appeals or by the insurance industry in counting its losses. However, they are typically based on only the direct, visible impacts of a disaster, such as damage to homes, hospitals, schools, factories, infrastructure and crops. Meanwhile, less easily quantifiable effects, such as the loss of personal belongings or jobs, widening trade or government budget deficits or the increasing scale and depth of poverty are typically ignored. Similarly, positive benefits of disasters – such as post-disaster construction booms or the opportunities disasters can present to upgrade machinery and equipment – are seldom reported.

From an economic, rather than financial, perspective, the impacts of disasters can be divided into three categories: 'direct' costs, 'indirect' costs and secondary effects (e.g., see Andersen, 1991; Bull, 1992; OECD, 1994; Otero and Marti, 1995). Direct costs relate to the physical damage to capital assets, including buildings, infrastructure, industrial plants, and inventories of finished, intermediate and raw materials, destroyed or damaged by the actual impact of a disaster. Crop production losses are sometimes also included in estimates of direct costs. Indirect costs refer to damage to the flow of goods and services including lower output from damaged or destroyed assets and infrastructure; loss of earnings due to damage to marketing infrastructure such as roads and ports and to lower effective demand; and the costs associated with the use of more expensive inputs following the destruction of cheaper usual sources of supply. They also include the costs in terms of both medical expenses and lost productivity arising from increased incidence of disease, injury and death.[1] Secondary effects concern both the short- and long-term impacts of a disaster on overall economic performance, such as deterioration in trade and government budget balances and increased indebtedness as well as the impact on the distribution of income or the scale and incidence of poverty. They can also include shifts in government monetary and fiscal policy to, for example, contain the effects of increased disaster-induced inflation or to finance additional government expenditure. Direct losses can therefore be roughly equated with stock losses whilst indirect costs and secondary effects both constitute flow losses.

Reflecting the difficulties in analysing economy-wide flow impacts and a preoccupation with the financial costs of disasters, most assessments of disasters concentrate on more easily measured direct 'stock' losses, as already noted. Yet such data are often of little value in informing broader policy-makers about the nature and

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[1] For example, droughts can result in an increased incidence of water-borne diseases such as diarrhoea, skin diseases and trachoma whilst floods and tropical cyclones can lead to outbreaks of water problems such as diarrhoea and cholera.

scale of natural hazard risks faced by an economy. Similarly, they say little about the role of various underlying factors in either exacerbating or minimising the economic impact of disasters such as the size and structure of the economy, including the relative importance of various sectors and inter-sectoral forward and backward linkages; the sectors affected by the disaster; economic performance in the period prior to the disaster; the international economic climate; the frequency and magnitude of other recent disasters; or government economic policy. Current disaster damage assessments are therefore of only limited value in helping to design appropriate mitigation, or risk management, strategies to minimise the adverse economic consequences of disasters. Indeed, the mere attempt to measure the economic impacts of disasters in a single figure reflects a naive conception of the economic impact of disasters. Moreover, by potentially considerably under-estimating the true economic impacts of disasters, they may have resulted less than economically-optimal levels of investment in disaster prevention and mitigation measures.

This paper forms part of a wider investigatory study on the economic impacts of natural disasters in south-east Asia and the Pacific.[2] The paper is one of three case studies, examining recent experiences in Fiji, the Philippines and Viet Nam. Each case study is based on a two-week country visit in late 1995 or early 1996 and subsequent desk-based analysis.

The case studies focus on the disaggregated impacts of natural disasters on various sectors of each economy and the role of government policy. They assess the factors determining the extent of vulnerability of each economy and whether and why that vulnerability has changed over time. They also consider how the economic consequences of disasters could be mitigated and the degree of attention currently attached to natural disasters in economic policy-making and planning. The case studies also briefly touch on the relationship between economic poverty and disaster vulnerability.

The case studies are necessarily exploratory given the relatively limited research to date on the economic impacts of natural disasters. This implies that some lines of investigation may reveal relatively little. However, these conclusions are findings in themselves.

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[2] The study explicitly excludes pestilence, environmental and technological hazards as well as civil disturbances.

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Charlotte Benson
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Abstract

There has been relatively little research on the economic impacts of natural disasters to date. This paper reports findings of a study of Fiji which is intended as a contribution in filling that gap. Findings include the following:

- Severe natural disasters constitute major exogenous shocks to the Fijian economy, resulting in substantial declines in GDP.

- Both the manufacturing and agricultural sectors, as well as overall GDP, have become increasingly vulnerable to natural disasters since the early 1980s. Current changes in the agricultural sector suggest that its vulnerability to natural disasters could increase further in the short- to medium-term. However, the vulnerability of the manufacturing sector looks set to decline.

- Severe natural disasters have had profound budgetary implications.

- The balance of payments has been relatively immune to natural disasters, primarily reflecting higher reinsurance flows as well as the use of sugar reserves to further boost earnings in the event of a disaster. However, anticipated diversification out of sugar production could increase the exposure of the balance of payments.

- Considerable attention has been paid to disaster management, particularly preparedness and post-disaster activities. Much less effort has been made to incorporate hazard risks into broader economic strategic planning or to mitigate the economic impacts, specifically, of disasters.

- There has been a gradual breakdown in traditional mitigation and coping mechanisms and communities have increasingly turned to the government for assistance in the aftermath of disasters.

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Acronyms

ADB	Asian Development Bank
AusAid	Australian Aid
EDF	European Development Fund
EMSEC	Emergency Services Committee
ENSO	El Niño Southern Oscillation
EU	European Union
FAO	Food and Agriculture Organisation
FSC	Fiji Sugar Corporation
FTIB	Fiji Trade and Investment Board
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
NDMC	National Disaster Management Committee
NDMO	National Disaster Management Office
NGO	Non-Governmental Organisation
PMHRC	Prime Minister's Hurricane Relief Committee
SPDRP	South Pacific Disaster Reduction Programme
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
VAT	Value Added Tax

1. Introduction

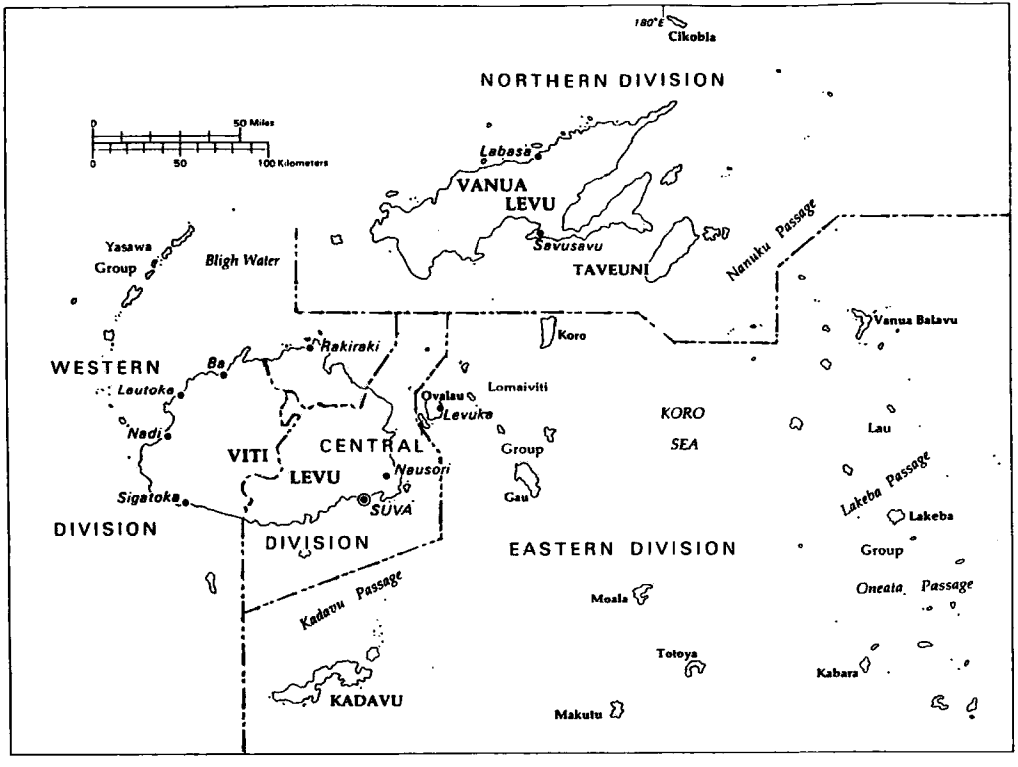
Fiji is comprised of an archipelago of over 300 islands, some 100 of which are permanently inhabited. The country had an estimated population of 771,000 in 1993 (EIU, 1995). The two largest islands, Viti Levu and Vanua Levu, account for some 87% of the total land area of the country and 75% of the population. Some 22% live in the capital city, Suva, on the east coast of Viti Levu (EIU, 1995) while over 90% live in the coastal lowlands (Nunn *et al.*, 1993). Around 60% of the population live in rural areas. The country has relatively high human resource development, ranking 47th on the UNDP human development index with an average life expectancy of 72 years and an adult literacy rate of 91% (UNDP, 1996). It is one of the most developed island economies in the South Pacific. For administrative purposes the country is divided into four divisions (Figure 1.1).

Fiji experiences a range of natural hazards, particularly cyclones and droughts. The population, agricultural and other economic activities, housing and key infrastructure are heavily concentrated in coastal areas because mountainous terrain further inland prohibits extensive development. This has effectively increased the disaster-vulnerability of both the population and economy. However, the number of deaths from natural disasters is relatively low with, for example, only 697 official deaths between 1882 and 1982 (although the real figure might be in excess of 800) (Campbell, 1984).

The Fijian economy has been heavily dependent on two industries – sugar and tourism – since before Independence. Successive development plans have emphasised a strategy which entails continued dependence on these two industries as well as some efforts at diversification to increase the long-term productive potential of the economy. Prior to the 1987 coups, these diversification strategies emphasised import substitution, with high effective rates of protection developed to protect domestic industries. Following the coups, there was a major shift in emphasis towards a more open economy, stressing export orientation in a low tax environment and a renewed focus on economic diversification.

The primary sector, including forestry and fisheries as well as agriculture, forms the backbone of the economy, contributing 21% of gross domestic product (GDP) in 1992–4. Sugar alone accounted for 41% of agricultural value-added and 9% of GDP over the same period. The two other main traditional crops are copra and rice. The industrial sector accounted for a further 17% of GDP in 1992–4 with the remaining 61% provided by the services sector. The latter includes a sizeable tourism industry which has been the country's single largest source of foreign exchange since 1989.

Figure 1.1 Map of the Fiji Islands



Source: Manao Mapworks

More recently, garment production has emerged as a new important industry but, despite government efforts to promote diversification, sugar and tourism remain the main driving forces behind the economy.

Maintenance of international competitiveness as well as global economic trends are critical to performance of the domestic economy in a small island economy such as Fiji which relies on world markets both as a source of imports and as an outlet for much of its output. Fiji's rate of inflation is also heavily influenced by price movements in the principal economies sourcing much of its imports.

Economic vulnerability is therefore a concept which is widely appreciated in Fiji, typically couched in terms of heavy dependency on sugar and tourism as a source of employment, government revenue and export earnings and of high dependency on world markets as a source of consumer goods and intermediate inputs to domestic production and as an outlet for its production. The role of natural disasters in determining inter-annual fluctuations in rates of growth and levels of capital stock in the Pacific islands economies is also well-recognised (e.g., World Bank, 1993; ADB, 1995).

Yet the economic impacts of natural disasters in the Pacific have been under-researched (PIDP, 1990),[3] effectively hindering the adoption of appropriate mitigation strategies or the integration of disaster management into overall macroeconomic planning and policy-making. Interest in disaster preparedness and mitigation is increasing but considerable further progress is still needed. Cohesive overall strategies, taking account of natural hazard risks in broad policy and strategic planning, rather than piecemeal strategies to respond to disasters as and when they occur, need to be set in place.

[3] Socio-economic impacts of climatic change in the Pacific are also reported to have been under-investigated (Porter, 1994).

2. Natural hazards in Fiji

The major natural hazards faced by Fiji are cyclones, floods and droughts and, on a less frequent basis, earthquakes and tsunamis.[4] Most of the soil is volcanic but no volcanic eruptions have been recorded since the arrival of the Europeans (Carter et al., 1991) and may not have occurred for over 2,000 years.

Cyclones Fiji lies in one of the most active tropical cyclone zones in the Pacific (Ibid.) and all areas of the country are probably equally vulnerable to cyclones (Blong et al., 1994). The main cyclone season extends from December to March but cyclones can occur as early as October or as late as May and do not occur every year. For example, there have been no cyclones since the 1992/3 season and nearly a quarter of the cyclone seasons between 1953/4 and 1992/3 were cyclone-free. In contrast, as many as seven cyclones were reported in the cyclone seasons 1922/3 and 1992/3 (Ibid.). Cyclones are typically classified according to wind strength and central air pressure. Based on the Australian cyclone severity scale, between 1953 and 1993 Fiji experienced two Category 5 cyclones, (with wind speeds in excess of 280km/hour); six Category 4 cyclones, (with wind speeds between 225 and 280km/hour); thirteen Category 3 cyclones (with wind speeds between 170 and 225km/hour); thirteen Category 2 cyclones (with wind speeds between 125 and 170km/hour); and fifty Category 1 cyclones (with wind speeds under 125km/hour). On the basis of records for the same period, Fiji can expect to receive 1.7 cyclones per annum whilst 2–4 cyclones will cause serious damage every decade.

However, classification of cyclones by strength alone is not very useful in assessing the economic significance of particular events. For example, cyclones will not necessarily strike towns or even land; and may or may not be associated with sea surges. Meanwhile, the occurrence of two cyclones in quick succession over the same area may result in higher levels of damage than would have occurred had there been a longer period of time between the two, allowing some opportunity for rehabilitation. Timing of cyclones is another critical factor, particularly in terms of damage to crops. Cyclones are typically accompanied by heavy rainfall and may result in landslides, again partly determining the scale of damage caused. However, more moderate and weak cyclones have sometimes been referred to as a 'blessing in disguise' by official

[4] A tsunami or tidal wave is a fast-travelling, broad wave normally generated by an undersea earth displacement. As the wave nears land it slows down and becomes much higher. A tsunami with a height of 24 metres was recorded in Japan in 1896, drowning 26,000 people (Alexander, 1993).

sources because of the heavy rain associated with them, bringing relief to drought stricken areas.[5]

Drought Fiji also experiences periodic national as well as more frequent regional drought.[6] The wet season runs from November to April, with much lower rainfall during the remainder of the year although the rainfall pattern varies across the country. The south-east and interiors of the two larger islands receive the highest rainfall. Lower rainfall is experienced in the north-west of the larger islands and the small outer eastern islands; and the Western Division and most of the islands in the Eastern Division regularly experience water shortages. However, the latter areas are not necessarily the most drought-vulnerable parts of the country: households in these areas will have adapted agricultural, economic and domestic activities to cope with regular water shortages. Instead, drought is defined for this study in terms of abnormally low rainfall in areas where water supply is normally assured.

There is some evidence of a relationship between weather patterns and El Niño Southern Oscillation (ENSO) events, which are associated with lower rainfall in the tropical Pacific region.[7] For example, both the 1987 and 1992 droughts appear to have been caused by ENSO episodes. The development of ENSO events is therefore monitored to provide medium term weather forecasts. The 1987 drought was considered to be one of the worst for much of the country (e.g., Porter, 1994). It began in the latter half of the 1986 dry season and continued through the 1986/7 wet

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[5] For example, such statements were made concerning Cyclones Rae (March 1990) and Fran (March 1992). The 1983 drought was also broken by two cyclones.

[6] This study uses drought to refer to infrequent rather than regular annual shortages of water during the dry season. Droughts are notoriously difficult to define and there is an extensive literature on their definition. For example, Glantz (1987) in a widely cited review, distinguishes meteorological, hydrological, agricultural and social drought. A general working definition of meteorological drought is 'a reduction in rainfall supply compared with a specified average condition over some specified period' (Hulme, 1995). Hydrological droughts pertain to the impacts of a reduction in precipitation on surface or sub-surface water shortfall and so may lag behind periods of agricultural or meteorological drought (Wilhite, 1993). Meteorological drought may result in hydrological conditions that have a direct impact on non-agricultural production, including hydro-electric power generation, and on human water supply. Agricultural drought is defined as a reduction in moisture availability below the optimum level required by a crop during different stages of its growth cycle and resulting in impaired growth and reduced yields. Social drought relates to the impact of drought on human activities, including indirect as well as direct impacts. However, it is difficult to establish a common basis for comparing different droughts because 'drought' as a concept is derived from the recognition of impacts. Furthermore, the relationship between rainfall variability and impacts depends on the specifics of a particular agro-ecological zone or economy.

[7] The relationship between El Niño events and cyclones in Fiji is less clear cut although there are apparently more cyclones east of the dateline during ENSO years.

season. It was particularly severe in the sugar cane-growing region of northwestern Viti Levu but even the normally wet Suva/Nausori area was affected.

Periods of low rainfall are also associated with increased risk of uncontrolled fire, reaping particular havoc on forests (see section 4.2).[8] The 1987 drought played an important role in exacerbating the scale of damage incurred as a consequence of increased numbers of arson fire attacks in that year, in turn associated with the then prevailing political turmoil.

Floods Many of the worst floods on record have been associated with cyclones and storm surges, resulting in riverine, coastal and flash flooding in catchments with steep mountains (Carter et al., 1991). For example, Cyclone Kina (1993) is reported to have caused the worst flooding in 60 years (NDMC, 1995). Fiji also experiences some seasonal riverine flooding, the risk of which has increased with deforestation, expansion of agricultural cultivation onto marginal lands and poor soil conservation techniques, in turn contributing to increased rates of soil erosion and siltation. Meanwhile, increasing urbanisation coupled with poor drainage facilities have increased the risk of urban flooding (Ibid.).

Earthquakes The Fiji Group experiences around 300 tremors per annum measuring under 4 on the Richter scale, particularly along the Suva-Beqa seismic zone. Earthquakes of Richter 6 or over occur about once every 10 years while earthquakes of Modified Mercalli Intensity 7.5 can be expected every 50 years on soft sediments and reclaimed lands in Suva and Nausori (Blong et al., 1994). The most damaging earthquake on record occurred in 1953, registering 6.5 on the Richter scale and, on the basis of available evidence, perhaps Mercalli Modified Intensity of 8 in some parts of Suva (Ibid.).[9] Considerable damage occurred in Suva and Kadavu, largely due to differential ground settlement rather than ground shaking (Ibid.). Most of the structures damaged were located on reclaimed land. The current macrozonation divides the Fiji region into areas of high, medium and low risk, with most of the region classified as medium risk. However, this map was developed for use by the building industry on a partly subjective basis and was considered 'too simplistic' by a spokesperson at the Minerals Resources Department. Furthermore, there is general 'apathy' about the risk of earthquakes, which are not perceived as a real threat (Prasad, 1993) by the general public. However, a new map is currently under

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[8] Fires are not considered as a disaster in their own right in this study but only to the extent that they are exacerbated by droughts. Major fires are usually started by the burning of sugar cane and cause considerable damage every year. One person interviewed for this study estimated fire damage of perhaps F$20m in 1995 alone.

[9] The Modified Mercalli Intensity ranges from 1 (not felt except by a few people under special circumstances) to 12 (total damage, objects thrown up into the air) (Alexander, 1993).

preparation and a microzonation is also being prepared for the Suva area, hopefully helping to improve public risk awareness.

Tsunamis Records on tsunamis are incomplete. The largest recorded tsunami occurred as a consequence of the 1953 earthquake, striking during low tide and reaching a height of 1.8 metres in Suva harbour. However, tsunamis of 2 metres are considered possible perhaps every 100 years in areas protected by reefs, with larger ones in other coastal areas. For example, a 2.8 metre tsunami could occur in Suva harbour during high tide (Blong et al., 1994). Past tsunamis have been generated both locally, within the Fiji area, and on the other side of the Pacific Ocean. Tsunamis can damage wharf and port facilities as well as seawalls, roads, bridges and buildings, as, for example, in 1953.

Global warming and changing hazard risks There are concerns, as yet scientifically unsubstantiated, that the frequency and intensity of certain natural disasters will increase as a consequence of global warming and that Fiji can also expect to face a rise in sea-level. For example, there has been an apparent increase in the frequency of cyclones since the early 1980s which some suggest may be linked to higher sea surface temperatures (e.g., Nunn et al., 1993). However, there is no hard evidence to suggest that this trend will be sustained or, indeed, that it is linked to global warming. There is also great uncertainty concerning the impact of global warming on levels of precipitation. Some argue that it may increase rainfall but there could also be greater inter-annual fluctuations in both precipitation and temperature (Porter, 1994). More intense rainfall events would trigger a larger number of landslides as well as increase the rate of soil erosion.

Environmental factors are also playing some role in increasing the country's hazard vulnerability. For example, mangrove forests, which offer important protection to both coastlines and coral reefs from coastal flooding, have declined from an original level of 45,000 ha to 42,000 ha as land has been reclaimed for agricultural purposes and trees cut down for fuelwood (IUCN, 1993). Ironically, some of the reclaimed land has subsequently proved unsuitable for agricultural production (Porter, 1994). The threat of damage from landslides is also reported to be increasing, in part due to the expansion of agriculture and urban areas into higher risk zones. The most extensive landslides recorded followed Cyclone Wally in 1980. A large number of landslides also occurred following Cyclone Kina in 1993, around half of which were related to road construction practices (NDMC, 1995). Greater attention to protection of the environment is clearly important in reducing the scale and frequency of natural disasters.

3. Economic performance and natural disasters, 1971–94

During interviews conducted for this study, some initial surprise was expressed about the selection of Fiji for a study of the economic impact of disasters. Fiji, it was argued, had not had a major natural disaster for several years. Furthermore, it was not nearly as vulnerable to natural disasters as some of its Pacific island neighbours. However, preliminary examination of GDP data over the past 25 years suggested that the Fiji economy had, in fact, suffered severe effects of natural disasters, particularly since the early 1980s. A clear picture emerged of substantial fluctuations in both overall GDP and the agricultural and manufacturing sectors which appeared to be partly correlated with the incidence of natural disasters (Figures 3.1, 3.2 and 3.3). This relationship was therefore examined more formally using quantitative statistical techniques (see Appendix 1). The impact of more severe disasters was also explored more qualitatively, as discussed below. A separate exercise was undertaken to explore the longer term impacts of natural disasters (see Box 3.1).

The quantitative statistical analysis confirmed that both the manufacturing and agricultural sectors as well as overall GDP have become increasingly vulnerable to natural disasters since the early 1980s (see Appendix Table 2). Regressions for the later period, 1982–94, excluding sugar in agricultural and manufacturing production indicate that the sugar industry is responsible for the increasing vulnerability of the manufacturing sector but is not entirely responsible for that of the agricultural sector (see Appendix Table 3). Ironically, the economic importance of sugar has also declined since the 1970s, as discussed in further detail in section 4.1. For example, sugar's contribution to GDP as part of manufacturing value added fell from 4.1 to 3.4% between the two periods 1978–80 and 1988–90 whilst its contribution to GDP as part of agricultural value added declined from 10.5 to 8.8%.

Actual relative to forecast economic performance provides a second indication of the economic impacts of disasters. Annual government budget statements are drawn up towards the end of each calendar year and include various growth and other forecasts for the forthcoming 12 months. These constitute short-term forecasts which, by definition, incorporate reasonably accurate assumptions about the prevailing longer-term state of the domestic and world economy and international commodity markets. Unsurprisingly, therefore, these forecasts have proved consistently over-optimistic in years of major disasters.

Figure 3.1: Fiji GDP, 1972-94 (annual growth rates)

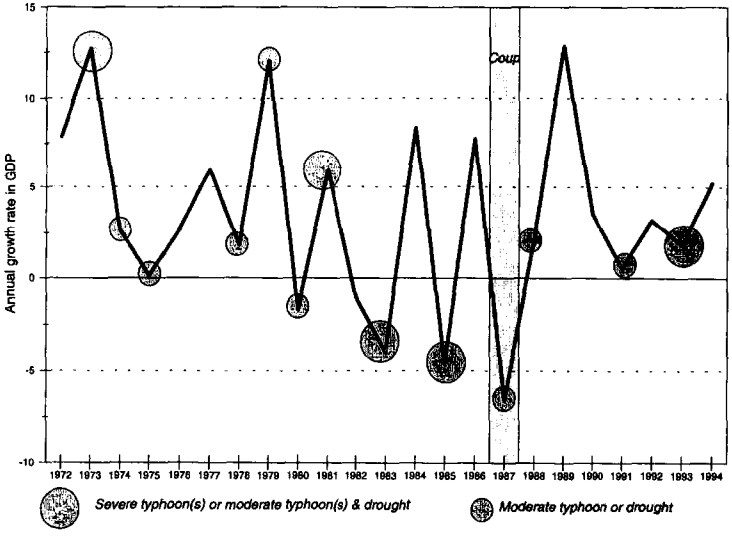
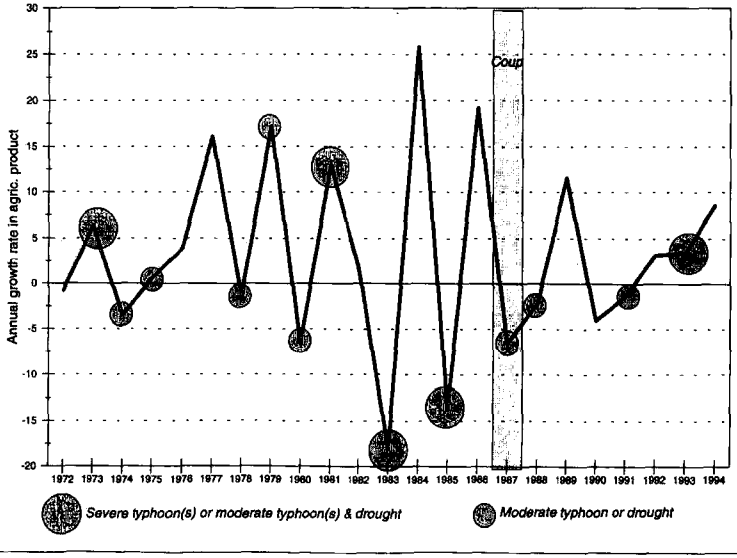


Figure 3.2: Fiji agricultural product, 1972-94 (annual growth rates)



Box 3.1 Modelling the longer-term impacts of natural disasters

To try to capture the impact of natural disasters on longer-term growth, a simple auto-regressive linear model using ordinary least squares multiple regression analysis was developed for the period 1982–93. GDP growth rates (at factor cost) in year t was regressed on GDP growth rates in year t-1 and on the cyclone/drought and coup dummies developed in Appendix 1:

$$y_t = \alpha + \beta y_{t-1} + \gamma C_t + \delta Cp_t + \epsilon_t$$

where y_t is real (constant price) GDP growth in year t, C is the cyclone/drought dummy and Cp is the coup dummy. The regression coefficients were then used to estimate annual rates of growth assuming a no disaster scenario (ie, setting all values of the cyclone/drought dummy to 0).

The results suggest a much smoother rate of growth under the no disaster scenario, as illustrated in Figure 3.4. Although this scenario would imply lower rates of growth in post-disaster years, average growth rates are considerably higher, averaging 4.8% per annum between 1982 and 1994 rather than an actual average annual growth rate of 2.4%.

Obviously, economic development entails far more than the achievement of higher levels of economic growth alone. The growth opportunities foregone as a consequence of natural disasters should not just be taken at face value but translated, for example, into lost investment and employment opportunities and an effective delay in longer term rises in standards of living and reductions in poverty. Moreover, the results exaggerate the projected rates of growth under a no-disaster scenario to the extent that a number of other factors which influence inter-yearly functions in GDP are excluded from the analysis. Nevertheless, it would be reasonable to conclude that average growth rates would be higher if Fiji did not experience intermittent natural disasters.

For example, in 1983 – the year of Cyclone Oscar, severe drought and a continuing world recession – the economy declined by 4.0% in real terms compared with a forecast growth rate of 2.7%. Prospects for 1985, another year of severe disasters, were not considered particularly bright even before the disasters struck, due to continuing world recession, low international sugar prices and poor investment performance. However, actual performance was even worse than expected as Cyclones Eric and Nigel, as well as faltering recovery in the world economy, resulted

Figure 3.3: Fiji manufacturing product annual growth rates, 1972-94

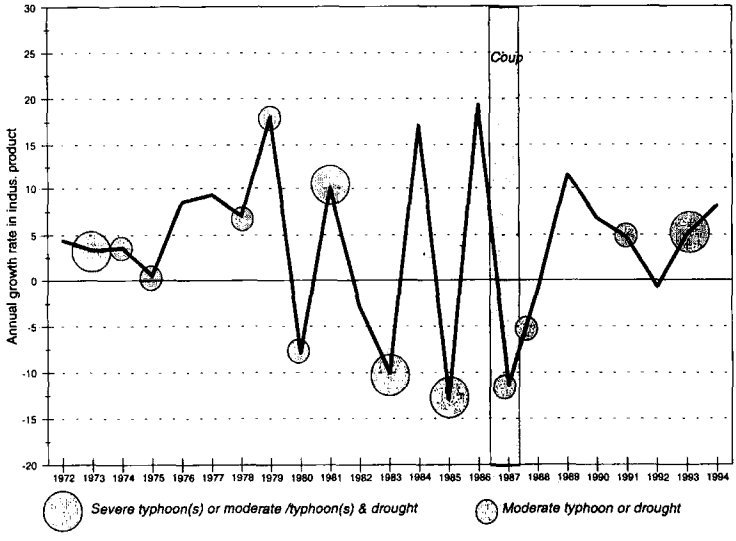
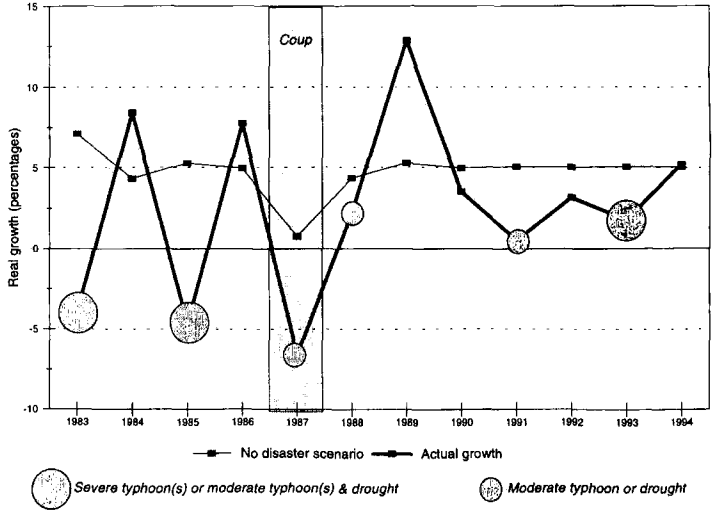


Figure 3.4: Fiji GDP growth, 1983-94: actual and fitted growth assuming a no-disaster scenario



in a real 4.6% decline in nominal GDP year on year compared with a forecast growth rate of 1%. Sugar cane production fell 29% to only 72% of forecast output, with inadequate cultivation and use of fertilisers exacerbating the impact of the cyclones (Fiji Government, 1985b).

The most recent major disaster occurred in 1993 when Cyclone Kina struck (see Box 3.2). This cyclone is widely regarded as one of the most damaging cyclones on record (e.g., Fiji Government, 1993). Again, economic growth was less than forecast, with a real growth rate of 1.8% compared to the 3% forecast. However, despite the severity of the cyclone, this shortfall in performance was relatively minor as compared with the experiences of the early 1980s. The manufacturing sector recovered rapidly and the country benefited from record visitor arrivals as tourism was boosted by strong economic recovery in Fiji's traditional tourist-sourcing markets. Non-sugar agricultural production fell but sugar and forestry output also increased, reflecting a timely start to the season and good milling performance, despite subsequent industrial action in September. [10]

In contrast, in years succeeding major disasters forecasts have typically underestimated actual performance. This appears to reflect a common assumption that sugar production will decline in post-disaster years. For example, weak performance was anticipated for 1984, in part as the sugar industry was expected to continue feeling the impact of the previous year's drought, and in turn placing pressure on the balance of payments. However, in the event, sugar production was 60% higher than forecast, contributing to a real GDP growth rate of 8.4 rather than 4.2%. The balance-of-payments deficit was also considerably reduced. Similarly, in 1986, sugar production increased by 47% year on year due to favourable weather conditions and a concerted effort to motivate farmers. Earlier fears that sugar output would be much reduced as efforts were diverted into the rehabilitation efforts instead, in turn delaying planting, and as a consequence of low prevailing prices proved unfounded. Meanwhile, the economy expanded by 7.7% in real terms rather than by 4.2% as forecast. Forecast growth proved unduly pessimistic, again, in 1994, with an actual growth rate of 5.2% compared with the forecast rate of 3.2%, in part because expected declines in sugar output did not materialise. Instead, Fiji achieved its highest sugar production since 1975, boosted by high sugar content in cane as well as good sugar cane yields. The livestock and fishing sectors also grew strongly

[10] A similar pattern of poorer actual than forecast performance was observed in 1987 but this probably largely reflected the impact of the coups rather than the severe drought which was experienced the same year. Relatively strong growth of 3.7% was forecast, with an anticipated expansion of sugar exports and of the fishing, forestry, tourism and trade sectors. However, actual GDP declined by a dramatic 6.6% in real terms, largely due to a fall in sugar production and a substantial decline in tourist arrivals, both consequences of the coups.

Box 3.2 Cyclone Kina, January 1993

The most recent severe cyclone to strike Fiji, Cyclone Kina, was estimated to cause financial losses to the tune of F$170m (US$110m), making it the country's most costly disaster on record. The heavy costs partly reflected the cyclone's unusual path, resulting in damage in most parts of the country, as well as heavy associated flooding. The northern and eastern parts of Viti Levu and some of the islands in the Lomaiviti Group and southern Lau were declared the most severely hit, whilst 23 people were killed.

The floods destroyed the country's two main bridges at Ba and Sigatoka, causing major disruptions to transport between the Central and Western divisions. A number of landslides, particularly in the interior of Viti Levu, also cut the road access to settlements inland whilst four major jetties were extensively damaged. Some areas suffered almost total crop loss, while farm machinery and equipment was washed away and drainage and irrigation systems damaged. Heavy livestock losses were experienced in Viti Levu, threatening the dairy and meat industries. The poultry industry was also badly damaged. Houses and other infrastructure close to river banks were swept away by floods whilst buildings elsewhere suffered damage from high winds. The industrial production index for the first quarter of 1993 suggested a slight decline in output, in part due to disruptions to the power supply as a consequence of the cyclone. Industrial output for the year overall fell by 4.5% in real terms, despite the fact that factories latterly worked increased overtime to partly make up the lost production. The start of the 1993 school year was deferred for 2 weeks whilst some 294 school buildings were repaired.

As of August 1993, the total relief and rehabilitation programme was estimated at F$64.6m of which 27% was for infrastructure, 28% for economic rehabilitation and 45% for social rehabilitation. External assistance to the value of US$6.3m, including US$89,000 from private sources, was provided in support of the relief and rehabilitation efforts. The government also redeployed F$40.2m of government finance, equivalent to 31.7% of the capital budget (see Chapter 9).

58,000 farmers were assisted through the rehabilitation programme, benefiting from the supply of planting materials, repair of agricultural infrastructure and assistance in land preparation and crop rehabilitation. A fishing rehabilitation programme was also implemented, primarily aimed at the utilisation of marine resources by those affected by the cyclone. Rations were distributed to some 140,875 people, equivalent to 17.9% of the population. Meanwhile, reconstruction costs included repairs to the value of F$12.2m to be undertaken by the Public Works Department, (including roads and bridges); F$7.0m for repairs to the electricity network; F$2.7m for postal and telecommunication service repairs; $F5.2m for agricultural sector repairs and rehabilitation; F$12.4m for repairs to Fiji Sugar Corporation facilities; F$1m. for rehabilitation of the pine forests; F$1.2m for repairs to schools; and F$1.2m for health sector rehabilitation.

Source: Rokovada and Vrolijks (1993), Fiji Department of Regional Development (1994).

although production of other crops declined marginally, partly reflecting the lingering effects of Cyclone Kina.

Meanwhile, the fact that the economy achieved a positive growth in 1993 despite Cyclone Kina suggests that the economic impacts of a disaster may be exacerbated during periods of more fundamental underlying weakness, whilst the effects of those occurring during periods of stronger growth, such as Kina, may be overcome more easily. This hypothesis is difficult to prove as it could be argued that forecasts typically underestimate the severity of impact of anticipated factors, such as world recession or depressed commodity markets. Nevertheless, a similar pattern is also apparent in the 1970s. The economy experienced high rates of growth from 1965–73, fuelled by the tourist industry and associated growth in the construction industry. The 1973/4 oil crisis, coinciding with a severe cyclone, Bebe, resulted in temporary difficulties but the economy recovered to experience higher growth again during the remainder of the 1970s, with disasters occurring during this period having little apparent impact on economic performance. In contrast, the early 1980s, when natural disasters appeared to exert a heavy toll on overall growth rates, was a particularly difficult period for the Fijian economy. The country faced increasing debt servicing charges associated with external financing of major infrastructure projects, the consequences of world recession and a deterioration in its terms of trade, in turn reflecting declining commodity prices and soaring oil prices following the second oil price shock of 1979–80. On the domestic front, there was also limited scope for attaining further economic growth from the import-substitution strategy pursued during the 1970s, a strategy which had also resulted in the emergence of a high-cost economy. Despite continuing economic difficulties, the remainder of the 1980s and the early 1990s were fortunately largely disaster-free whilst, as already noted, Cyclone Kina occurred against a backdrop of economic recovery.

This point about the scale of impact of particular disasters relative to underlying economic performance may not be particularly profound. However, it does underscore the need to recognise and address longer-term problems, rather than attribute any difficulties to natural disasters, an easy scapegoat. It also highlights the fact that some of the most economically-vulnerable elements of Fiji's economy, in terms of their dependence on external markets, are also vulnerable to natural disasters. Diversification out of more disaster-prone sub-sectors would help minimise inter-annual fluctuations in economic performance, which can only serve to undermine investors' confidence.

4. Productive sectors and natural disasters

4.1 Agriculture

Performance in the agricultural sector continues to remain critical to the overall economy. The sector accounts for some 20% of GDP and 56% of export earnings while more than 75% of households are engaged either full or part-time in crop production, livestock, forestry and fisheries (World Bank, 1995). Furthermore, subsistence farming for on-farm use and consumption by relatives in urban areas, much of which probably goes unrecorded in official statistics, remains an important source of food supply and even sugar cane farmers grow a major part of their own food supplies. Subsistence farming consists of production of a mixture of rootcrop staples, tree crops, green vegetables and a range of other crops as well as livestock farming (Porter, 1994). Agricultural productivity is relatively low, in part reflecting limited use of fertiliser and other agro-chemicals, except in sugar production (World Bank, 1995).

According to the 1991 National Agricultural Census, farms average 7.2 ha in size (Fiji Ministry of Primary Industries and Co-operatives, 1992). However, land distribution is relatively unequal and over 60% of farms are under 3 ha. Flat, undulating and gently hilly land account for only 31% of the total land area, with most land suitable for intensive agricultural production located in coastal areas, river deltas and the wider alluvial terraces of the lower courses of many rivers (Porter, 1994). Yet these areas are also particularly susceptible to cyclones, coastal and riverine flooding, storm surges and tsunamis. Most first class arable land is already in use and additional increases in land under cultivation now imply expansion into marginal hill areas and steep lands, causing environmental degradation and increasing the risk of natural hazards. Certain agricultural practices in these areas, such as steep land sugar cane and ginger production, have contributed to soil erosion, loss of topsoil and sedimentation of rivers and streams, the latter effectively exacerbating problems of flooding.

The agricultural sector is particularly susceptible to droughts and cyclones although the extent and nature of impact depends partly on the timing of each disaster relative to the cropping cycle of various crops. Total rainfall is generally considered sufficient for rainfed production except in the Western Division but occasional prolonged dry periods of 3–4 months can create difficulties elsewhere (Amerasinghe, 1984). Droughts reduce yields of most crops, with the notable exception of sugar which to some extent performs better under poor rainfall conditions (see below). Drier conditions are also associated with pest outbreaks, with further adverse implications

for crop yields. More generally, droughts can have particularly severe effects on reduced yields if they are preceded by several years of low rainfall; or if they succeed a cyclone which has already damaged crops. They can also delay planting operations.

The impact of cyclones on crop production is complex. Amerasinghe (1984) identifies the following effects:

> '. . . lack of sunlight due to cloudy spells, lack of soil air due to excess rainfall or inundation as a result of storm surges, lack of soil nutrients and anchorage due to erosion and landslides, physical injury due to strong winds, floods, storm surges or sea spray.[11] Elevated humidity and splashing by rain or carriage of spores by wind and ecological changes may also increase the incidence and severity of certain pests and diseases. Rapid weed regrowth also has been associated with the season.' (p.131).

Trees can be particularly vulnerable as cyclones break branches, defoliate trees and sometimes even uproot them. Production from remaining trees can be reduced for several years as, for example, in the case of coconuts or breadfruit. Cyclones can also dislodge other crops, such as sugar cane, damaging rooting systems and greatly reducing production. Heavy rainfall, which is often associated with cyclones, can also result in the waterlogging of soils and the consequent rotting of crops. It may also wash out more shallow-rooted crops (Porter, 1994). In fact, cyclones have completely destroyed food crops in some parts of Fiji on occasion. A rapid succession of cyclones, or cyclones and droughts, also gradually increases the vulnerability of perennial crops as, for example, observed in the case of coconut stands in 1983.

Disasters, particularly cyclones, can also have indirect impacts on the agricultural sector via their impact on farming equipment and agricultural infrastructure, such as drainage and irrigation systems. Transport and marketing infrastructure may also be affected, both in terms of physical damage and of capacity relative to demand, as the movement of relief supplies places additional pressures on the system. For example, the 1992 drought coincided with the sugar harvest, reportedly making it difficult to obtain trucks to move water because truck owners could make more money transporting sugar cane.

However, Chung (1987: 43) points out that the impact of natural disasters may not be entirely negative: they offer 'an opportunity to stimulate greater activities through (1) increasing areas of both cash and food crops, (2) replacing lesser economic

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[11] For example, salt-water sea-spray created as a consequence of Cyclone Joni (December 1992) caused damage to rootcrops all over the island of Kadavu (Fiji Department of Regional Development, 1993).

crops,[12] (3) introducing high yielding as well as less vulnerable crops, and (4) improvement of existing infrastructure and support systems'.

There are also a variety of ways in which the agricultural impacts of natural disasters can be mitigated, both at the household level, with the objective of ensuring household food security, and in terms of national agricultural output. Vulnerability to disasters can also be reduced by adjusting farming techniques, cropping patterns and the varieties of crops produced. For example, multi-cropping or multi-tiering may offer a way of protecting crops against high winds. Meanwhile, cultivation of a number of crops with varying seasonality and dates of maturity can also offer some protection. Traditional agricultural practices recognised the vulnerability of households to natural disasters, with the cultivation of a wide range of crops with varying vulnerability to high winds and water requirements (Rokovada, no date). For example, swamp dalo (taro or *colocasia esculenta),* also known as *via*, was grown in flood-prone areas. Although the crop takes 3 years to mature, it can withstand floods and hurricanes and be stored for up to 15 months without deteriorating. Other crops were also preserved and stored for use in periods of hardship. For example, yams were commonly grown before the cyclone season and stored whilst another variety of dalo, *dalo-ni-tana*, could be stored underground for months. A number of foods were also fermented, particularly plantain, breadfruit, Tahitian chestnut, dalo and cassava. After several months' fermentation, the food would keep indefinitely and could be served baked, boiled or steamed.

However, regression analysis of the impact of cyclones and droughts on agricultural GDP suggests increasing vulnerability of the sector to disasters, as already noted. This is partly due to an apparent increase in the vulnerability of sugar but also, as discussed below, of other crops such as coconuts. More generally, traditional disaster mitigation practices have gradually been eroded. For example, nowadays, with the widespread availability of cold-storage facilities, traditional long-term storage practices are not very common. Cultivation of disaster-resistant crops also occurs on a much smaller scale than in the past.

Moreover, current changes in the agricultural sector suggest that the sector's hazard vulnerability could increase even further in the medium term. Since the 1980s, efforts to promote diversification have been stepped up and movement into irrigated rice, vegetables, fruit and, more recently, flowers and herbs has begun. New crops include citrus, pineapple, paw-paw, mango, and certain indigenous crops such as taro, duruka (*saccharum edule*) and yaqona (*piper methysticum*). Dairy, beef and poultry production has also increased. Yet many of the new crops are highly vulnerable to cyclones and droughts. Moreover, much of the diversification is aimed at the export

[12] By 'lesser economic crops' Chung refers to crops which are of less importance to the economy than certain other crops.

market yet even wind-damaged crops with only slight surface markings may not be acceptable for export. Meanwhile, individual farmers are increasingly producing just a few crops rather than a larger number, with varying vulnerability to a range of weather conditions and natural hazards. Environmental degradation is also playing some role in increasing the disaster vulnerability of the agricultural sector and could become a critically important factor in future years. Natural coastal vegetation, which provides some protection of crops against sea spray, has been partly destroyed. There has also been some reclamation of mangroves, as already noted, whilst an estimated 11–16% of the country's forests have been converted to non-forest uses since the mid-1960s (IUCN, 1993). The country's *National Environment Strategy* concluded that 'Fiji is definitely at a threshold, environmental problems ... have the potential to escalate rapidly both in extent and severity' (ibid: 13).

However, increasing vulnerability is not inevitable. For example, there is some scope for diversification into crops which are less hazard vulnerable, such as winter crops which are grown under irrigated conditions and also, by definition, outside the cyclone season. For example, although Cyclone Sina (November 1990) caused some damage to vegetables and squash, the extent of damage was limited by the fact that much of the crops had already been harvested (National EMSEC Task Force, 1990). Early maturing perennial winter crops could offer particular benefits in terms of their reduced hazard vulnerability. Diversification back into traditional rootcrops and tubers could also play an important role, both at the household and, with increasing development of niche export markets, the macroeconomic level. For example, export markets have already been established for less disaster-vulnerable crops such as dalo, duruka and yaqona (Fiji Government, 1993). As already indicated, faming techniques and choice of crop varieties can also be particularly important in reducing the impact of natural hazards.

Despite such possibilities, the Government appears to have done relatively little to promote measures to reduce the agricultural sector's vulnerability to natural disasters. According to the *Fiji National Disaster Management Plan*, communities and individuals are expected 'to take adequate preparations before disasters to ensure the availability of food after the disaster, and to recover, to the extent possible, damaged food crops for consumption' (NDMC, 1995: V-6). Moreover, the Plan specifically identifies a role for the Ministry of Agriculture in reducing the vulnerability of agriculture to natural disasters. This would seem to imply a part for the government in providing advice on strategies to reduce the impact of disasters and in helping to sustain knowledge and practice of traditional coping methods. However, it is not clear to what extent the government is fulfilling these roles nor how much formal research has been undertaken into disaster mitigation strategies. Broader policy documents also appear to fail to recognise, let al.one address, the potentially serious agricultural impacts of natural disasters. For example, the *Opportunities for Growth* document (Fiji Government, 1993) makes no mention of natural disasters in discussing

constraints faced by the agricultural sector, whilst the policies and strategies outlined also fail to include any aimed at reducing the sector's disaster vulnerability.

More positively, the government does support agricultural rehabilitation efforts in the aftermath of a disaster, which are important in ensuring a relatively speedy recovery and restoring household self-sufficiency. There is typically increased planting of more disaster resistant crops in the aftermath of a disaster, a practice endorsed by the government. For example, several district officers promoted a shift to more drought resistant crops, such as yams and kawai, in response to the 1992 drought. The Ministry of Agriculture also recommends the planting of sweet potatoes and other quick maturing crops, with short growing seasons of only 2–4 months; and helps ensure availability of both sweet potato cuttings and dalo tops for planting in support of such efforts.[13]

A statistical analysis of the impact of cyclones and droughts on five major food, agro–industrial and export crops – sugar, coconut and copra production, roots and tubers, cassava and ginger – was undertaken as part of this study with the objectives of:

- to establish the relationship between rainfall variability and cyclones and crop yields and acreage planted (as disasters may effect cropping decisions or hinder planting operations)[14]; and
- to identify which crops, and thus which parts of the economy linked to these crops, are more sensitive to natural disasters (see Appendix 2).

The results of this analysis are presented below, together with a more qualitative discussion of the nature and extent of vulnerability of individual crops.

Coconuts Coconuts are the country's second largest traditional export crop and form the economic basis of the Eastern Islands and much of the Northern Division (Fiji Ministry of Primary Industries and Co-operatives, 1992). Some 48,000 people are estimated to rely on coconut production as a source of income (World Bank, 1995), with the crop grown under a mixture of large- and small-scale production. Copra is crushed and converted into oil, primarily for export.[15] Coconuts are also used for on-farm consumption, with most meals in the coconut-growing regions involving the use of coconut milk (Brookfield et al., 1985). According to the 1991 agricultural census,

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[13] In practice, some dalo tops are eaten rather than planted to meet immediate food needs.

[14] For example, Cyclone Kina (1993) and subsequent adverse weather conditions delayed the preparation of land for maize production, leading to a 4.5% decrease in the acreage planted (Fiji Ministry of Agriculture, 1994).

[15] Approximately 6,000 nuts are required to produce one tonne of oil.

over half of the area under coconuts was mixed with pastures or other crops (Fiji Ministry of Primary Industries and Co-operatives, 1992), effectively making it difficult to assess the scale of damage in the aftermath of a disaster.

Since the early 1990s there have been growing concerns about the advanced age of the country's coconut trees and, thus, about the future viability of the industry. Some two-thirds of the trees are now senile and, reflecting this, production has gradually declined although the acreage under coconuts is reported to have remained approximately constant over the past 15 years (World Bank, 1995). Poor price expectations since the 1950s have acted as a continuous disincentive to replanting while intermittent damage from cyclones has added a further disincentive (Brookfield et al., 1985).

Cyclones can cause widespread premature nutfall and delayed setting of new nuts. Older trees can take 3–5 years to recover whilst younger ones do not bear nuts for up to 7 years and can also be knocked down. For example, copra production fell by 35% in 1993 due to the combined impacts of Cyclone Kina, depressed world market prices and higher sale of whole nuts (Fiji Government, 1994c). Even lower production was reported in 1994, reflecting the continued effects of Cyclone Kina as well as the increasing senility of the stands. Coconut trees are generally less susceptible to rainfall shortages but severe droughts can result in substantial declines in production, particularly when they occur in the aftermath of a cyclone, and recovery is slow. For example, the prolonged 1987 drought was largely responsible for a 34% decline in coconut production and a 43% fall in copra production, with a further 15% decline in the latter in 1988, whilst production of both coconuts and copra was not restored to 1986 levels until 1990.

Regression analysis undertaken for this study on both coconut and copra production confirms their high vulnerability to cyclones. It also indicates increasing vulnerability between 1970–82 and 1982–92, probably reflecting the increasing age of trees. The regression analysis provides little evidence of any correlation with rainfall but this could reflect the more extended impacts of rainfall deficits, with the effects felt over a number of years rather than in the drought year alone.

Despite their vulnerability to natural hazards, coconuts will continue to represent an important source of income for certain rural areas, particularly in the outer islands where there are few alternative income-generating opportunities. New high-yielding dwarf hybrids are currently on trial in a relatively drought and cyclone free area of the country, achieving yields of 3–4 tonnes per annum compared with 1.5–2 tonnes from older varieties. These new varieties will gradually be planted up in certain parts of the

country.[16] However, hybrids are more susceptible to droughts, with water shortages affecting fruiting, and will therefore only be planted in areas with sufficient rainfall. They also have shorter rooting systems and so will be planted in 'less cyclone prone areas', according to a Ministry of Agriculture spokesperson.[17] Thus, natural hazard risks will effectively limit the scale of potential productivity gains by limiting the adoption of higher-yielding varieties.

Rice Rice is largely produced under rainfed conditions as a subsistence crop, with production concentrated in the Northern and Central Divisions. Rainfed production accounts for some 90% of total paddy production. Rice is normally planted in mid-November but can be delayed up to mid-December if there is insufficient water available. If water shortages continue through mid-December no rice can be planted that season. Rice production can also be adversely affected by cyclones, primarily as the heavy rainfall which cyclones are often associated with dislodges plants.

Regressions of rice yield against cyclone and lagged cyclone dummies suggest that in practice national rice production has been relatively immune to cyclones although individual farmers have suffered damage. However, rice yields are sensitive to rainfall fluctuations, with some evidence of increasing vulnerability as rice production has expanded marginally. This relationship is confirmed by data for individual years. For example, the 1983 drought resulted in a 14.8% fall in rice yields year on year whilst yields fell by 9.5% in 1987. However, no relationship was found between acreage and rainfall lagged one year, implying that rainfall deficits do not result in a diversion out of rice production.

Rootcrops Rootcrops are grown both for on-farm consumption and as a source of cash income, providing an important source of revenue for some subsistence farmers. Cassava is the most common traditional staple in Fiji and is mainly grown by smallholders, largely as "pure stand". It is planted throughout the year and takes 9–12 months to reach maturity. Dalo is another common rootcrop, grown for both domestic consumption and, particularly in recent years, export. The main planting season is between September and November, with an off-season crop planted between March and June. However, dalo can be planted throughout the year in the wet zone. The crop takes 8–12 months to reach maturity.

On balance, rootcrops are relatively immune to natural disasters. Cyclones agitate the leaves and stems of cassava, causing the underground roots and tubers to move and,

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[16] For example, the 1993 Annual Report of the Extension Department of the Ministry of Agriculture outlined plans to establish 128 0.5 ha coconut hybrid farms and to replace senile and damaged coconut stands with Fiji Tall and Rotuma Tall varieties.

[17] It is not quite clear what is meant by 'less cyclone prone areas' since all areas of Fiji are regarded as equally vulnerable to disasters.

in turn, resulting in damage and bruising and, thus, quick infection and rotting. More mature crops are particularly susceptible to such damage but younger ones may recover. However, losses can be mitigated by cutting the leaves and stems down to almost ground level immediately prior to a cyclone, as is commonly done although this reduces the flavour of the crop. Yams and dalo are generally less vulnerable to the wind effects of cyclones. However, all rootcrops can be destroyed by flooding, which is often associated with cyclones. Damaged crops which are not harvested within 2 weeks of a flood are lost. Droughts present less of a problem as neither cassava nor dalo have major water requirements.

The relative immunity of rootcrops to both cyclones and droughts is confirmed by regression analysis,[18] underlining the importance of promoting increased production of these crops both to meet domestic food requirements and to help stabilise export earnings during the aftermath of major natural disasters. Exports of rootcrops have already begun, as already noted. For example, yams are largely produced for the export market nowadays rather than for storage for use in the aftermath of natural disasters whilst cassava and dalo are also being exported. Export earnings from rootcrops increased by 88% in real terms between 1988 and 1992, to F$3.2m.

Ginger Ginger was introduced to Fiji as a diversification crop and the government has identified it on several occasions as one of the 'most successful' diversifications crop to date because of its high labour absorption capacity and significant contribution to value added output (e.g., Fiji Government, 1992: 14). The government supports further diversification into ginger production. However, certain reservations about ginger production have gradually crept into official documents, with warnings of the need to encourage production in an environmentally sustainable way because of the potential damage it can cause (e.g., Fiji Government, 1995). To date, production has remained limited and has not created substantial environmental damage but current practices are considered to have set a poor precedent for further expansion (IUCN, 1993).[19]

Ginger is an annual crop which is planted in September and harvested either in late February or March, as immature ginger for processing into syruped and crystallised forms, or in September, as mature ginger which is dried and ground to a powder. The crop requires high rainfall and good drainage for successful cultivation and so is often grown on hillsides (Porter, 1994), effectively making it vulnerable to drought. Ginger

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[18] Long series of production, yield and acreage data are not readily available for individual rootcrops. Data on rootcrop acreage published by the FAO, is rounded up to the nearest thousand hectares effectively making it insensitive to analysis because acreage is relatively low in the first place (for example, averaging 5,000 ha in 1989–92).

[19] There has also been a major problem of disease in the ginger crop.

production can also be adversely affected by defoliation during cyclones, reducing yields although not directly damaging the ginger.

Regression analysis suggests no significant relationship between rainfall variability or cyclones and ginger production at the national level. However, incomplete data on yields of immature ginger alone suggest otherwise, with an apparently significant decline in yield in years of major cyclones. This is confirmed by reports of the impact of Cyclone Kina which resulted in a 34.6% decline in ginger production in 1993 and a consequent fall in exports.

Sugar Sugar is the single most important crop in Fiji, as already indicated. It contributed 41% of agricultural GDP, 28% of manufacturing GDP and 39% of merchandise exports in 1992–4. Molasses, a by-product, is sold by tender to the highest bidder and normally secures good returns. Some 20,000 people work on cane farms, including landless cane cutters who earn very low wages.[20] Farming is based around small-holder production, with average holdings of 3.8 ha (Fiji Ministry of Primary Industries and Co-operatives, 1992).

Production is undertaken under rainfed conditions. Sugar cane can be replanted every year but farmers tend to adopt multi-ratooning, with an average of 5, and in some cases up to 7, crops derived from shoots which spring up from existing sugar cane roots following each harvest. The older the ratoon, the weaker and shorter the crop. Multi-ratooning therefore reduces sugar yields but, since payments are based on cane bulk rather than sugar content, there is little incentive to adjust practices. Planting of new cane occurs in around March and sugar grows for 12–16 months before it is cut. The harvest and milling season runs from April through December.

The sugar industry is managed by the Fiji Sugar Corporation (FSC), a state enterprise which provides extension, research, transport, milling and marketing services. The FSC operates four sugar mills, three of which produce raw sugar for export and one for the local and regional market. The FSC also operates a railway network, including rail-lines and locomotives, to transport cane to the mills.

Production expanded during the 1970s as the acreage under sugar cane increased. It was envisaged that output would continue to grow in the 1980s and the Eighth Five-Year Development Plan set an output target of 600,000t by 1985. However, actual production was only slightly over half this level in 1985 and around two-thirds of it in 1986. The Ninth Five-Year Plan adopted the same target but, instead, sugar production remained approximately static during the remainder of the 1980s, reflecting little change in either area planted or yield. This poor performance was

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[20] In the early 1980s, many landless cane cutters were reported to be permanently in debt (Barr, 1990).

principally due to a combination of natural disasters and the limited incentive to increase yields.

Cyclones can damage sugar cane, dislodging crops and causing cane to break but generally not uprooting plants. For example, Cyclone Oscar devastated the main sugar-growing areas in the Western Division, resulting in a US$20m loss of earnings for cane farmers whilst the 1985 cyclones resulted in losses of US$21.7m. However, crops will normally recover the following season. Meanwhile, various infrastructure including mills and tramlines have been damaged by cyclones on a number of occasions, although mills are cyclone-proofed, whilst sugar stocks have been lost.[21] [22] In terms of disruption to milling operations, cyclones occurring at the beginning of the cyclone season, between October and December, are potentially most serious because they coincide with the harvest and milling season. For example, although Cyclone Kina caused extensive damage, estimated at some F$15m, to two mills as well as tramlines and bridges (Rokovada and Vrolijks, 1993), it occurred at the beginning of the maintenance period. Thus, repairs were almost fully completed before the beginning of the 1993 milling season.

Droughts have also been identified as a major problem for the sugar industry (Amerasinghe, 1984). However, the relationship between sugar production and rainfall variability is complex. Large and timely inputs of water, as well as temperatures of around 30^{0}C, are required during the earlier stages of growth, whilst dry, cooler conditions are needed in the months immediately prior to harvesting to ensure high sugar content. Indeed, in the early 1960s, sugar production was deliberately moved from the wet, eastern side of Fiji to the climatically more suitable dry regions of the southwest and northwest coast of Viti Levu and to parts of Vanua Levu. Moreover, less severe droughts can result in improved sugar content of cane as, for example, in 1987. However, rainfall in the dry season is uneven and conditions are often too dry for sugar production, reducing yields. For example, large parts of the sugar crop had to be replanted following the severe 1983 drought. The FSC is currently working on the development of more drought resistant strains although it has not explored the possibility of improved cyclone resistant varieties. Studies undertaken to consider the viability of irrigating the sugar crop have concluded that this would not be a viable option.

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[21] For example, some 20,000 tonnes of raw sugar was washed away after the roof of a store was blown off during Cyclone Eric or Nigel in 1985 (*Islands Business*, 1985).

[22] The FSC operates its own bio-gas generators, exploiting a by-product of sugar production. This implies that milling operations are not vulnerable to potential power shortages in the aftermath of a cyclone or during an extended drought.

Meanwhile, the disaster vulnerability of the sugar crop has increased over time due to its gradual expansion into hilly areas and marginal coastal areas, in turn resulting in soil erosion. Between the mid-1970s and mid-1980s, acreage rose from 45,000 to over 70,000 ha, encouraged by artificially high prices although yields in the newer areas have been much lower. Indeed, the *National Environment Strategy* identified the FSC as by far the most significant agent of land degradation in Fiji today 'because of its encouragement of sugar cane cultivation in marginal hill lands without limiting production to gentler slopes' (IUCN, 1993). Formal analysis of the relationship between sugar cane yields and natural disasters confirms a much stronger correlation between sugar cane yields, cyclones and drought in the period 1982–94 than in 1970–82. Meanwhile, over-expansion into lower-yielding marginal lands together with a failure to modernise the industry has transformed the Fiji sugar sector from a low- to high-cost producer since the early 1980s. However, because of preferential pricing arrangements, Fiji has not been under pressure to increase its international competitiveness.

Concluding comments Carter et al. (1991: 278) identify three factors which should determine the types of mitigation adopted and the level of resources invested in their development:

- the importance of activities to the economy;
- the vulnerability of enterprises to likely natural phenomena;
- the cost of effective protection.

According to the first of these criteria, particular emphasis should be placed on mitigating the impact of disasters on the Fijian sugar industry, with sugar production perhaps even scaled down. However, the industry's importance has been distorted by preferential access and pricing arrangements with the European Union (EU) and, to a lesser extent, the USA which have ensured artificially high sugar prices and, thus, encouraged domestic production. For example, in mid-1992, the two markets offered prices some three times those prevailing on the open market (IUCN, 1993). This favourable price environment is expected to be partially eroded up to the year 2001 as agricultural support and protection is gradually reduced in accordance with the Uruguay General Agreement on Tariffs and Trade (GATT) Agreement. EU sugar prices may decline by an estimate 1–3% per annum between 1995 and 2000 (FSC, 1994), finally resulting in some diversification out of sugar production and a potential simultaneous reduction in the vulnerability of the agricultural sector to natural disasters.[23]

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[23] The Fiji government suggested in its 1992 Budget Statement (and reiterated in its 1993 and 1994 Budget Statements) that a dual pricing system should perhaps be considered, with farmers allocated a quota of high price cane for exports to the EU under the Lomé Convention and then left to face lower world market prices for sugar exported to other destinations rather than being

This would therefore seem a particularly appropriate moment to develop a strategy aimed at reducing the agricultural sector's vulnerability to natural disasters. The government has apparently been investigating alternative crops (Fiji Government, 1994a and 1994c) and, if it is not already, reduced disaster vulnerability should be one of the main goals of any alternative production strategies.

Two of the most successful diversification crops to date which are yaqona and dalo, both of which are less perishable than competing high-value crops, are already fairly widely grown in Fiji and, moreover, are relatively immune to natural disasters. There has already been some success with the export of these crops but they do not receive priority attention from the Ministry of Agriculture and their production could be promoted more (World Bank, 1995). Production of off-season export crops such as vegetables also offers some scope for reducing disaster vulnerability to the extent that the growing season occurs outside the cyclone season. However, they would require irrigation, with implications for water resources (see below) as well as air freight capacity.[24]

4.2 Forestry

Fiji has some 935,000 ha of forest, covering 51% of the country (Porter, 1994). Much of this forest cover is indigenous but several forest plantations have been established. In terms of production forests suitable for commercial timber production, there are some 270,000 ha of indigenous forest and 145,000 ha of plantation forest comprised of 57,000 ha of softwoods (primarily pine), 48,000 ha of hardwoods and 40,000 ha of coconuts.

Since the mid-1980s, the timber industry has been expected to shortly emerge as one of the country's major growth sectors, as it moves from the development to processing and export phase. The government has placed particularly high hopes on

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paid an average of the higher and lower prices for all production, as is currently done (Fiji Government, 1991, 1992 and 1994a). This, it was argued, would allow farmers to make more rational production decisions and increase efficiency of production. Although no mention was made of the implications in terms of increased or reduced vulnerability to natural disasters, it could also achieve this.

[24] For example, one possible winter crop which could be grown is squash. Market research in Fiji identified a seasonal market niche for squash exports to Japan over ten years ago, in 1982/3. However, Fiji failed to take this opportunity up because of the high average returns offered to farmers by sugar production although Tonga later exploited the opportunity instead with considerable success (ADB, 1995). Squash production for export has now begun in Fiji on a limited scale and the sector is expected to expand.

pine exports which are eventually expected to compete with sugar as the country's primary export. In 1990, some sources estimated exports in excess of F$100m by the end of the century whilst increased furniture production for both the domestic and export markets was also anticipated. (Fiji Government, 1990). However, the timber industry is vulnerable to disasters and, largely because of this, there has, in fact, been little real growth in timber earnings since 1988. Timber exports accounted for only 5.5% of domestic exports between 1991 and 1994, averaging F$33.4m (in 1994 prices), whilst sugar exports contributed 39.1% of the total. This section considers the impact of natural disasters on one sub-sector of the forestry, the pine industry.

Fiji Pine Large-scale pine plantations were initially established in Fiji under the Ministry of Agriculture, Fisheries and Food following experimental planting of a range of species of trees in various agro-ecological areas of the country. In the drier zones, pine was found to be the most durable species growing all year round. The pine plantations were initially used as part of a watershed management scheme, to prevent erosion of soils upon which little else could be cultivated. However, subsequent tests revealed that the chip was of a very high quality and could be used for pulp, paper and sawn timber production. The decision was therefore taken to extend production. In 1976 ownership of the pine plantations was transferred to the Fiji Pine Commission with the primary objective of establishing a viable forestry industry based on planted forests (Fiji Government, 1976). In 1991 Fiji Pine was corporatised into a public limited company as part of a wider privatisation programme of government bodies. Pine forests are now largely concentrated in west Viti Levu and the provinces of Bua and Macuata in Vanua Levu.

However, Fiji Pine has consistently under-performed in meeting both plantation and timber production targets. In 1976, there were 19,708 ha of planted forests under the Pine Scheme. The Eighth Development Plan (1981–85) aimed to expand the plantation to 54,000 ha in Viti Levu and 6,800 ha in Vanua Levu but, in fact, fell 31% short of its target. The Ninth Development Plan (1986–90) was less ambitious, setting a target figure of 55,500 ha by 1990 but, instead, total area planted gradually declined over the duration of the Plan to only 33,671 ha. In terms of log and timber production, performance has also been poor. Harvesting began in 1983 with the timber initially milled at a single small plant. Production of pine logs and saw log timber was expected to expand rapidly in the mid-1980s as pine trees reached maturity (Fiji Government, 1984). In 1985, site works therefore began on a larger mill which came on-stream in 1987. This mill was expected to begin operating 24 hours/day immediately; and to provide some 403 direct jobs in logging, transport and mill operations, with a further 430 jobs generated indirectly through multiplier linkages with other sectors. However, in 1996 the mill was still operating only 12 hours/day due to lower throughput of wood than originally anticipated. It is now envisaged that the mill should be working at full capacity by 2005, assuming no further setbacks in production.

Damage inflicted by cyclones and fires lies at the crux of Fiji Pine's failure to date to achieve its objectives. For example, by the end of 1990, certain areas in the southern forests had been replanted twice without being harvested because of cyclones and fires. Trees up to the age of around 7 years are relatively supple and so tend to lean and bend during cyclones, rather than break or topple over. Nevertheless, trees over a height of about 2 metres subsequently need to be propped up whilst younger ones require supportive sticks, a time-consuming and costly process. Older trees tend to snap during cyclones, effectively destroying the trees. Although the broken wood can be milled, it will rot if it is not collected within about 6 months and will typically be of lower quality. The amount of wood harvested may also be substantially reduced,[25] whilst dead and severely damaged trees are also more susceptible to destructive insect activity. Successive cyclones have also inflicted periodic damage on seed collection areas and disrupted planting operations while staff dwellings and industrial buildings may be damaged. Despite pine's relative immunity to drought conditions, the pine plantations have also suffered severe damage from increased risk of fire during periods of drought.

For example, Cyclone Oscar, which occurred in March 1983 in the middle of the pine planting season, severely disrupted planting operations, causing a 24% or 800 ha shortfall in the planting target as seedlings were diverted to restock areas damaged by the cyclone. Planting was further adversely affected by the subsequent drought, which both shortened the planting season and killed some newly-planted trees, necessitating replanting. The diversion of labour from planting into the propping and uprighting of trees also disrupted planting operations. The replacement of forests damaged by Cyclone Oscar accounted for almost two-thirds of the total 5,132 ha planted in 1984. Uninsured losses as a consequence of the cyclone were estimated at some F$2.1m net of insurance recoveries while Fiji Pine received over F$2m in insurance claims.

In 1985, further damage was inflicted by Cyclones Eric and Nigel, particularly to the Lololo forest in north-west Viti Levu. In 1990 4,866 ha of pine forest, valued at F$6.4m, were again lost due to cyclone damage while a further 3,493 ha, valued at F$5.3m, were written off due to poor stocking as a consequence of earlier fires and cyclones. Some 1,827 ha, or 1.03m trees, had to be uprighted or propped following Cyclone Rae (1990) and a further 2,454 ha following Cyclone Sina (1990). Problems were once again experienced in 1993. Damage from Cyclone Kina and a series of fires, in turn partly related to a drought, was estimated at almost F$1m although this was partly offset by a F$0.47m exchange rate gain (on which no income tax is applicable). For the year overall, the company suffered a net loss of F$0.82m compared with a profit of F$0.46m in 1992 and expenditure on property, plant and equipment was reduced to help contain cashflow problems. Some 4,625 ha of 1–4

[25] For example, a pine tree harvested at 15 years will have an approximate diameter of $0.5m^3$ whilst a 20 year-old tree will have one of $1.25m^3$.

year old crops had to be propped or uprighted whilst planting operations were disrupted. A drought further delayed plantings in the last quarter of 1993 and only 1,274 ha of new forest was planted. Seed collection areas in Vanua Levu were also adversely affected as cones were blown off trees, necessitating a drawing down of contingency stocks. In 1994, a further F$1.4m of damage was incurred as droughts resulted in the spread of fires and some 1,100 ha, valued at F$1.26m, had to be written off.

For the period 1984–94 overall, Fiji Pine wrote off some 16,540 ha as a result of cyclones and fires whilst a further 22,339 ha were damaged by fires (Table 4.1). Over the shorter period 1984–90, the area restocked as a consequence of cyclones or fires (9,092 ha) was only slightly lower than that of new plantations (10,385 ha). In financial terms, cyclones and fire damage totalled over F$34.2m (at 1994 prices) between 1983 and 1994, compared with gross profits over the same period of F$323.7m. There can therefore be little doubt that Fiji Pine has suffered considerable damage as a consequence of a succession of natural disasters. Indeed, Fiji Pine is keenly aware of the risks posed by natural disasters. For example, in its 1994 Annual Report, protection of plantations against fires and cyclones were identified as 'the critical success factors for the company' (Fiji Pine, 1995). Moreover, since the 1960s, Fiji Pine has been involved in various activities precisely to reduce the cyclone vulnerability of the pine plantations. On-going tree-breeding and cross-breeding trials are being undertaken to develop a deep-rooted supple pine tree which would be better able to withstand cyclones. Experiments have also been carried out on patterns of planting, with trees planted in rows lying in the direction of the prevailing wind; and on the distance between trees, to assess whether cyclone damage can be reduced by widening the gaps between rows. The damage caused by Cyclone Oscar also partly prompted a re-examination of the choice of seed planted. On the basis of both the cyclone damage and the shift in use of pine from chips to higher value saw logs, it was decided to use genetically improved seeds which produce straighter and more wind resistant trees. Meanwhile, efforts to minimise the impacts of fire have focused particularly on the construction of firebreaks and the stepping up of fire prevention activities during periods of drought.

The primary objective of Fiji Pine is now to become self-funding with a planted pine estate of 64,000 ha by the year 2000. Until it achieves this goal, the corporation continues to be supported by government loans, effectively imposing additional pressure on government resources (see Chapter 9). It remains to seen when Fiji Pine will finally achieve the high export potential which it is widely perceived to have.

Table 4.1 : Fiji Pine Commission production and financial performance

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Plantation acreage (hectares)												
Area planted	n.a.	2,009	1,929	2,143	2,444	591	680	589	794	1,492	1,274	857
Area restocked (logging)	n.a.		109	393	160	620	883	664)	1,891	1,437	704	2,746
Area restocked (cyclone/fire)	n.a.	3,239	2,485	1,242	44	675	888	519)				
Cyclone and fire restocking as % total planting	n.a.	62	55	33	2	36	36	29	70	49	36	76
Area logged	n.a.	159	217	128	384	893	1,017	1,095	1,471	1,282	1,474	1,310
Area written off (cyclones/fire)	n.a.	n.a.	-	-	3,274	3,711	-	8,359	-	-	85	1,111
Area damaged by fires	n.a.	n.a.	122	892	12,297	-	65	79	512	2,905	626	4,841
Total estate area (hectares)	n.a.	n.a.	64,985	67,949	68,357	67,221	68,454	68,526	73,459	73,726	75,515	75,643
Planted area	33,263	37,685	42,063	45,150	44,101	41,428	40,971	33,671	35,632	37,566	37,291	38,519
As percentage total area			65	66	65	62	60	49	49	51	49	51
Financial data (real 1994 F$'000)												
Gross revenue	2,869	1,851	2,100	1,716	1,767	2,009	2,296	2,057	3,400	3,293	4,217	5,078
Operating profit	15	-29	-356	-728	-623	61	74	2	640	495	-670	613
Extraordinary items - of which:-	-2,293	-1,113	-	-	-23,615	2,872	-745	-18,776	166	10	-205	-1,223
Forest damage from cyclones and fires	-2,293 *	-1,113 *	-	-	-9,809	-2,872	-	-15,927	-	-	-1,006	-1,261
Net profit (loss)	-2,278	-1,142	-356	-728	-24,238	2,933	-671	-18,774	805	505	-875	-610
Government budgetary appropriations (F$m)	12.0 *	13.5	10.5	33.1	7.9	4.6	5.5	3.0 *	6.4	3.6	3.5	3.3

Source: Fiji Pine Commission Annual reports, various.

Notes
n.a. - not available
* - net of insurance

4.3 Manufacturing

Since the late 1980s, the manufacturing sector has emerged as one of the country's key growth areas, generating most new jobs. By 1995, it accounted for 26% of total paid employment. The sugar industry alone accounted for 28% of manufacturing output in 1992–4.

The manufacturing sector is vulnerable to natural disasters primarily via their impact on plants, equipment and inputs. Temporary breakdowns of electricity, telecommunications and transport networks, including shipping, can also disrupt productive and marketing activities (see Box 3.2).[26] In addition, disasters can affect patterns and levels of consumption and, thus, demand for manufacturing products. However, the precise nature and magnitude of all such impacts is dependent upon the structure of the sector, existing stock levels, the price elasticities of demand and supply for intermediate and final consumer goods and the openness and composition of external trade. The extent of insurance coverage also plays a role, as discussed in Chapter 10.

The results of the regression analysis presented in Chapter 3 and Appendix 1 indicate that the manufacturing sector has, in fact, become increasingly vulnerable to natural disasters since the early 1980s, as compared with the first 12 years of Independence. However, regressions for the later period excluding sugar manufacturing suggest that this increasing vulnerability largely reflects developments in the sugar industry (see section 4.1) while non-sugar manufacturing has remained relatively immune to disasters.

There is some evidence to suggest that this vulnerability may decline again in the future. Since the late 1980s, there has been some diversification of the manufacturing sector out of sugar and, with further diversification as well as a decline in sugar production itself, as expected, the sector could gradually become less vulnerable to disasters. However, any reductions in vulnerability would not represent deliberate efforts on the part of the government: the government has deliberately created more favourable conditions to attract new industries but has not targeted any particular industries – be they more or less disaster-prone – specifically.

The garment industry has shown particularly strong growth, emerging both as the country's second largest merchandise exporter in 1989 and as one of its main

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[26] A study of the vulnerability of the Fiji power sector to various hazards estimated that the sector scored 12 out of 19 (minimum score = 4) for risk of damage from the environment, including earthquakes and tsunami; and 19 out of 29 (minimum score = 4) for risk of damage from windstorm (Pacific Power Association internal report, no date).

employers, accounting for around 12.4% of total paid employment by mid-1995. The garment industry already had a base in Fiji prior to 1987 but the 1987 devaluation and the subsequent introduction of trade liberalisation and tax and export incentives stimulated rapid growth in the industry. Development was further encouraged by preferential market access to Australia and New Zealand. More recently, Fiji also managed to penetrate the US and European markets, operating on a more competitive basis and effectively establishing itself a potentially more secure market for the future. The garment industry has been one of the few areas attracting foreign investment (World Bank, 1995).

In terms of the implications for the disaster vulnerability of the manufacturing sector more generally, the garment industry is relatively immune to natural disasters and has suffered very little damage to date. The industry essentially manufactures garments from imported materials and then re-exports the bulk of its output. Most of the industry is located in the Suva area, with imports and exports channelled through Suva port. This implies that the industry is largely independent of domestic demand and supply or internal transport infrastructure. Only one company was reported to be adversely affected as a consequence of Cyclone Kina, for example, suffering some F$1m damage to materials and fabrics as a consequence of flooding. However, a major earthquake in the Suva region could have more catastrophic implications for the industry.

The fishing industry has been another important area of growth and, again, appears to be relatively immune to natural disasters except in terms of the vulnerability of fishing infrastructure, such as boats and harbours, and of fish habitat, such as coral reefs. High levels of sedimentation due to soil erosion, in turn often the consequence of heavy rainfall, can have an adverse impact on inshore and freshwater fisheries (Porter, 1994).

Fiji has also begun to develop a few other niche manufacturing sub-sectors but these, too, have apparently suffered little overall damage to date as a consequence of natural disasters. More generally, much manufacturing output is exported, reducing the importance to the industry of healthy domestic demand, whilst some sub-sectors are also sourced from imported inputs, again reducing the linkages with the disaster-vulnerable domestic economy. However, any growth in agro-processing industries or timber and furniture production could imply increased vulnerability and hazard risks should certainly be taken into account in any overall planning exercises or risk reduction strategies. Probably one of the issues of most concern is the relative concentration of manufacturing plants in the Suva/Nausori area. A severe cyclone or earthquake in this area could cause extensive damage to the manufacturing industry. To avoid further concentration of industries in more hazard-prone areas, the location of any dedicated tax free factories or industrial parks, which implicitly entail a concentration of industry, should be carefully appraised in terms of their vulnerability

to all types of natural disaster. All potential investors should also be encouraged to undertake proper hazard risk assessments before deciding on the location of their plants.

4.4 Investment

Levels of investment have been consistently low in Fiji and considerably below those of domestic savings. This has primarily reflected concerns about the country's political stability; lack of confidence in the government's commitment to sustain and implement policies; the country's inability, to date, to secure sustained economic growth; the high costs of conducting business in Fiji;[27] and, more recently, the implications of international trade liberalisation and uncertainty over the renewal of land leases.[28] However, increased levels of investment are particularly important in securing future growth and efforts to stimulate investment have featured heavily in government policy. It is therefore relevant to consider the potentially adverse impacts of natural disasters on levels of investment.

Sudden-impact disasters damage and destroy capital stocks and infrastructure, conceivably boosting levels of investment as lost assets are replaced, with certain potentially beneficial multiplier effects (see Box 4.1). Some of the main infrastructural impacts of Cyclone Kina, for example, are illustrated in Box 3.2. However, subsequent reconstruction and rehabilitation efforts may not increase the net capital stock except to the extent that they entail upgrading.[29] Meanwhile, disasters can act as a disincentive to new investment – or even to the replacement of existing investment – especially in their immediate aftermath when perceptions of hazard risks are heightened. In assessing investment performance in post-disaster circumstances it is therefore important to distinguish between investment, which replaces or repairs destroyed and damaged assets, and new investment, which may be depressed.

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[27] For example, telecommunication, freight, building and infrastructure costs are high. Some potential tourism industry investors are also discouraged by the high international travel costs to and from Fiji.

[28] Currently 83% of land is communally-owned by indigenous Fijians whilst the remainder is leased to non-Fijians by the government. Between 1996 and 2000, 40% of long-term native land leases are due for renewal. Uncertainty about the outcome of this process is apparently having a major impact on levels of investment in rural-based activities (ADB, 1995).

[29] Total investment figures will also partly reflect the government's practices in recording rehabilitation expenditures in terms of the shares of that spending accorded to capital and recurrent expenditure.

Box 4.1 **Construction**

Cyclones, floods and other sudden-onset disasters can cause severe damage to buildings as well as transport and other infrastructure, One might therefore expect an upturn in conservation activity in the aftermath of such disasters. Some even argue that in the longer term natural disasters can generate a construction-led economic boom (e.g. Albala-Bertrand, 1992),

In practice, it is difficult to identify any impact of natural disasters on the Fijian construction industry in recent years although an earthquake causing heavy damage in, say, the Suva area would probably precipitate substantial construction activity. Physical damage from cyclones is typically less severe, often involving repair rather than total reconstruction; and may be undertaken by homeowners or tradesmen operating informally. There are also certain measurement problems to the extent that construction activity can fluctuate significantly between years, depending on the status of a few larger projects. For example, construction activity was expected to slump in 1983 following the near completion of the Monasavu hydroelectric scheme although several cyclones were reported to have stimulated some private construction activities which would continue into 1984 (Fiji Government, 1983). Similarly, in 1993 despite increased construction activity at the beginning of the year to repair damage caused by Cyclone Kina, annual output fell by 25.5%, year on year largely owing to the completion of reclamation works under a major development project (1994 Budget Supplement). Meanwhile the increase in construction activity observed in 1985 was principally due to the commencement of some major construction projects rather than cyclone-related reconstruction.

The Building Price Index also provides little real evidence of any post-disaster construction boom, which would be expected to increase the price of building materials as demand for them rose. However, some temporary shortages have been reported in the aftermath of disasters, particularly of the two main roofing materials, corrugated iron and timber. It takes 6–7 weeks to import additional supplies of corrugated iron from Australia. Meanwhile, Fiji has an embargo on the import of timber, exacerbating potential shortages arising not only from increased demand but also from lower supply if the disaster disrupts timber production and transport operations. Shortages of timber can last 3–4 months.

In practice, there is no discernible pattern of the impact of natural disasters on rates of investment. Gross domestic investment showed an almost continuous real year on year decline between 1981 and 1987 and again from 1989–93, excluding 1991 when

non-disaster-related factors dominated investment performance. There is also little evidence of post-disaster investment booms linked to the construction industry, although a severe earthquake could potentially result in a substantial increase in investment. Meanwhile, natural disasters have generally not been perceived as a disincentive by potential investors who, instead, appear to be almost unaware of the notion of hazard risk. For example, most prospective investors do not seek any advice on disaster risks from the Fiji Trade and Investment Board (FTIB). The few who do, receive informal advice based on the FTIB staff's own knowledge. The FTIB was also unaware of any would-be investors who had enquired about earthquake risk;[30] of any investors who had altered the proposed site of their investment to reduce the hazard risk; or of any investors who had withdrawn from Fiji following damage incurred as the consequence of a natural disaster.

The tourism industry provides another example of would-be investors' apparent lack of concern about the risk posed by natural hazards. Although some tourist resorts have suffered considerable damage as a consequence of natural disasters, this does not appear to have deterred foreign investors. For example, a number of resorts suffered damage during the 1985 cyclones yet construction of some major projects, including the Sheraton Hotel in Nadi, were begun the same year.

[30] Instead, prospective investors presumably receive most of their hazard risk information from the insurance industry.

5. External sector and natural disasters

Fijian exports have historically been dominated by sugar but, more recently, there has been a sharp increase in exports of garments, canned fish, timber and other non-traditional products. Reflecting this, garments accounted for 22%, fisheries for 8% and clothing for 6% of domestic merchandise exports in 1991–4. Sugar's share in exports stood at 39% over the same period compared with 63% in 1981–4. Other major exports include gold, molasses and, in the past, copra. The tourism industry is another important source of foreign-exchange earnings and has consistently been the country's single largest source of such earnings since 1989. Imports cover a wide range of items including machinery, manufactured goods, food and mineral fuels.

In a small economy such as Fiji's, performance of the external sector is fundamental to the economy's health. Stability of the export sector has therefore been continually viewed as crucial, both in the shorter term and as a necessary pre-condition for long-term economic growth. Meanwhile, imported goods and services form a substantial part of total consumption, implying that Fiji could face serious domestic shortages if it were unable to finance its import requirements.

In theory, major disaster shocks would be expected to create balance-of-payments difficulties to the extent that they result in a reduction in availability of goods for export and an increase in imports to meet domestic food deficits and repair damages. Depending on levels of foreign-exchange reserves, this could imply an increase in a country's external debt stock, with implications for future levels of debt servicing and, ultimately, economic growth. It could also exert pressure on the exchange rate and, thus, a country's international competitiveness, again with serious consequences. However, to the extent that natural disasters have a domestic recessionary effect, demand for non-essential imports could decline, alleviating some pressure.

In practice, Fiji normally has a deficit on its trade account which is at least partly met by tourism earnings and external assistance. Therefore trade deficits in themselves are not unusual. Furthermore, the impact of any fluctuation in the volume of imports and exports is partly dependent on movements in the terms of trade, for which Fiji is a price taker. Any attempt to isolate the impact of exogenous shocks is also complicated by the effects of "bulky" imports and exports and capital transfers in some years – for example, the import or export of aircraft or the drawdown or repayment of sizeable external loans.

These caveats notwithstanding, natural disasters appear to have had little net impact on Fiji's balance of payments and, thus, on external borrowing or the exchange rate. Inflows of reinsurance payments have played an important part in minimising any

adverse impacts (see Chapter 10) whilst the impact of disasters on tourism earnings has been modest (see Chapter 6). Sugar stocks have also been used to buffer any potential balance-of-payments impacts as well as to ensure the maintenance of supply to major export markets (Table 5.1). In fact, Fiji has attached great importance to the honouring of existing sugar contracts. In the wake of the 1983 disasters, for example, some F$8m worth of refined white sugar was imported for domestic consumption so that higher quality domestically-produced sugar could be exported to meet existing commitments, even though domestic consumption totals less than 1% of production in a normal year. There were further imports of sugar in 1988/9 and 1992 to ensure that the country could, again, fulfil its export commitments whilst also satisfying domestic demand. Meanwhile, at least since 1983, lower sugar production during years of severe cyclones have typically not implied lower sugar exports in post-disaster years despite reduced carry-over stocks. During the one notable exception of 1986, a 25% decline in the volume of sugar exports was fortuitously offset by a 44% increase in the average export price.

A more detailed qualitative discussion of the impact of the 1983, 1985 and 1993 disasters provides useful further evidence on the balance-of-payments implications of natural disasters as well as of the difficulties in measuring their impacts from very broad aggregates. Although the 1983 cyclones and drought resulted in a sharp decline in sugar production, exports were partly maintained through a rundown of sugar stocks, as already noted, and slightly higher world prices than originally anticipated. The country also benefited from an inflow of reinsurance payments to the value of F$34m and additional disaster-related external assistance (see Chapters 10 and 13). Without these latter two inflows, Fiji would have experienced a current account deficit in excess of F$100m (Fiji Government, 1983). Instead the current account declined marginally year on year, to F$64.1m. The overall balance of payments was also boosted by non-disaster-related increases in overseas borrowing; and by a fall in imports of machinery and other capital equipment, following the near completion of several large projects. The country also began to feel the benefits of reduced fuel imports as the new Monosavu hydro-electric power station came on-stream, resulting in a real 23% fall year on year in fuel imports to form 23% of merchandise imports, compared with 29% in 1982. These lower imports more than offset disaster-related imports. Net foreign reserves also increased, reversing declines over the previous two years.

In 1985, Fiji faced both several major disasters, damaging agricultural export crops, and substantial declines in world sugar and coconut oil prices. Coconut oil exports alone fell by 36% in volume terms and 62% in value terms. Tourist earnings also declined marginally as the numbers of visitors arrivals fell, largely in response to the cyclones. However, the country achieved a much smaller balance-of-payments deficit than forecast, of F$7.1m rather than F$21.7m. This was largely due to a substantial inflow of disaster-related reinsurance payments as well as several non-disaster-related

Table 5.1: The Fiji sugar industry: actual and forecast performance

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Cane ('000 t)												
Actual	2,203	4,290	3,043	4,109	2,960	3,185	4,099	4,016	3,380	3,533	3,704	4,064
Projected	4,500	2,700	4,200	3,600	4,000	3,000	3,500	4,000	4,000	3,500	3500-3800	3,900
Actual as % proj.	*49.0*	*158.9*	*72.5*	*114.1*	*74.0*	*106.2*	*117.1*	*100.4*	*84.5*	*100.9*	*97-106*	*104.2*
Sugar ('000 t)												
Actual	276	480	341	502	401	363	461	408	389	426	442	517
Projected	540	300	490	420	480	350	350	500	470	420	400-430	430
Actual as % proj.	*51.1*	*160.0*	*69.6*	*119.5*	*83.5*	*103.7*	*131.7*	*81.6*	*82.8*	*101.4*	*103-111*	*120.2*
Exports ('000 t)												
Actual	343	379	410	324	429	330	398	394	357	365	404	473
Projected	509	258	432	398	484	310	331	459	429	378	381-413	395
Actual as % proj.	*67.4*	*146.9*	*94.9*	*81.4*	*88.6*	*106.5*	*120.2*	*85.8*	*83.2*	*96.6*	*98-106*	*119.7*
Price (F$/t)												
Actual	534	461	405	582	569	685	697	663	676	646	576	560
Projected	495	552	370	440	442	647	626	624	614	591	573-575	572
Actual as % proj.	*107.9*	*83.6*	*109.6*	*132.4*	*128.8*	*105.9*	*111.3*	*106.2*	*110.2*	*109.2*	*100.2-100.5*	*97.9*
Sugar export earnings (F$'000)												
Actual	183	175	166	189	244	235	277	261	241	235	240	283
Projected	251	142	160	175	214	201	207	286	255	224	226-245	226
Actual as % proj.	*72.9*	*122.8*	*103.8*	*107.9*	*114.2*	*117.2*	*133.6*	*91.3*	*94.4*	*105.2*	*98.0-106.2*	*125.2*
Molasses ('000 t)												
Actual	84	188	108	159	130	130	151	164	138	129	136	155
Projected	153	99	146	160	143	115	125	125	144	130	120-140	135
Actual as % proj.	*54.9*	*189.9*	*74.0*	*99.4*	*90.9*	*113.0*	*120.8*	*131.2*	*95.8*	*99.2*	*97-113*	*114.8*
Molasses export earnings (F$'000)												
Actual	5	11	10	11	14	14	12	7	14	14	11	15
Projected	10	10	8	9	11	7	10	13	11	13	*n.a.*	11
Actual as % proj.	*50.8*	*108.1*	*122.6*	*119.7*	*129.3*	*200.0*	*119.0*	*53.6*	*130.0*	*108.3*	*n.a.*	*136.4*

Source: Government of Fiji, `Supplement to the Budget Address', various; FAO data for actual sugarcane production.

factors – namely, a restrictive import policy, a domestic wage freeze policy and the more general economic downturn, the latter two further dampening imports. As in 1983, the volume of sugar exports were also boosted by a rundown in stocks to a level marginally higher than in 1984 and overall sugar export earnings therefore fell by only 5.1% in real terms. Average foreign reserves in the first 9 months of 1985 were reported to be at a record high (Fiji Government, 1985b); and reserves in terms of months of retained imports showed a healthy improvement in 1985 on 1983 and 1984 levels.

Finally, in 1993 – the year of Cyclone Kina – the government had forecast a decline in the trade deficit as growth in exports was expected to outstrip imports. Particularly large increases were anticipated in exports of gold, timber, fish and, to a lesser extent, garments. The current account was also expected to improve, in part as continued promotional campaigns and the scheduled opening of several new resorts boosted tourism earnings. However, the capital account was expected to decline due to a drop in direct investment. In the event, the balance of payments moved from a surplus to a F$62m deficit while the trade deficit rose to F$264m (although these figures are distorted by the import of a F$82m aircraft). A 22.5% increase in food imports to F$167m, reportedly due to the cyclone as well as expansionary domestic demand, also contributed to the trade deficit. However, this was partly offset by a 10.8% increase in tourism receipts and a 17.6% increase in private services credit, in turn due to increased reinsurance receipts following the cyclone. In addition, sugar production was largely unaffected by the cyclone and so, although the sugar price declined by 10.8%, sugar export earnings rose by 2.1%.

On balance, therefore, natural disasters have had little discernible impact on overall balance-of-payments aggregates primarily due to a rundown of sugar reserves and to higher reinsurance inflows in the aftermath of a disaster, offsetting increased disaster-related imports. This has enabled the Fiji dollar to remain relatively stable against other currencies (with the notable exception of the 1987 coup-related devaluations). Similarly, there is no discernible pattern of increases in the external debt stock or declines in levels of gross foreign-exchange reserves during severe disaster years.

In the future, some diversification out of sugar production is likely as preferential prices are gradually eroded (see section 4.1). Indeed, sugar's share in overall export earnings is already declining as economic growth largely originates from the development of new industries. It is therefore important to consider the likely stability of future export earnings an important buffer – namely, the rundown of sugar reserves in more severe disaster years – is removed. The garment industry has so far been relatively immune to the effects of natural disasters although the implications of an earthquake could be far more serious (see section 2.7). Likewise, tourism earnings are projected to grow, offering another relatively disaster-insensitive source of foreign-exchange earnings (see Chapter 6). However, the forestry industry, which is also

hoped to enter a period of rapid export growth, could introduce a considerable element of instability into export earnings by implication of its high disaster vulnerability (see section 4.2). Similarly, diversification into certain agricultural exports could add an additional degree of vulnerability (see section 4.1). It is therefore important to maintain some element of reinsurance not only to help protect the domestic insurance industry but also to boost foreign-exchange earnings in the event of major disasters (see Chapter 10).

6. Tourism and natural disasters

The tourism industry has grown rapidly over the past 35 years, with tourist arrivals increasing from 15,000 in 1960 to 110,000 in 1970, 190,000 in 1980 and 319,000 in 1994. Since 1989, the industry has been the largest single source of export earnings whilst it provides direct or indirect employment for some 40,000 people (Fiji Government, 1993). The tourist industry is also an important source of government revenue via tourist expenditure on value added tax (VAT) items and hotel taxes. Admittedly, there is high leakage, estimated in the order of two-thirds of total earnings in the mid-1980s, as tourists consume high levels of imported goods whilst foreign-owned tourist resort and airline profits are repatriated. For example, in the mid-1980s, the industry was estimated to have an income multiplier of only 0.94 compared with one of 1.47 for sugar (Fiji Government, 1985c). Nevertheless, the sector remains an important source of foreign-exchange earnings as well as a major attractor of foreign investment.

The tourism industry has been consistently viewed as a key area for further growth and a central component of the government's strategy to reduce dependence on the sugar industry, despite certain obstacles such as the high costs of international air travel and the still limited supply of tourist accommodation. The Ninth Development Plan (1986–90) went so far as to state that 'in the short-to-medium term, the tourism sector appears best placed to contribute most towards economic growth and employment generation' (Fiji Government, 1985c: 87). Tourist arrivals are projected to reach 454,000 by 2000, 42% higher than in 1994 (Fiji Visitors Bureau, 1995). The largest increases are expected in arrivals from Japan and other Asian countries.[31] Another major objective of the government both in its Ninth Development Plan and *Opportunities for Growth* document, is to strengthen the linkages between the tourism industry and the rest of the economy, thus reducing leakages. This would include greater consumption of domestically-produced food and other consumer goods, rather than imports, by foreign visitors.

However, relatively little attention appears to have been paid to the hazard vulnerability of the sector and thus the potential ramifications of heavy reliance on the tourist industry (Table 6.1). Many of Fiji's tourist resorts are located in coastal areas, often positioned at vantage points to ensure the best views. By their very nature, tourist resorts are therefore likely to be particularly vulnerable to cyclones, sea

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[31] The volume of Japanese tourists has already risen significantly, forming an important component of the upper end of the tourist market. Japanese tourists are also the highest spenders. For example, in 1994, Japanese visitors spent an average of F$322 per day although there is high leakage, as already noted (Fiji Visitors Bureau, 1995).

Table 6.1: The Fiji tourism industry: actual and forecast performance

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
No. of visitors ('000)												
Actual	192.8	235	228	258	190	208.2	250.6	279	259.4	278.5	287.5	318.9
Projected	n.a.	212	240	259	278	230	220	250	290	290	280	295
Actual as % forecast	n.a.	110.8	95.0	99.6	68.3	90.5	113.9	111.6	89.4	96.0	102.7	108.1
No. of visitor days (m.)												
Actual	1.7	2	1.9	2	1.6	1.8	2.3	2.5	2.2	2.4	2.4	2.6
Projected	n.a.	1.97	2	2.1	2.3	1.8	1.9	2.2	2.7	2.6	2.4	2.5
Actual as % forecast	n.a.	101.5	95.0	95.2	69.6	100.0	121.1	113.6	81.5	92.3	100.0	104.0
Expenditure (real 1994 $Fm.)												
Actual	221.1	256.6	250.4	261.2	195.3	231.0	327.3	343.8	313.8	349.6	362.6	419.6
Projected	n.a.	267.9	264.2	275.5	275.6	213.6	240.3	326.8	414.8	435.3	375.4	382.6
Actual as % forecast	n.a.	95.8	94.8	94.8	70.9	108.1	136.2	105.2	75.7	80.3	96.6	109.7

Source: Government of Fiji, `Supplement to the Budget Address', various.

surges and, to the extent that they are built on reclaimed land, earthquakes. Most of the more severe cyclones experienced in recent years have caused heavy damage to some resorts although tourist establishments are scattered across much of the country, implying that any single cyclone or other disaster will not affect them all. For example, Cyclone Oscar (March 1984) resulted in some F$12m damage to the Regent of Fiji hotel in Nadi as well as damaging other hotels in the Nadi area and on the Coral Coast. Cyclone Sina (November 1990) caused little overall economic damage to the country but nevertheless damaged a substantial tourist establishment, the Warwick Hotel. Cyclone Joni (December 1992) also caused considerable damage to tourist resorts.[32]

The industry is also potentially indirectly vulnerable to natural disasters via their impact on air, sea and road transport as well as tourist consumer items. Food supplies for the tourism industry are largely secure to the extent that they are mostly imported. However, the situation could change in the future, as efforts to increase domestic sourcing of tourist food and other consumer goods are stepped up, as already noted, in turn implying that in the aftermath of a disaster increased imports to meet tourist requirements could place additional pressures on the external account.

Clearly, natural disasters are but one of a number of factors determining the performance of the tourism industry, as measured in terms of the number of arrivals and tourism earnings. Other factors include overall economic growth rates in major countries of origin; Fiji's international competitiveness (including the strength of the dollar); the relative attractiveness of holidays in Fiji; tourist promotion activities (both promoting Fiji and rival destinations); and the capacity of the industry, including air access.[33]

Meanwhile, there are certain variables which partly determine the impact of a particular disaster on the tourist industry irrespective of its scale. In particular, adverse publicity in the wake of a disaster and, more specifically, the death of a tourist can be very damaging, although no tourists have apparently been killed by natural disasters in Fiji in recent years. Adverse publicity appears to have occurred

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[32] Water constraints have limited tourism developments to some extent, particularly in the past. Tourist resorts are predominantly located in the drier, less humid parts of the country, particularly the Nadi area on the west of Viti Levu and some of the smaller islands where water shortages occur annually. An embargo was therefore placed, for example, on tourism development in the Nadi area prior to the construction of the Vatura Dam, which provided a consistent water supply for the Nadi-Lautoka area and permitted tourism development (Porter, 1994). Tourist opportunities in the west more generally improved in the early 1980s following the completion of a new regional water supply scheme.

[33] Nuclear testing in Mururoa atoll was also claimed to affect tourism numbers for a while.

mainly in the aftermath of major disasters, which obviously receive the greatest media attention. To counteract the effects of such publicity, the government responded by undertaking increased promotional campaigns. The impact of disasters on the tourist industry also depends on the extent to which holidays are pre-paid and whether such holidays can subsequently be postponed or the payment refunded in the event of cancellation. In 1994, for example, 80% of accommodation was booked on a pre-paid basis. Some 26% of car rentals were also pre-paid. However, the average booking period may have been relatively short.[34]

Nevertheless, there is certain circumstantial evidence to suggest that major natural disasters may have some impact on tourism arrivals and earnings, even if detailed analysis would be needed to confirm this. For example, in the wake of Cyclone Kina visitors from Australia declined by 2.1% year on year in the January and by 20.2% in February, whilst visitors from New Zealand and other Pacific islands fell by 9.1 and 5.8% respectively year on year in the same month. Earnings per head of tourist were also estimated to fall by about half in January 1993 as many tourist activities were cancelled. Some tourists in the country at the time the cyclone struck were also reported to have left. However, the number of visitors from countries outside the Pacific region continued to increase, presumably reflecting less media coverage of events in the South Pacific.

Another question concerns the issue of the extent to which hazard risks are limiting the overall scale of tourism in Fiji. A spokesperson for the Fiji Visitors' Bureau indicated that natural disasters, particularly cyclones, were a constraint, pointing to a consistently lower monthly occupancy rate between October and April. This is confirmed by an examination of the monthly pattern of visitor arrivals from Australia, New Zealand and Japan as well as tourist arrivals overall, and despite the fact that September to December is one of the major holiday seasons in Australia and New Zealand. However, a detailed survey of potential visitors in their countries of residence would be required to confirm the factors underlying the pattern of distribution of arrivals through the year, including the role played by the risk of cyclones.

In summary, the tourism industry is vulnerable to natural disasters although less so than certain other sectors. Further development of the sector offers some opportunity to mitigate the overall impact of disasters on the country's foreign-exchange earnings but any upper limits imposed by natural disasters on a further expansion of the industry, from the perspective of both potential investors and visitors, should be investigated. Efforts should also be undertaken to prevent any loss of life of tourists during cyclones and other natural disasters as, unlike much of Fiji's own population,

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[34] For example, in 1994 only 26% of Australian visitors made their accommodation bookings more than 3 months before visiting whilst 32% booked under 5 weeks prior to their arrival.

tourists may be entirely unaware of the risk of disasters or of appropriate actions to take during them. This requires disaster awareness training for those involved in the industry, as has recently been begun with respect to cyclones, and the implementation of appropriate building standards (see Box 10.1).

7. Inflation and natural disasters

Domestic rates of inflation are particularly important in Fiji because of their implications for the real exchange rate and, therefore, the country's international competitiveness. In theory, natural disasters can have two opposing effects on the price of domestic goods. However, their net effect is likely to be inflationary, possibly requiring a tightening of monetary instruments. Certain items could be in short supply as a consequence of the disaster, either because supplies (or the means of production) have been destroyed or because of increased demand (e.g., for building materials in the aftermath of sudden-onset disasters), resulting in a rise in price. Such increases may be partly offset by a decline in the price of certain other goods as demand falls, in turn reflecting the generally recessionary nature of major disasters.

Localised temporary price hikes have undoubtedly occurred in the aftermath of natural disasters in Fiji, particularly in the remoter islands. For example, a price survey of rootcrops, vegetables and fruits in Suva in the aftermath of Cyclone Kina, which occurred in early January 1993 and badly affected all major crop-producing areas on the island of Viti Levu, indicated that all produce with the exception of dalo displayed significant price increases in the first two months following the cyclone. By the end of April, vegetable prices had fallen to their pre-cyclone level following a notable increase in imported vegetables. However, performance of rootcrop prices was mixed as shortages of some items continued beyond the end of May. Fruit prices also remained high, again due to shortages (Fiji Ministry of Agriculture, 1993). More worryingly, a comparison of average year on year food price increases for the 3 months preceding each cyclone, the month of the cyclone and the 2 succeeding ones and then the following 3 months for major cyclones dating back to 1979 suggests that cyclones may contribute to a permanent rather than temporary increase in food prices (Table 7.1). This is confirmed by evidence from 1993 when Cyclone Kina, which, as already noted, occurred at the very beginning of the year, was said to be attributable for an annual 6.8% increase in food prices (Fiji Government, 1994a). Such price increases are of particular concern in the context of poverty alleviation because poorer households spend a disproportionately larger share of their income on foodstuffs.

However, the overall rate of inflation is not determined by domestic factors alone. Some 75% of consumer goods are imported and the rate of inflation is therefore heavily dependent on shifts in the effective exchange rate and price increases in the main countries of supply, Australia and New Zealand. In consequence, natural disasters appear to have had little impact on fluctuations in the rate of inflation. For example, despite the occurrence of Cyclone Oscar and widespread drought in 1983, the rate of inflation fell due to both depressed domestic demand and lower rates of inflation amongst Fiji's principal trading partners who themselves were experiencing

Table 7.1: Fiji consumer price index: year-on-year average growth rates for the three month period preceeding a cyclone (t = -3, -2 and -1), the month of the cyclone and two suceeding months (t= 0, 1 and 2) and the third, fourth and fifth months after the cyclone (t= 3, 4 and 5)

	Year-on-year growth rates			
	All items	Food	Housing	Non-food
Cyclone Meli (26-28/3/79)				
t = -3, -2 and -1	5.7	1.5	9.8	8.5
t = 0, 1 and 2	7.7	7.2	8.8	8.1
t = 3, 4 and 5	7.7	6.8	5.0	8.3
Cyclone Wally (5-6/4/80)				
t = -3, -2 and -1	11.7	13.0	2.3	10.4
t = 0, 1 and 2	15.2	15.7	5.3	14.3
t = 3, 4 and 5	15.9	15.6	5.8	15.3
Cyclone Arthur (13-15/1/81)				
t = -3, -2 and -1	15.0	16.9	4.3	13.2
t = 0, 1 and 2	14.0	13.7	11.4	14.2
t = 3, 4 and 5	10.4	11.0	11.3	10.2
Cyclone Oscar (28/2 - 2/3/83)				
t = -3, -2 and -1	6.4	4.8	11.0	7.1
t = 0, 1 and 2	7.2	6.0	13.5	7.8
t = 3, 4 and 5	7.0	6.2	13.9	7.4
Cyclones Eric and Nigel (17-20/1/85)				
t = -3, -2 and -1	4.0	2.2	2.1	5.0
t = 0, 1 and 2	4.4	7.5	1.6	2.8
t = 3, 4 and 5	4.5	8.7	1.4	2.4
Cyclone Martin(11-13/4/87)				
t = -3, -2 and -1	3.6	3.0	4.0	3.9
t = 0, 1 and 2	3.3	0.5	3.0	4.7
t = 3, 4 and 5	6.5	7.4	1.8	6.0
Cyclone Raja (24-30/12/87)				
t = -3, -2 and -1	9.2	13.5	-1.8	7.0
t = 0, 1 and 2	12.2	20.1	-2.5	8.3
t = 3, 4 and 5	13.5	22.5	-2.6	9.2
Cyclone Sina (26-9/11/90)				
t = -3, -2 and -1	8.6	7.0	8.2	9.6
t = 0, 1 and 2	8.6	6.1	8.5	10.0
t = 3, 4 and 5	7.1	2.8	10.1	9.6
Cyclone Kina (26/12/92-3/1/93)				
t = -3, -2 and -1	6.3	1.1	15.4	9.1
t = 0, 1 and 2	7.7	7.5	15.6	7.8
t = 3, 4 and 5	7.5	7.1	14.8	7.6

a period of recession. Again, in 1985, the rate of inflation declined marginally, despite temporary increases in domestic food prices in the first half of the year as a consequence of 2 major cyclones. The building materials price index was also reported to be largely unaffected by the cyclones. In 1987, other factors again dominated changes in the rate of inflation as two successive devaluations of the Fiji dollar, totalling 33%, were largely responsible for a 5.7% increase in the consumer price index (CPI) although domestic food prices also increased 6.1%, in part reflecting the disruptions to agricultural production caused by a severe drought as well as the two coups.[35]

The fact that there is little apparent relationship between the occurrence of natural disasters and the rate of inflation may also be partly attributable to various government efforts to prevent price increases, both in the wake of disasters and more generally. In the immediate aftermath of some disasters, such as Cyclone Kina, the government has imposed a temporary ban on the export of all food crops except those grown under contract.[36] Annual stockpiling of food and other items prior to the onset of the cyclone season, by both the government and individual households, must also play some role in minimising the inflationary impact of natural disasters. Meanwhile, an Anti-Inflationary Act is permanently in force, controlling the price of certain commodities including some foodstuffs, building materials, washing soap and medicines. This Act plays some role in preventing price rises as a consequence of natural disasters although most items covered by the Act are largely unaffected by disasters whilst some more severely affected items are not included. The Act may also be re-endorsed following a disaster. For example, in the aftermath of Cyclone Kina, the Prices and Incomes Board issued a statement informing traders that 'prices of commodities (were) not to be distorted in any way by the recent cyclone Kina' (Prices and Incomes Board Press Release, 5 January 1993). Price control items were to be sold 'at the prices as stipulated under the respective Orders' whilst uncontrolled items were 'to be maintained at those rates prevalent prior to the cyclone' although a 5% increase in the price of soap was permitted due to damage suffered by the copra industry. The statement also indicated that if prices of uncontrolled items rose 'the Board (would) be left with no alternative but to bring those items under price control'.

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[35] It was beyond the scope of this study to undertake a more detailed analysis of the main factors determining rates of inflation in Fiji. This would have involved analysis of a number of factors including inflation in the main countries sourcing Fiji's imports and movements in the exchange rate as well as various domestic factors including the introduction of VAT in mid-1992. Regressions were nevertheless run of monthly and annual year on year growth rates in the overall CPI and the food and housing components of the index against simply a series of lagged cyclone dummy variables over the period 1978–95. However, unsurprisingly, no significant correlations were revealed.

[36] In the case of Cyclone Kina, the ban was lifted again in May for all crops except cassava (Fiji Ministry of Agriculture, 1993).

Retailers largely appear to have abided by this legislation, as demonstrated, for example, by the fact that the number of complaints under the Act were not unduly high in 1993, after taking account of the rise in complaints due to the introduction of VAT in mid-1992.

In summary, the inflationary impact of natural disasters is probably not a major cause for concern in Fiji at the present time since the rate of inflation is relatively low. However, should the country enter a period of higher inflation then the potential additional inflationary pressures exerted by cyclones could contribute to more serious economic difficulties. The price of foodstuffs should also be carefully monitored to ensure that disasters do not generate permanent price increases, particularly in view of the fact that lower income groups spend a disproportionately high share of their income on foodstuffs.

8. Monetary aspects of natural disasters

Throughout the 1980s and 1990s, monetary policy has emphasised external financial stability as a pre-condition for long-term economic development. Growth in the money supply has been kept in close check with that of GDP, whilst efforts have also focused on ensuring that the country maintains an adequate level of foreign reserves in order to protect its exchange rate and so maintain the country's international competitiveness. In addition, there have been some efforts to contain private demand for credit and to mobilise savings for investment purposes. The government has been broadly successful in these policies although low demand for domestic credit has, on occasion, exacerbated problems of excess liquidity (Fiji Government, 1993).

Natural disasters can imply both increased monetary tightness, to the extent that households and businesses seek increased credit to finance their rehabilitation efforts, but also a reduction in credit demand from other quarters as the generally recessionary nature of a severe natural disaster feeds through to domestic demand and investment confidence. At the same time, foreign-exchange reserves may come under greater pressure as a consequence of any adverse balance-of-trade impacts but this may be partly offset by higher reinsurance inflows (see Chapter 5). The impact of a natural disaster on the monetary sector also ultimately depends on monetary policy itself. However, this is less relevant in the context of Fiji, where the openness of the economy effectively limits the scope of monetary policy by implying that movements in the money supply are heavily influenced by domestic fiscal and world market performance instead.

Fiji has apparently managed the monetary implications of natural disasters relatively easily relaxing policies as necessary without any major adverse consequences. For example, increased liquidity in excess of the rate of economic growth was permitted in 1983 to ensure sufficient availability of financial resources to meet the costs of rehabilitation. This represented a reversal of previously tighter policies aimed at maintaining the country's international competitiveness and containing the balance-of-payments deficit. However, the shift in policy created no real problems of excess monetary growth until the end of the year, when monetary policy was tightened marginally. In the year ending 1985, increased foreign reserves, primarily the result of reinsurance flows, were largely offset by lower domestic borrowing from the Reserve Bank, effectively avoiding a large monetary expansion and thus any destabilising effects. Meanwhile, in 1993 monetary policy continued its efforts to moderate high domestic liquidity, in turn reflecting high foreign reserves, through an appropriate low interest rate structure whilst monitoring aggregate demand to maintain a viable balance of payments. Excess liquidity declined towards the end of 1993 as foreign reserves decreased.

9. Government budgetary aspects of natural disasters

Natural disasters may have several important impacts on public finance. Government-financed relief and rehabilitation operations imply either an increase in public expenditure or the partial redeployment of planned spending. In the context of Fiji, budgetary resources to the tune of F$2m are annually earmarked for emergency relief activities but this may prove grossly inadequate in the event of a major disaster. An annual budget al.location of F$0.1m is also made for the 'emergency' transport of water but, again, this is far from sufficient during periods of drought. Public enterprises may also face losses, which the government may have to meet, if their operations are hampered by natural disaster. Meanwhile, government revenue could be adversely affected as lower levels of economic activity, including possible net falls in imports and exports, reduce direct and indirect tax revenues. Flows of external grant aid may increase but this is unlikely to offset increased levels of expenditure. In consequence, the government may face increasing budgetary pressures which it will be obliged to meet by increasing the money supply, running down foreign-exchange reserves or increasing levels of domestic and/or external borrowing.

These financing options have potentially significant knock-on effects. The creation of base money is inflationary. Domestic borrowing exerts upward pressure on interest rates and can result in a credit squeeze. Foreign borrowing can result in an appreciation of the exchange rate, reducing the price of imports and increasing that of exports, as well as involving future drains on the economy via higher debt-servicing costs. Another option, the run-down of foreign-exchange reserves, is limited by the very size of those reserves and entails an appreciation in the exchange rate, with possible associated risks of capital flight and a balance-of-payments crisis (Fischer and Easterley, 1990).

Disasters can also impose more permanent pressures on government finance to the extent that governments implement disaster prevention, mitigation and preparedness measures on a more regular basis – i.e., costs which governments of less disaster-prone countries do not have to bear.

In practice, it is difficult to ascertain any short-term impact of individual natural disasters on the budget deficit from aggregate annual data on planned and actual expenditure and revenue (see Appendix Table 4). Expenditure data for the period 1983–94 suggest that capital expenditure was consistently under-budget until 1988 whilst operating expenditure was approximately on budget except in 1984. Revenues also reveal little pattern of correlation with natural disasters, staying near budgeted levels except in 1987, the year of the coups. Meanwhile, it is extremely difficult to isolate the budgetary impacts of disaster mitigation and preparedness activities, which

are contained in overall allocations to relevant ministries with a few notable exceptions (such as drainage operations).

More detailed examination of the impact of natural disasters, isolating them from other factors affecting budgetary performance, indicates a somewhat different picture revealing that natural disasters can have considerable shorter-term impacts on budgetary resources. Such impacts are not entirely quantifiable. For example, relief efforts may involve the temporary redeployment of some public sector workers – such as those in social services, public works, the armed forces and the navy – which normally goes unrecorded. Nevertheless, experiences in 1983, 1985 and 1993 provide some useful evidence in this regard. In the wake of the 1983 natural disasters, for example, some F$30m in government relief assistance was provided, equivalent to 8.3% of total expenditure for the year.[37] Certain other non-relief items were under-budgeted, placing additional strains on budgetary resources. These included established staff costs, for which actual costs were $F5m more than budgeted. Yet overall government expenditure for the year was only F$23.2m in excess of initial allocations, implying that the impacts of the cyclone were greater than overall data suggest and that there must have been a significant redeployment of allocated funds. Inland revenue was also lower than expected, reflecting the impact of the disasters on the domestic economy. However, customs revenue was boosted by increased imports of some high import duty items, more than offsetting both these and other declines in revenue and the increase in expenditure as well as hiding the overall revenue impacts of the cyclone. In consequence, the overall budget deficit was smaller than initially forecast.

In 1985, expenditure on cyclone rehabilitation amounted to F$16m, or 4.0% of total government expenditure. Again, part of this was met by the redeployment of allocated resources as well as cash grants to the value of F$4.4m from overseas. However, a public sector wage freeze removed potentially additional pressure on government budgetary resources and total government expenditure for the year was 7.8% below budget. Government revenue fell, largely because of income tax reforms, a wage freeze (in turn impacting on income tax earnings) and depressed economic conditions, in turn partly attributable to the cyclones. However, despite the impacts of the cyclone, the country achieved an overall improvement in the budgetary deficit, declining 18.3% in real terms to only $F36.5m or 2.8% of GDP and to only 72.4% of the forecast deficit. The impact of the cyclones continued to be felt through 1986, with a wider budgetary deficit than originally forecast as imports, and thus import duties, declined marginally reflecting the lagged effect of the economic downturn as

[37] The rehabilitation costs included F$4m 'seed money' towards a F$16m interest-free loan scheme offered to cane farmers by the Fiji Development Bank as part of a broader sugar cane rehabilitation scheme. The National Bank of Fiji, a public enterprise, also waived 1983/84 repayments on Cane Farmer Loans in the affected areas (Fiji Government, 1984).

well as tax reforms. Revenues were further reduced as tax payable on reinsurance premiums remitted overseas was waived to assist recovery in the insurance industry. In addition, an existing tax exemption on farming income was extended for a further 5 years, until 1990, in part in recognition of the particular difficulties faced by cane farmers. Current expenditure was also higher, partly due to cyclone-related grants and transfers. In addition, the FSC was awarded a F$1.5m capital grant to upgrade its transport infrastructure as difficulties faced by the sugar industry during the early 1980s, including the cumulative effects of a series of natural disasters, implied that it was unable to meet such costs itself. Government domestic borrowing was increased to help finance the budget deficit.

Cyclone Kina probably provides the best-documented case to date of the implications of a natural disaster for overall government expenditure. Under the 1993 Budget, attempts to contain government expenditure had been stepped up following a widening of the budgetary deficit the previous year to 3.3% of GDP, the highest level since 1987, in part due to a government expenditure growth rate almost double that of GDP in 1991 and 1992.[38] A target budget deficit of 2.5% GDP was therefore set for 1993; and quarterly rather than annual warrants for public expenditure introduced to help control expenditure. At the beginning of 1993, Fiji then experienced a severe cyclone, Kina, necessitating a government rehabilitation programme to the tune of F$40.2m, equivalent to almost a third of the capital budget and 5.3% of total allocated expenditure (Table 9.1). Nevertheless, the government remained intent on achieving its revenue objectives and instead redeployed resources to meet the cost of the programme, holding a special meeting to determine reallocations.

In the event, a budget deficit of 3.9% of GDP was incurred for the year overall. Total expenditure increased by 5.9% in real terms (and 13.2% in nominal terms) to F$818.9m, only marginally higher than the forecast level of F$815.2m. Indeed, the 1994 Budget Supplement noted that 'expenditure was closer to original approval in 1993 than at any other stage since 1987', largely reflecting the way in which the cyclone rehabilitation programme was financed as well as a Public Service Settlement (Fiji Government, 1994a). However, this apparent success was not without some casualties: operating expenditure alone increased by 7.1% year on year whilst capital expenditure fell by 3.4%, to around only 75% of the original allocation. The reallocations also had severe consequences for certain individual projects and schemes. For example, the Department of Regional Development's Self Help Programme, which caters for small rural projects and aims to stimulate social and economic development, was suspended as was a Rural Roading Programme (Rokovada and Vrolijks, 1993). A Poverty Alleviation Fund which had been

[38] Efforts to contain the budgetary deficit were originally stepped up in 1989, when the government announced a new medium-term goal of a zero net deficit. The government now aims to achieve this goal by the year 2000.

Table 9.1: Impact of Cyclone Kina on Government Expenditure (F$'000)

	Original allocation			Amount redeployed	Actual expenditure			Of which redeployed resources (%)	Initially allocated for	Reason for redployment
	Operating	Capital	Total		Operating	Capital	Total			
Ministry/ Department										
Home Affairs	514		514	710	2,064	3	2,066	34.4	Repair & upgrading of police buildings & construction of new buildings	Repair to office & building & institutional quarters for the police
Fijian Affairs	11,458		11,458	600	10,824	651	11,475	5.2	Purchase of equipment and "dollar to dollar" grant	Food rations & housing assistance
Miscellaneous Services	22,491	381,770	404,261	10,730	19,468	24,821	44,288	24.2	Poverty Target Projects and interest free loan to Fijian Affairs Board	Food rations & housing assistance
Regional Development	3,401		3,401	2,049	22,459	1,708	24,167	8.5	Self help projects & upgrading of non-PWD roads	Government housing assistance
Indian Affairs				500					Community Development	Government housing assistance
Education & Women & Culture	131,220	4,321	135,541	2,261	140,530	2,242	142,771	1.6	Construction of schools, purchase of equipment & building grants. Women & culture Development Opportunity programme	Rehabiliation works to schools & government housing assistance
Youth & Sport	6,331	1,015	7,346	3,770	4,066	415	4,481	84.1	Training, building, construction, upgrading of sporting grounds & facilities	Rehabilitation work of schools
Health	50,471	3,046	53,517	2,000	57,369	1,333	58,702	3.4	Upgrading of township roads	Repair damaged facilities & replace equipment & drugs
Housing & Urban Development	3,072	1,173	4,245	200	2,890	740	3,630	5.5	Drainage/flood protection, agriculture/aquaculture develoment projects, facilities, equipment etc.	Repair damaged facilities & replace equipment
Ministry of Agriculture & Fisheries	18,770	10,047	28,817	5,200	22,474	3,016	25,490	20.4	Construction of roads & bridges, jetties, upgrading of roads, urban & regional water supply schemes & sewerage schemes	Rehabilitiation to crops, livestock, fisheries, drainage & irrigation & research
Infrastructure, Public Works & Maritime	46,160	45,816	91,976	10,600	56,780	45,819	102,599	10.3	Extension of outfitting jetty and dredging	Repair to roads, bridges, jetties, water & sewerage & buildings
Marine	10,317	1,119	11,436	300	9,302	596	9,898	3.0	Construction of building complex & purchase of vehicle testing equipment	Repair to damaged jetties
Road Transport	1,985	1,290	3,275	1,290	1,579	0	1,579	81.7		Repair to damaged roads & buildings
TOTAL	649,800	109,000	758,800	40,210	688,700	82,000	770,700	5.2		

Source: Department of Regional Development (1994); Fiji Government Supplement to Budget Address, 1983 and 1985

established under the 1992 Budget with an allocation of F$7m had its budget reduced to F$2.8m in 1993. Meanwhile, the largest single redeployment involved budgetary allocations for the Ministry of Infrastructure, Public Works and Maritime, including some funds which had been earmarked for dredging works – ie, entailing a reallocation of resources from disaster mitigation to rehabilitation. The Ministry of Agriculture also faced a substantial 20% redeployment of resources.

Despite the government's success in avoiding a considerable rise in expenditure in 1993, Cyclone Kina also had some adverse impact on government revenues, in turn contributing to a widening of the budget deficit. Revenues were F$26.1m lower than originally forecast due to shortfalls in VAT receipts (in part reflecting reduced purchasing power in the aftermath of Cyclone Kina (Fiji Government, 1994a)), other general revenues and grants. Government savings also fell, basically due to increased operational expenses to meet cyclone related expenditure. The budget deficit was financed by domestic borrowing, which rose to a level 70% higher than originally planned.

Natural disasters also have longer-term impacts on both government expenditure and revenue. Annual expenditure incurred on various disaster prevention, mitigation and preparedness activities. For example, annual commitments are made for flood protection measures, including dredging activities and river embankment construction, as well as for the construction of cyclone resistant housing, the latter coming under the rural housing programme. These costs are semi-transparent but are not identified under a specific disaster preparedness and mitigation budget line. There are further hidden costs such as those entailed in fortifying government buildings and infrastructure more generally to better withstand the impact of hazards. Meanwhile, the expenditure implications of specific natural disasters can also extend over several years. For example, the 1984 budget included a new agricultural development programme to help rehabilitate the areas affected by Cyclone Wally which had occurred 3 years earlier in 1981.

On the revenue side, natural disasters also imply a continual longer-term direct loss in revenue via the Cyclone Reserve. This Reserve, which was introduced under the 1986 budget, provides a special deduction to taxpayers carrying their own cyclone cover or bearing excess losses on cyclone damage under their insurance policies. At the point the scheme was first introduced, deductions up to a maximum of F$500 per annum were allowed on residential properties and of up to 1.5% the replacement value of business properties (Fiji Government, 1985b).

In conclusion, disasters have implications for both government revenue and expenditure although these impacts are not necessarily reflected in overall figures. The government has made various efforts to limit the net impacts on total spending, particularly through the redeployment of resources. This reflects its longer-term

objective of containing the budget deficit to free resources for the private sector, which finances much of the government deficit, whilst containing debt servicing costs. However, such redeployments have not been without consequences. In particular, disaster rehabilitation programmes have contributed to an imbalance between government capital and recurrent expenditure as resources have been switched from the former to latter, partly thwarting government efforts to increase the ratio of capital to operating expenditure.

Finally, the vulnerability of particular sources of government revenue to natural disasters also needs to be considered within the context of various tax changes since 1989. These have placed increased emphasis on revenue raised within the domestic economy, involving a widening but reduction of the direct tax base; a gradual reduction in import tariffs and a switch to non-tariff barriers; and the introduction of VAT in mid-1992. The reforms have been viewed very positively in terms of reducing effective rates of protection. However, that they may have also increased the vulnerability of the tax base to natural disasters to the extent that imports are relatively immune to natural disasters as compared with domestic economic activities, which translate into earnings, profits and domestic sales. Farming activities have also been liable to taxation since 1990, further potentially increasing the vulnerability of the tax base to natural disasters.

10. Disaster insurance

Insurance is not an economic solution to potential disaster losses but simply a mechanism for the transfer of risk, effectively altering the economic impacts of a disaster but not necessarily reducing them. In countries which rely heavily on the world reinsurance market, insurance also implies a substantial constant leakage. This has potential implications for domestic rates of growth and levels of investment, although it has not been a problem in Fiji to date, where domestic savings have exceeded private sector investment requirements. However, insurance helps facilitate the recovery of individual producers and may encourage investment in enterprises where the risks would otherwise have been too great. Extensive use of the reinsurance market al.so offers an important means of reducing the cost of reconstruction activities born by the domestic economy. Moreover, in a small open economy such as Fiji's, it can play an important role in preventing a deterioration in the balance of payments, as already indicated (see Chapter 5). The insurance industry can also be used to promote the adoption of disaster mitigation measures, particularly improved building standards. Indeed, Fiji is widely quoted as an important success case in this regard (see Box 10.1). On balance, it is therefore important to encourage the uptake of insurance policies whilst also ensuring that the country does not become unattractive in the eyes of reinsurers.

There are currently six licensed non-life insurers in Fiji, one of which has domestic shareholders, and six insurance brokers. However, the number of insurance companies has fluctuated substantially, reflecting both the impacts of disasters and changes in perceived risk. Following Cyclone Oscar and large associated insurance claims in 1983, the domestic insurance industry sought a 400% increase in property premiums. However, this rise was blocked by the Reserve Bank of Fiji and the Insurance Commissioner. In consequence, the insurance industry suffered further heavy losses as a result of Cyclones Eric and Nigel in 1985, causing the insurance industry to issue a warning that it might have to withdraw all cyclone insurance and resulting in the immediate withdrawal of two of the then six insurance companies operating in the country. A third company subsequently withdrew in around 1991, in part as a result of continuing financial difficulties relating to the 1985 cyclones. However, these companies have been replaced by others. A local insurance company was established in 1991. More recently, following relatively low domestic insurance losses as a consequence of Cyclone Kina together with domestic insurance industry profits of F$2.2m in the same year (Reserve Bank of Fiji, 1994), two more insurance companies have entered the Fiji market.

Basic property insurance policies consist of either fire or general household policies, the latter providing cover against fire, theft and earthquakes. No cover is offered

Box 10.1 Building Codes

The Fiji Building Standards Committee was originally established by the Commissioner of Insurance in 1984, in the wake of the destructive 1982/3 cyclone season, to examine the factors underlying the high incidence of cyclone damage. In 1985, following Cyclones Eric and Nigel, the government officially charged the Committee with the task of overseeing the preparation of a National Building Code which would provide some minimum standards both to reduce disaster-related losses and to help 'achieve stable and perhaps reduced hurricane insurance premiums' (Fiji Government, 1985a: 14).

The National Building Code was drawn up in the same year, providing guidelines to home-owners on the upgrading of properties to enhance their cyclone resistance. The Code lays down basic standards for building materials and structures in areas of differing hazard risk. It contains guidelines on fire resistance, access and egress, electricity, health and amenity, and ancillary provisions for dwellings, outbuildings, public buildings and group dwellings. Upon completion of one of three design upgrades detailed under the Code, houses are inspected by a structural engineer and then issued with a certificate. This certificate must be presented to secure cyclone insurance cover and mortgages. Fiji also follows the New Zealand 1965 seismic building code, which applies a single standard across the country.

In practice, it is difficult as yet to establish to what extent the Building Code has improved the disaster resistance of Fiji's building stock. Some attribute the relatively small levels of insured damage occurring as a result of Cyclone Kina to the improvement in building standards. Others argue that the success of the Building Code has yet to be fully tested, pointing out that Cyclone Kina was not a typical cyclone: it was relatively slow moving with a strength of only 2–3 (compared with strength 4 for Cyclones Eric and Nigel) but was accompanied by particularly heavy rainfall, resulting in record flood levels but causing relatively little wind damage the latter of which can potentially be particularly costly.

Adoption of the Building Code has also remained largely confined to urban areas to date. At the rural level, construction of public buildings such as schools, community centres and churches is normally checked by building inspectors but may nevertheless fall below urban standards. Meanwhile, individual homes are typically built by the owner and, particularly in the outer islands, are not inspected. In consequence, rural buildings may suffer much greater damage than urban ones as, for example, during Cyclone Kina, whilst damage to urban housing largely occurs in squatter settlements or villages on the outskirts of urban areas, which are also less likely to be built by contractors (Rokovada and Vrolijks, 1993). Buildings insured overseas may also not comply with the Building Code, as, for example, in the case with some smaller tourist resorts at least prior to Cyclone Kina (Ibid.). Finally, there are some claims of corruption involving the issue of certificates to sub-standard buildings, implying that the scale of adoption of cyclone proofing measures may be less widespread than official records suggest.

against floods or volcanic eruptions whilst cyclone cover has to be obtained separately. Cyclone insurance is relatively expensive. For example, in the soft market conditions prevailing at the beginning of 1996 it was estimated that cyclone coverage

would increase premiums on a general household policy by about a third whilst as much as doubling them under tight market conditions.[39] Nevertheless, the uptake of cyclone insurance has been promoted by making the securing of mortgages conditional upon the acquisition of cyclone insurance. As a result, there is a relatively high rate of cyclone insurance coverage in urban areas, with perhaps 7–8% of the total population and, since virtually all policy holders are located in urban areas, 18–20% of the urban population covered by cyclone insurance. One insurance industry spokesperson interviewed for this study estimated that perhaps 90% of businesses, including all factories, also have cyclone insurance.[40] [41]

Despite high premiums, general data for property insurance indicates that such policies have sometimes involved massive losses for insurers.[42] In particular, the 1983 and 1985 cyclones were largely responsible for net loss ratios (the portion of the loss which is born by the direct underwriters) of 110 and 885 in 1983 and 1985 respectively for fire insurance and 186 and 227 for property insurance policies, although insured losses as a result of Cyclone Kina were much lower (see Box 10.1).[43] To reduce the scale of losses to the domestic insurance industry, considerable use has therefore been made of reinsurance markets more recently, as demonstrated by a comparison of the pattern of claims as a result of Cyclones Oscar and Kina (Table 10.1). However, heavy reliance on the world reinsurance market al.so exposes Fiji to the vagaries of this rather unstable market, with fluctuations in premiums reflecting external, as well as domestic, factors.[44]

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[39] In February 1996, basic property insurance on a F$100,000 house cost around F$350 per annum, including a 10% or F$1,000 deductible, depending on which was higher, in the event of an earthquake. Additional cyclone coverage would have increased the cost of premiums to around F$550 per annum, with a 10% or F$250 deductible on domestic properties and a 20% or F$1,000 deductible on commercial properties in the event of a cyclone.

[40] In 1993, expenditure on household and fire premiums averaged F$18 per capita or, assuming that policies were taken out entirely by urban dwellers, F$45 per capita for the urban population.

[41] In common with governments in many other developed and developing countries, public property is self-insured although all government housing is covered by commercial insurance policies.

[42] Data on loss ratios for cyclone insurance are not available.

[43] Comparable figures on gross loss ratios were not readily available for this period.

[44] Until 1983 the world reinsurance industry were able to offset underwriting losses against substantial investments in money markets. Subsequent falls in world interest rates have forced reinsurers to rely on profits from underwriting activities, resulting in an escalation of insurance premiums. The international insurance and reinsurance industry faced a particularly difficult period in the early 1990s when the global incidence of natural disasters increased, precipitating an upward spiralling of premiums and a sharp reduction in the capacity of reinsurers.

Table 10.1 Domestic and reinsurance payouts as a consequence of severe cyclones, 1983–93

Cyclone	*Domestic insurance pay-outs*	*Reinsurance and off-shore insurance pay-outs*
Oscar (1983)	F$53m	F$34m
Eric and Nigel (1985)	F$80m	n.a.
Kina (1993)	F$5m	F$33m.

Unsurprisingly, domestic risks appear to have most bearing on premium levels in the immediate aftermath of a disaster. For example, in the wake of Cyclone Kina insurance premiums on some policies more than doubled and insurees were also asked to accept higher levels of deductibles (Reserve Bank of Fiji, 1994). At the same time, the insurance industry sought a reduction in reinsurance premiums in view of the supposed reduction in risks demonstrated by the cyclone (see Box 10.1). The reinsurance industry, in turn, expressed concern about earthquake risks in Fiji instead, culminating in the commissioning of a private investigative study of such risks by the Fiji insurance industry. This study revealed that an earthquake on the scale of the 1953 one could result in very high insured losses, in part because some areas of Suva and Nadi are built on reclaimed land. However, at this point the influence of global reinsurance conditions rather than domestic factors came into play and, rather than forcing reinsurance premiums up even further, premiums fell instead as the world reinsurance market moved into a period of improved profitability and concerns about the relatively small Fiji reinsurance market dissipated.

Indeed, as of early 1996, the Fiji market had become highly competitive after, in the absence of any natural disasters, the domestic industry achieved record profits in 1995. Premiums had fallen by some 20–40% whilst rates for the FSC, the largest insurance risk in Fiji, were reported to have been slashed by about a half. New companies were even rumoured to be demanding no cyclone-proofing certification for the issue of cyclone insurance policies. Some working within the insurance industry expressed concern about this trend and felt that Fiji almost needed a major cyclone to shake up the industry and increase premiums to a more realistic level.

In the wake of Cyclone Kina and the associated increase in premiums experienced by some policy-holders, businesses also exerted some pressure on the government to help reduce their exposure to fluctuating premiums by broadening the scope of the Cyclone Reserve, thus enabling companies to build up larger reserves from pre-tax profits and to reduce insurance premium payouts (see Chapter 9). Several organisations rely quite heavily on such reserves because they are no longer able to

obtain insurance at, from their perspective, reasonable levels of premiums and deductibles.[45] Options for a regional disaster insurance scheme have also been discussed on occasion (for example, PIDP, 1990). However, it is ultimately important that any such schemes remain relatively modest and that high levels of reinsurance are maintained because of the implied inflow of foreign exchange following natural disasters (see Chapter 5). Alternative schemes held in local currency could not have the same effect. In part for the same reason, efforts should also be taken to ensure that insurance risks are not under-assessed and thus that reinsurers do not make substantial losses in Fiji, either driving away potential reinsurers or increasing premiums to such an extent that there is a large decline in insurance coverage.

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[45] For example, both Fiji Pine and the FSC operate Cyclone Reserve accounts. Since Cyclone Oscar, Fiji Pine has been unable to procure insurance at reasonable rates on its growing timber, which represented some 70% of its total assets in 1994. Instead, Fiji Pine has made regular annual payments into a Cyclone Reserve account to provide contingency resources in the event of damage resulting from fires and cyclones.

The FSC is the largest insurance risk in Fiji, as already noted, costing the insurance industry some F$40m in the wake of Cyclone Kina. In 1994, faced with high premiums, the FSC established a Cyclone Reserve account into which it invested F$2.5m in pre-tax profits annually. Latterly, international insurance interest in the FSC recovered. For example, when the FSC's insurance policy came up for renewal in late 1995, five international brokers quoted on it. Nevertheless, the FSC has also maintained payments into its Cyclone Reserve account.

11. Disaster management policy and practice

Considerable attention has been paid to disaster management in Fiji. These efforts have concentrated particularly on preparedness and post-disaster responses as well as technical disaster mitigation and preparedness projects. However, broader strategies to mitigate the economic impacts of natural disasters and to incorporate hazard risks into overall economic policies have been largely neglected. This chapter focuses particularly on the role which economic considerations have played in disaster management.

11.1 Disaster management

The country's formal disaster management structure dates back to 1960 when an Emergency Services Committee (EMSEC) was established as an *ad hoc* governmental committee in the Ministry of Finance with responsibility for warning, relief and rehabilitation efforts in the event of natural disasters and civil disturbances. The EMSEC was specifically not intended to meet long term reconstruction and rehabilitation requirements of disaster victims, let al.one to undertake disaster mitigation activities. Meanwhile, the EMSEC's location within the structure of government represented less an effort to incorporate disasters into broader development planning than the fact that disaster relief required budgetary resources. The EMSEC was subsequently complemented by a Prime Minister's Hurricane Relief Committee (PMHRC), created in the wake of Cyclone Bebe (1972). The PMHRC was comprised of a group of private citizens under the chairmanship of the Prime Minister, working in collaboration with the Ministry of Agriculture and the District Administration. It had responsibility for the determination and formulation of relief policies and the implementation of reconstruction programmes but, again, did not have any responsibilities with respect to disaster mitigation. Similarly, the *EMSEC Precautionary Manual for Emergencies*, which was published in 1979, contained no reference to mitigation, which can potentially play the largest role in mitigating the economic impacts of natural disasters, except in the case of drought. Instead, it was essentially an emergency response plan.

The structure of disaster management was finally altered in 1990 to make it more comprehensive, covering prevention, mitigation, preparedness and rehabilitation activities as well as emergency operations and relief.[46] A new *National Disaster Management Plan* was also published in 1995, broadening the scope of the earlier

[46] In keeping with this shift of emphasis, responsibility for disasters was also transferred to the Ministry of Regional Development and Rural Housing because of its existing grassroots network.

1979 manual to include mitigation and rehabilitation, as well as outlining the roles and responsibilities of individual bodies and providing guidelines for operations and activities relating to all stages of disaster management (NDMC, 1995). The supporting role of non-governmental organisations (NGOs) in mitigation, preparedness and emergency response and rehabilitation was also detailed.

Although it could do more, this new Plan goes some way in promoting mitigation measures and represents a step forward towards a broader orientation of disaster management. For example, the importance of incorporating disaster proofing into rehabilitation efforts is recognised: 'if possible, ... rehabilitation efforts should also contribute to a reduction of the vulnerability of communities and public and private assets, in order to reduce the impact of future natural disasters' (NDMC, 1995: V-8). The new structure of disaster management also contains a Mitigation and Prevention Committee with a membership including the Permanent Secretaries for Finance and Agriculture amongst others. However, the committee does not include any representatives from, for example, tourism, industry or commerce. Moreover, the Ministry of Finance's broader role is defined, once again, in terms of ensuring that adequate financial resources are available for essential preparedness and relief measures rather than of developing diversification and growth strategies which explicitly take account of hazard risks.

On a more positive note, the Ministry of Agriculture is expected to play a more participatory role in disaster mitigation under the new Plan, providing advice on crop preparedness and mitigation measures, including the best methods to safeguard crops, livestock, equipment and plants from the effects of natural disasters. The ministry is also expected to work closely with the Public Works Department in flood control and watershed management programmes. Meanwhile, the Fiji Electricity Authority, for example, is expected to undertake some disaster mitigation measures by ensuring that power lines and other installations are kept clear of trees and other possible obstructions.

Nevertheless, the more general lack of importance attributed to a cohesive mitigation policy in the new Plan is further undermined by the fact that the Mitigation and Prevention Committee does not meet regularly. For example, no meetings were held in 1995. In addition, there does not appear to have been any real effort to ensure that mitigation activities are adopted at the grass roots level. Further evidence of the limited interest in disaster mitigation is demonstrated by the fact that the National Building Code was scheduled to be put before Parliament in 1996, some eleven years after it was first drawn up, despite the fact that it had always been intended that the Code would be enacted.

The National Disaster Management Office (NDMO) itself is also constrained in the extent to which it can become involved in disaster mitigation activities. As of early

1996, it had only four permanent staff although certain efforts were being made to strengthen it and increase its autonomy. In the meantime, the NDMO was focussing its efforts on disaster preparedness and relief, reflecting financial and personnel shortages.

In contrast, the new Plan carefully outlines a number of measures for promoting disaster preparedness, awareness and training. Indeed, the government has been quite active in promoting preparedness activities over the past couple of years – in itself a very positive development – and considerable efforts are being made to increase awareness of natural disasters. For example, a National Disaster Awareness Week, which is mentioned in the Plan, is held annually in October, prior to the beginning of the cyclone season. The funding for this is not assured, however, and in 1995, for example, was only approved by the Ministry of Finance after some cajoling. The NDMO is also working through schools, women's groups and the media to increase preparedness awareness. In 1994 and 1995, efforts focused on a poster campaign and, in 1995, radio broadcasts as well, informing people how to act in the event of cyclones, tsunamis, floods and earthquakes. The Ministry of Education has responded particularly well to the need for greater disaster awareness[47] whilst governmental preparedness measures have been complemented by the efforts of certain NGOs and the Fiji Red Cross. Meanwhile, before each cyclone season, stocks of government emergency supplies throughout the country are inventoried whilst the Fiji Red Cross also places stocks of disaster packs around the country and people are encouraged to store food and water.

Adequate warnings are also important, both in saving lives and reducing physical damage. Again the *National Disaster Management Plan* attaches considerable importance to alerts and warnings, including good communications. The current state of scientific knowledge also permits warnings of cyclones, floods and some tsunamis although earthquakes cannot be predicted. Meanwhile, the extent and nature of drought events unfolds slowly and requires careful monitoring. The Fiji Meteorological Service has had long experience of preparing cyclone warnings, both for Fiji and most of the South Pacific more generally; and issues special weather bulletins some 36–48 hours before they strike land. These allow endangered populations some opportunity to secure window shutters, tie down roofs, put equipment and vehicles under cover and so on, effectively reducing the extent of damage. Offices and schools are also shut and people remain in their own homes, or with friends or relatives who are perceived to have safer houses, for the duration of the cyclone. Such measures can play an important role in minimising the impact of disasters, particularly in terms of loss of life.

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[47] Currently disasters are covered under several subjects, including geography and social sciences. The idea of introducing disaster management onto the school curriculum, as a subject in its own right, has even been mooted.

Finally, the nature of disaster response can be important in determining the pace of economic recovery. However, the *National Disaster Management Plan* is rather weak in this regard, at least with respect to the importance it attaches to ensuring a rapid such recovery. The Plan states that public sector rehabilitation efforts 'will be based on full assessment of the impacts of the disaster, including direct and indirect effects' (NDMC, 1995: V-3). However, there has been little actual analysis of either indirect or secondary effects and, instead, efforts focus on physical reconstruction on the apparently implicit assumption that any indirect effects will be automatically addressed as well. 'Economic recovery' is listed in the Plan under typical post-disaster needs for earthquakes but not under those for cyclones, floods, landslides or droughts. Only in the case of drought is any attention paid the need to address to more specific economic impacts such as price instability and increased unemployment. Provision of seeds for planting is only listed under cyclones although, again, this is an important measure required in the aftermath of most disasters to speed recovery.

11.2 Disaster prevention and mitigation measures

Disaster prevention and mitigation activities are potentially particularly important in minimising the broader economic consequences of a natural disaster and so are worthy of particular consideration. Such efforts have focused primarily on cyclones and floods. Some drought activities are also being undertaken but are not well coordinated (see Box 11.1).

In terms of flood, and indirectly cyclone, prevention and mitigation, Fiji's Ninth Development Plan (1986–90) called for a range of structural measures – namely, a programme of construction and maintenance of drainage; river-dredging; and proper catchment area management. The country has since established a River Improvement Management Plan which provides the basis for an integrated river improvement programme covering dredging, flood and bank protection works (Rokovada and Vrolijks, 1993). Such measures have had some success. For example, dredging operations were partly successful in reducing the levels of floods experienced following Cyclone Kina. Major drainage works are also undertaken annually.

However, structural prevention and mitigation efforts are effectively constrained by high per capita investment costs in small islands. For example, the Ministry of Regional Development estimated that coastal protection of the island of Serua, which lies just off the southeast coast of Viti Levu has just one village and faces considerable coastal erosion problems due to high winds and cyclones, would cost around F$250,000 (Porter, 1994). In terms of minimising the impacts of disasters, such costs imply the need for an alternative mitigation strategy which ensures that agricultural and other livelihoods are well-adapted to the prevailing environment instead.

Box 11.1 **Water Strategy**

Parts of Fiji regularly experience dry periods, as already noted, whilst ability to both tap and preserve water supplies also varies considerably. Some water-related investments are being undertaken, involving a number of government ministries. Some communities have also initiated self-help measures, usually under a scheme whereby recipients meet a third of the cost and the government the remainder. However, these efforts are not particularly well-coordinated and the most drought-prone areas not necessarily targeted. Part of the problem lies in the fact that mapping of groundwater resources is incomplete. At the same time, some areas continue to rely largely on hand-dug wells despite surveys indicating that underground water supplies exist which could be tapped through the drilling of boreholes.

Meanwhile, water usage is gradually increasing as populations expand and the water reticulation system extended (Porter, 1994). Demand for water will inevitably increase further with, for example, rising standards of living, continued expansion of irrigation networks and growth of the tourist industry. There are even fears that urban water supply, which to date has been relatively secure, could be threatened (UNDHA-SPPO, 1993). The 1987 drought has already resulted in the introduction of water restrictions, including in Suva and Nausori. Competition for water has also increased since the commissioning of the Monasavu Hydro Power Scheme in 1983, requiring considerable volumes of stored water to operate at full capacity. By 1992, this station accounted for approximately 90% of electricity production, implying that future water shortages could reverberate on industrial processes as well as health and other services by resulting in power shortages. They could also imply increased energy imports, exerting pressure on the external sector, particularly as the government plans to increase reliance on hydro-electricity-generating plants further as part of efforts to reduce the overall volume of imported energy products. The Monasavu dam ran short of water for several weeks during the 1992 drought (NDMC, 1995) and similar shortages could occur again.

Essentially the country requires a comprehensive water strategy identifying water resources and appropriate techniques to exploit that water on a systematic, national basis. The strategy should also consider all aspects of water usage. This is by no means a new idea although such a strategy has yet to be drawn up. For example, the *Opportunities for Growth* document states that: 'Attention needs to be given to increasing knowledge of water as a resource, coordination and prioritisation of competing demands on the resource, and long term planning to ensure sustainable development.' (Fiji Government, 1993: 117)

Faced with increasing competition for water usage, the government also needs to promote water conservation practices. Rainfall statistics dating back at least to the turn of the century need to be examined to identify any long-term trends and water consumption needs adjusted in accordance with them. Water users, particularly industrial ones, also need to be charged prices equated to the long-run marginal cost to of water ensure full cost recovery and to encourage water conservation practices. Urban water rates are currently set well below marginal cost, and there appears to be limited appreciation of the urgent need for marginal cost pricing. Meanwhile, the World Bank (1995) notes that currently inadequate cost recovery is demonstrated by the fact that planned maintenance and upgrading is falling seriously behind schedule. The government also needs to work hard to overturn the general perception of unlimited availability of water (Porter, 1994).

At least in the past, structural mitigation efforts may also have been constrained to some extent by insufficient public appreciation of their benefits. For example, such a lack of understanding was said to be attributable for certain problems encountered in the implementation of the drainage works component of a World Bank funded reconstruction project in the wake of Cyclone Wally (1980) which was hindered by a reluctance on the part of farmers to allow drainage facilities to be built on their land or to permit right-of-way access (World Bank, 1985).

Non-structural disaster prevention and mitigation measures include disaster-proofing of buildings, measures to upgrade flood-vulnerable roads and the taking out of insurance policies (see Chapter 10) as well as various adaptations to agricultural practices (see section 4.1).[48] Some risk hazard mapping is also currently under way. However, there is scope for further vulnerability assessments as a basis for designing additional measures to reduce the impact of natural disasters. For example, Rokovada and Vrolijks (1993) call for a more systematic assessment of the road network and power supply.

11.3 Broader economic policy and disasters

The country's economic vulnerability to natural disasters is clearly recognised by the government and international agencies. For example, the *National Environmental Strategy* states that Fiji '... is subject to potentially catastrophic climatic events such as cyclones, earthquakes, flooding and multiple land-slips which can have a major impact on the economy and infrastructure' (IUCN, 1993: 3). The adverse impacts of natural disasters also feature heavily in accounts of economic performance *ex post*, particularly since the early 1980s, as, for example, in various Fiji Government budget statements. Indeed, as Carter et al. (1991: 267) argue 'Any development scenario for these small (South Pacific) economies is likely to be flawed if it does not take into account the impact of frequent natural disasters, especially on infrastructure facilities'. Meanwhile, the *Fiji National Disaster Management Plan* recognises that disaster mitigation activities should not just be project-based but also 'form part of the overall development efforts of Fiji' (NDMC, 1995: VI-2). Yet, most official general policy documents produced by the Fijian government and regional and multilateral organisations have paid little attention to natural disasters in the formulation of overall policies or planning. For example:

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[48] There are certain inherent contradictions in designing building structures which are resistant to all types of hazard experienced in Fiji. For example, the Town Planning Act enforces the construction of houses on piles in low-lying areas, reducing their vulnerability to floods but increasing that to earthquakes.

- The 1993 document *Opportunities for Growth: Policies and Strategies for Fiji in the Medium Term* (Fiji Government, 1993) makes a number of references to the impact of Cyclone Kina, which occurred whilst the document was being drawn up, on agriculture, forestry, infrastructure and buildings. It also notes that cyclones 'are not uncommon in Fiji and their disruption has to be accommodated with minimum detriment to the implementation of longer term policies' (p14). Yet, although it states that 'environmental management is an integral part of the planning and development process' (p.78), it does not make the same point about natural hazard management. It also largely ignores natural disasters at the sectoral level. For example, natural disasters are not included in the discussion of agricultural sector constraints whilst measures to reduce vulnerability to natural disasters are not listed under "essential" components of agricultural policy and strategy. Indeed, the only place where disasters are specifically identified as a sectoral constraint is in the discussion of Fiji Pine where forest fires are mentioned. Meanwhile, the document identifies a need for long-term water resource planning to help ensure that the economy remains on 'an environmentally sound growth path' but does not acknowledge the potentially serious economic implications of water shortages.

- The *Suva Declaration on Sustainable Human Development in the Pacific,* drawn up at the Twenty-Fourth South Pacific Forum in 1993, identifies a number of constraints to sustainable growth but fails to mention natural disasters (Forum Secretariat, 1994). The Declaration advocates development strategies which, amongst other things enhance the productivity of the rural and subsistence sector, address inequality and emerging poverty, overcome regional disparities and support environmental regeneration. The attainment of such objectives could be undermined in the event of a natural disaster yet, again, disasters are not mentioned.

- In the official report of the Twenty-Fifth South Pacific Forum global warming and sea level rise are identified as 'among the most serious threats to the Pacific region and the survival of some island states' (Forum Secretariat, 1995) but there is no mention of natural disasters.

- A 1995 World Bank report includes some reference to the impact of natural disasters on production of certain crops; and acknowledges vulnerability to natural disasters as one of Fiji's 'handicaps'. Yet it fails to suggest the promotion of policies which aim to reduce that vulnerability, even within the narrower context of the agricultural sector (World Bank, 1995).

- The *National Environment Strategy* (IUCN, 1993) recognises the cross-cutting nature of environmental issues and the need to incorporate them into all aspects of government business because 'environmental policies designed in

> isolation of other sectoral and national goals are difficult to implement and frequently fail' (p.29). Yet little is said about, effectively, the reverse process – ie, the impact of the environment, including natural hazards, on development – other than in calling for strategic long-term planning for resources which may be affected by climate change, particularly sugar cane cultivation in the dry zones of Viti Levu and Vanua Levu which could be adversely affected by increasingly dry conditions (IUCN, 1993).

In contrast, considerably more interest has been paid to environmentally sustainable development as one of the three central themes of sustainable human development. Environmental policies and objectives have been included in government documents dating back to 1971 although, in practice, implementation difficulties have been encountered due to several factors including lack of integration of development and environmental policies and inadequate and highly sectoralised legislation (IUCN, 1993). Similar factors appear to hinder consideration of natural disasters in overall economic policy-making.

However, it is not entirely clear what factors underlie the general malaise in incorporating hazard risks into broader economic policy. Admittedly, environmental issues, for example, probably demand greater attention as environmental degradation is directly linked to human actions and presents a continual threat whereas natural disasters occur infrequently. Nevertheless, human actions also partly determine the scale of impact of natural hazards and, when they do occur, disasters may constitute severe exogenous economic shocks. Part of the problem of incorporating hazard risks into economic policies and strategies must lie in the current nature of post-disaster assessments which, as discussed below, largely fail to take account of indirect and secondary impacts and so may considerably underestimate their full costs.[49] If the latter was more transparent, then this alone could push policy-makers into action. There may also be some sense of collective non-responsibility – that is, that because the impacts of disasters are so all-pervasive, potentially reaching into most aspects of the economy, no government ministry or department is willing to recognise them as in part their own responsibility.

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[49] Cost-benefit analyses of disaster prevention and mitigation projects also appear to entail a very narrow definition of economic benefits. For example, an economic assessment of the benefits of a flood protection scheme in the Rewa Delta was undertaken which included a valuation of the types and value of assets which would be damaged or destroyed under varying flood scenarios (UNDP/FAO, 1994) but excluded any consideration of the indirect or secondary impacts of a flood. On some occasions, such narrow approaches could imply that a decision is not taken to invest in a potentially highly beneficial project, particularly if social benefits are also excluded from the analysis.

11.4 Damage assessment - an obstacle to comprehensive disaster mitigation strategies?

Current efforts to assess the economic impacts of natural disasters in Fiji are essentially confined to post-disaster damage assessments. Such assessments should aim to serve two purposes. First, they should provide essential information upon which appropriate and timely responses can be based, addressing both short-term humanitarian needs and efforts required to ensure a rapid economic recovery. Second, damage assessments should form a fundamental component of efforts to ascertain the broader economic impacts of disasters, providing important information for policy-makers in furthering their understanding of possibly changing economic vulnerability to natural hazards and in determining how economic development can be directed towards reducing that vulnerability. The *National Disaster Management Plan* recognises the importance of maintaining proper records of disaster experiences for use in improving future plans, policies and procedures. Indeed, one of the missions of the Preparedness Committee is 'to establish a simple but effective data base on natural disaster damage and protective control mechanisms as a guide for policy direction and programme development' (NDMC, 1995). However, to date the scope and quality of disaster assessments is somewhat limited and needs to be improved before a really useful database can be developed.

Part of the problem lies in the currently short-term nature of assessments. In the aftermath of a disaster, daily briefings are prepared by Emergency Operation Centres at the national, divisional and district levels. According to guidelines laid out in the 1995 *National Disaster Management Plan* and broadly reflecting recent practices, a series of reports should also be prepared at the national and divisional level comprised of the following:[50]

- initial damage and relief needs assessment reports (within 48 hours);
- relief needs assessment reports (within 1 week); and
- damage assessment and outstanding relief needs reports (within 2 weeks).[51]

At the end of an emergency operation, a debriefing and review of the operation should then be produced, outlining outstanding relief needs. Additional assessments should be prepared for rehabilitation programming, taking into account baseline data where available.

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[50] These assessment procedures were clearly laid out in the *National Disaster Management Plan* partly in response to inadequacies in the assessment process which were revealed following Cyclone Kina. They broadly reflect past practices but hopefully, when they are put to the test in the next disaster, will provide for a fuller and more systematic assessment.

[51] Droughts do not fit into this format and, in practice, drought assessments are limited to an assessment of emergency water supplies.

The primary purpose of this series of assessments is to identify the impact of a disaster and indicate emergency response, relief and rehabilitation requirements (NDMC, 1995). Information should be provided on the numbers affected; the numbers of homes destroyed or damaged; damage to food crops, cash crops and livestock and the availability of food; damage to essential services and facilities; and damage to roads, bridges and overall accessibility of areas. Assessment reports sometimes refer to disruption to trade as a consequence of infrastructural damage but no attempt is apparently made to cost this economic loss. Additional reports are provided by other public and private institutions – such as the Fiji Electricity Authority, the Fiji Sugar Corporation, the Public Works Department, Telecom, the Fiji Pine Commission, the Red Cross and NGOs – and incorporated into the national and divisional reports.

However, these procedures fail in one important respect: according to them, the final debriefing should occur perhaps only 6 months after a disaster. At this stage it is far too early to assess the full impact of a disaster on, for example, the balance of payments, the government budget, or the allocation of budgetary resources. There has been some improvement in this regard to the extent that in the immediate aftermath of Cyclone Kina both the Reserve Bank of Fiji and the Ministry of Finance undertook brief economic assessments of the damage incurred, considering the price, balance-of-payments and budgetary effects as well as direct impacts on productive sectors and infrastructure. However, the Ministry of Finance's paper was drawn up in February 1993 and the Reserve Bank's one even earlier, in January – that is, only a few weeks after the cyclone – and so were based largely on conjecture rather than hard fact. Neither document was subsequently updated nor any effort taken to consider the lessons learnt in terms of strengthening the economy against future disasters. Furthermore, the 1995 manual did not outline any requirement for broader economic assessments of the impacts of disasters at any point in the assessment process.

Other problems have also been encountered in the past. For example, relevant ministries have typically failed to pool their reports, undertaking initial survey and assessment work separately. This has effectively undermined the coordination of the overall relief and rehabilitation operation, as, for example, in the case of Cyclone Kina where poor coordination and thus incomplete knowledge of the extent of damage and existing relief efforts implied that the government was unable to respond to some offers of international assistance in good time (Rokovada and Vrolijks, 1993). To date, any efforts to implement standardised reporting formats have also failed, effectively hampering efforts to construct a clear picture of the precise nature

of the damage caused by disasters.[52] The general literature on the agricultural impact of natural disasters is particularly thin, especially as concerns subsistence crops.[53] [54]

More positively, to help ensure accurate assessments of damage in the future, districts, divisions and the NDMO are also expected to collate baseline data according to the *National Disaster Management Plan*. These should include information on population distribution, agricultural areas and the location of key facilities; and should be reviewed annually, prior to the start of the cyclone season in September. If implemented, this could represent a major step towards an improved assessment of the broader economic impacts of natural disasters, in turn helping to promote appropriate agricultural and other policies.

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[52] UNDHA have also produced two booklets on disaster assessment in the Pacific in recognition of the need for improved practices. However, these booklets are not used, at least in Fiji. In 1991, there appears to have been another effort to introduce a standardised format for reporting damage, this time on the initiative of the Fiji Government. Draft forms were drawn up by the Ministry of Regional Development, covering damage to crops, houses and schools. They were then circulated for comment but apparently not taken any further.

[53] This is partly attributed to the 'unreliability and lack of objectivity of crop loss appraisal methods' (Amerasinghe, 1984: 143). Lack of trained personnel presents a further problem whilst assessments may be complicated by multi-cropping. The impact of natural disasters also extends beyond crop losses to factors such as reduced plantings, the purchase of new planting materials and other agricultural inputs to replace lost ones and even loss of export markets. Yet it may be difficult to gauge the impact of natural disasters on such factors as crop planting decisions.

[54] This is true not only of Fiji but also of the South Pacific more generally.

12. Traditional coping mechanisms

Traditional coping mechanisms to deal with the effects of natural disasters, including both longer-term mitigation measures and shorter-term preparedness measures, have been developed over centuries in both Fiji and the Pacific more generally. Early recognition of an annual cyclone season was reflected in the naming of the months.[55] Preparedness measures were traditionally based on certain weather and animal behaviour patterns which were believed to foretell a hurricane, some of which have subsequently been proven to have a scientific basis.[56] In recent times, these have been supplemented by meteorological warnings which, for example, enabled the country to be placed on alert four days before Cyclone Kina struck (Rokovada and Vrolijks, 1993).

However, there is reported to have been a gradual breakdown in traditional mitigation and coping mechanisms (e.g., Carter et al., 1991). There has also been much discussion of the emergence of a relief-dependency syndrome, with communities increasingly relying on government and international donor efforts, rather than self-help initiatives, in the aftermath of disasters.

Various factors have contributed to these trends:

- **Changing agricultural practices** – as already discussed, there has been a shift away from multi-cropping towards production of just a few crops together with much reduced cultivation of more disaster-resistant crops. Some commentators point to increasing reliance of households on cash crops for export as their major source of income as another factor contributing to increased vulnerability (Carter et al., 1991). Certain traditional practises to preserve food supplies for use in the event of a natural disaster are also dying out (see section 4.1).

- **Increasing poverty** – various commentators have suggested that levels of poverty in Fiji are probably increasing (e.g., Bryant, 1992; Chung, 1995), particularly following the 1987 coups and the subsequent economic decline. A draft poverty study, under preparation by the Central Planning Office with UNDP assistance as

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[55] Fijians divide the year up into a number of periods which refer to various natural phenomena. The months from December to February are variously known as the *vula i katakata* ('hot season'), *vula i solelaca* ('sail-wrapping season') and *vula i tabulaca* ('season when the sail is prohibited'), the last two referring to the fact that sailing is not normally undertaken during this period because of the threat of hurricanes (Rokovada, no date).

[56] For example, both ancient and modern-day Fijians believe that when a breadfruit tree is heavily laden with fruit there will be a hurricane (Amerasinghe, 1984).

of early 1996, has estimated that some 25% of the population live below the poverty line (based on Household and Income Expenditure Survey data from 1990–1), compared with under 20% in 1977. It has been recognised that a large proportion of the poor are located in ecologically fragile areas and that their economic and social deprivation is one of the factors contributing to further environmental degradation (e.g., Norindr, 1993). It has also been recognised that natural disasters contribute to poverty. However, the fact that the poor are also particularly hazard-vulnerable by definition of their location, as well as, commonly, quality of housing and that disaster vulnerability must be addressed as part of wider efforts to reduce poverty have yet to be incorporated into any anti-poverty strategies.

- **Population and land pressure** – this has contributed to the gradual cultivation of marginal lands as well as the construction of housing in increasingly hazardous areas, particularly those vulnerable to landslides, as urban areas expand. Newer developments also tend to be located in drier areas rather than near adequate water supplies (Porter, 1994).

- **Modernisation of the housing stock** – there has been a gradual shift from the use of traditional to modern housing designs and materials which has probably been accompanied by an increasing level of sub-standard housing. Traditional *bure* (thatched) housing could be relatively easily replaced in the aftermath of a disaster; and was relatively safe, with fairly low risk of fatalities or injuries in the event of cyclones or earthquakes. However, *bure* houses are an increasingly rare sight. For example, a survey of 124,098 households in 1989 reported that only 9% of houses were still constructed from *bure* materials (Fiji Bureau of Statistics, 1989). Instead, even on the outer islands, housing is increasingly constructed from cement, timber and corrugated iron. Such structures are not necessarily less disaster-proof, depending on their design, but poorer households can only afford lower quality modern building materials, may use a combination of traditional and modern materials and may not apply the Building Codes, together implying a decline in the level of disaster-resistance. The Ministry of Rural Housing funds some housing construction which should be built in accordance with the one of several building plans satisfying Building Code requirements but, in reality, carpenters and builders may lack the skills to follow these plans (Carter et al., 1991).

There is no systematic source of information about sub-standard housing (Chung, 1995) or about the proportion of housing stock which does not incorporate cyclone proofing features. However, the level of squatter housing – which is both sub-standard and unlikely to incorporate cyclone-proofing features – is increasing. For example, a 1986 survey revealed that 1 in every 8 people in Suva was a squatter (Bryant, 1992). Forecasts suggest that over the next 15 years, almost

19,000 additional urban houses will be required to meet increasing demand as urbanisation continues (IUCN, 1993). This substantial expansion could result in construction of further sub-standard housing, increasing the vulnerability of both the housing stock and individual households to natural disasters.

- **Breakdown of the extended family system** – some argue that the importance attached by indigenous Fijian society to the extended family and the practice of reciprocity and sharing within a community has played a major role in mitigating household impacts of disasters, preventing acute deprivation of individual households or people. This system has to some extent deteriorated as households have become increasingly involved in the market economy. However, the extent of the system, even in the past, has perhaps been exaggerated. For example, Bryant (1992: 92) comments that 'disparities in access to basic necessities occur much more frequently than might be expected in a society where social networks are theoretically intended to ensure that such situations do not occur'. Chung (1995: 8) also questions whether 'practices and systems of production (are) really designed to "share and care for those in need"?'. Several surveys have also indicated that intra-community disparities may be much greater than generally believed. Furthermore, there is reported to be no economic interdependence between Indo-Fijian households, (Chandra, 1983) who formed 45% of the population in 1993 and, presumably, a greater share of the lower-income groups.

Attitudes to disaster relief in Fiji are also reported to have changed. For example, Amerasinghe (1984) reports that in the late 1940s offers of cash relief, even on a loan basis, were only accepted with reluctance by inhabitants of the outer islands while rural housing was rapidly repaired by the affected communities in the aftermath of a disaster. However, in the more recent wake of Cyclone Meli (1979), for example, victims awaited the arrival of relief items rather than eating uprooted dalo and cassava. Increasing availability of relief supplies has been held partly to blame for the apparent breakdown of traditional coping mechanisms (e.g., PIDP, 1990). However, others view the increased government intervention in the aftermath of a disaster as a response to a perceived reduction in the ability of communities to cope, rather than the other way round (Rokovada, no date).

Finally, despite the general increase in vulnerability of poorer households to natural disasters, little research has been undertaken on the economic impacts of disasters at the household level, either in Fiji or elsewhere in the Pacific. Such studies should form an essential underlying component of any anti-poverty strategies, covering issues such as the extent to which household indebtedness increases as a consequence of natural disasters and the role of disasters in contributing to rural-urban migration. Action should also be taken to ensure that knowledge of traditional coping mechanisms is not lost.

13. Donors

External assistance is less important in Fiji than in other South Pacific island economies, accounting for only 3–4% of GDP. In terms of natural disasters, donor efforts have primarily focussed on preparedness and response rather than mitigation. This paper does not attempt to provide a comprehensive account of donor disaster-related activities. Instead, it merely aims to impart a flavour of this external assistance on the premise that donor behaviour provides an indication of the international community's perception of the physical, economic and social risks imposed by natural disasters and is thus worthy of a brief examination in a study on the scale of their economic impacts. The degree of concessionality of foreign assistance, particularly for relief purposes, is also considered.

Disaster relief can only be provided in response to an official appeal.[57] Many donors provide relief in the aftermath of disasters although the Australian, French, New Zealand and Japanese governments play particularly large roles, reflecting their existing disaster response capacity in the South Pacific more generally. In 1973, the South Pacific Forum Secretariat also established a Regional Disaster Fund which can provide disaster funds up to a maximum value of F$20,000 to any member country. Since 1977, this Fund has also been available for use in disaster preparedness.

Donor relief assistance is largely funded out of emergency budgets, rather than entailing the diversion of development assistance, and normally provided as grant aid. Some development project funds may be used to finance the repair of damaged infrastructure which is directly relevant to a project's success but it would be very difficult to assess the extent to which this occurs or the implications for the overall achievements of the project.[58] Meanwhile, AusAid, at least, will meet a larger share of the local costs of development projects in the aftermath of a disaster in recognition of the increasing financial demands which the disaster places upon the government. However, some disaster reconstruction activities have been funded by loans rather than grants, with longer-term debt implications. For example, the World Bank extended a US$18m loan for the reconstruction of roads, bridges and drainage works and for the dredging of several rivers in the wake of Cyclone Wally (1980), which had caused numerous landslides and severe flooding in the Navua and Waimanu river

[57] Sometimes, appeals are made to specific countries rather than issued more generally (NDMC, 1995).

[58] For example, funding for an education project could be used to repair a school.

catchments. Some of the work completed under the project was subsequently damaged by Cyclone Oscar (1983) although the loan still had to be repaid in full.[59]

In a perhaps slightly unusual case, one cyclone offered the opportunity to utilise allocated, but as yet unspent, development funds . Flooding associated with Cyclone Kina (1993) destroyed four bridges in Viti Levu, including the two most important ones (Ba and Sigatoka). The EU financed their reconstruction, incorporating cyclone- and earthquake-proofing features into the new structures and also widening one of the bridges from a single to double lane, in recognition of the gradual increase in use of the bridge which had occurred since its original construction. Existing development funding to the value of 10.2m ECU (US$12.0m) was allocated to the bridges, representing almost half of the total 22m ECU available under the EU's Seventh Indicative Programme (1990–5) of the European Development Fund (EDF). The EU had previously faced certain absorption problems disbursing this funding, although such problems had not been experienced by most other donors.

In terms of preparedness, several bilateral and multilateral donors, including Australia, Japan, New Zealand and the World Meteorological Office, have supported the country's meteorological services at various times, including its cyclone warning capacity. As already noted, these services cover not only Fiji but much of the South Pacific as well. New Zealand also offers back-up cyclone tracking services from Wellington. More recently, in the wake of Cyclone Kina (1993) the EU has begun a 1.96m ECU (US$2.3m) project to upgrade cyclone warning systems in the Pacific, including installation of equipment on isolated islands to provide a first line of warning and a component to improve the translation of technical warnings into public ones. The EU is also considering a risk assessment project for the Pacific. Australia has been particularly active in non-technical disaster preparedness activities, funding workshops and seminars as well as providing financial support for the publication of the 1995 *National Disaster Management Plan*. A number of donors, including the United Nations Department of Humanitarian Affairs (UNDHA)'s South Pacific Programme Office (see Box 13.1), have also been involved in disaster training, either directly or indirectly.

In contrast, donor support of disaster mitigation activities is relatively new with the notable exception of the South Pacific Disaster Reduction Programme (see Box 13.1) and Australia's support of the development of Fiji's Building Code. As of early 1996, Japan was undertaking preliminary studies for the establishment of a watershed management project. However, some development projects include disaster

[59] This study does not consider the sourcing of post-disaster relief supplies and the extent to which local materials are drawn upon, where available. However, evidence suggests that on some occasions the scope for domestic sourcing was not fully exploited. For example, much of the emergency rations provided in the aftermath of Cyclones Eric and Nigel were imported (Chung, 1988).

Box 13.1 The South Pacific Disaster Reduction Programme

The South Pacific Disaster Reduction Programme (SPDRP) is a regional programme covering the 15 Pacific island countries which has been in operation since 1990. The programme represents a major regional initiative to systemise and rationalise the management of disasters, particularly from the perspective of disaster mitigation and preparedness. It is implemented by UNDHA through its South Pacific Programme Office, with financial support from a number of multilateral and bilateral donors.

The SPDRP's objectives include to 'improve the capacity of countries to mitigate, prepare for and respond to natural disasters through institutional strengthening and community based disaster management programmes' as well as to provide technical support and training and to promote cooperation between governments, donors and others involved in various aspects of disaster management (UNDHA, 1996: 1). Disaster mitigation forms one of the SPDRP's six project components and several disaster mitigation projects have been developed under this component of the project. These include the Suva Earthquake Risks Management Programme, a programme incorporating housing vulnerability reduction, land-use planning, emergency planning, public awareness and public sector services. Other SPDRP initiatives in Fiji include production of the *National Disaster Management Plan*, the undertaking of an assessment of drought problems and a pilot mitigation project.

The SPDRP clearly recognises the links between the reduction of disaster threats and sustainable development. Indeed, its mid-term review proposed the establishment of a programme 'that assists countries to reexamine and fine-tune their development programmes, and identifies disaster mitigation policies, strategies and measures that improve the sustainability of development programmes by taking relevant counter-disaster measures' (UNDHA, 1996: 9-10). It also proposed that the SPDRP should 'stimulate countries to feed disaster mitigation programmes into their national prioritization arrangements' (UNDHA, 1996: 13). If successful, such efforts could constitute a major step in mitigating the economic impacts of natural disasters at both the household and broader macroeconomic level.

mitigation elements. For example, most donors apparently include disaster-proofing measures in the construction of any buildings, a measure effectively reinforced by the fact that the Public Works Department will not take on the maintenance of any building which has not been cyclone-proofed. However, it is less clear whether earthquake-proofing measures are also included in the design of buildings. More generally, although many donors now undertake Environmental Impact Assessments as part of the feasibility studies for at least some projects, they do not undertake hazard risk assessments except in cases where high risks are already transparent. For example, the New Zealand government apparently considered the risk of disasters in providing support to the forestry sector, where the risks of cyclones and fires are well-recognised. Meanwhile, although a number of Fiji's larger donors, including Australia, New Zealand and multilaterals such as UNDP, have recently begun to place an increasing emphasis on human resources development, including anti-poverty

strategies, there are no projects specifically aimed at reducing the disaster vulnerability of individual households.

14. Conclusions

The main findings of the paper are as follows:

- Severe natural disasters constitute major exogenous shocks to the **Fijian economy**, resulting in substantial declines in GDP. The economic impacts of disasters may be exacerbated during periods of more fundamental underlying weakness, underscoring the need to recognise and address any longer-term problems rather than attribute difficulties to natural disasters.

- The **agricultural sector** has become increasingly vulnerable to natural disasters since the early 1980s. In terms of individual crops, the vulnerability of the country's important sugar crop has increased as production has expanded onto marginal lands, encouraged by artificially high export prices which have perpetuated the economy's reliance on a highly-disaster vulnerable industry. Coconuts, an important cash crop in the Eastern Islands and much of the Northern Division, have also become increasingly vulnerable to cyclones between the 1970s and 1980s, probably partly reflecting the increasing senility of trees. However, rootcrops remain relatively immune to the impacts of both cyclones and droughts.

- Current changes in the agricultural sector suggest that the sector's vulnerability to natural disasters is unlikely to decline in the medium term, despite an anticipated decline in sugar production. Instead, farmers are diversifying into other disaster-vulnerable crops such as fruit, vegetables and flowers, with little apparent consideration, at least on the part of government, for the consequences of potential natural hazards. Increased expansion into marginal areas and environmental degradation could also exacerbate the sector's hazard vulnerability. However, rising vulnerability is not inevitable. For example, winter crops grown under irrigated conditions and, by definition, outside the cyclone season, are less susceptible to natural disasters while early maturing perennial winter crops could offer particular benefits in terms of lower vulnerability to natural disasters. Increased cultivation of traditional roots and tubers could also play an important role in reducing hazard vulnerability both of households and, as export markets are built up in response to growing overseas demand for such crops, the broader macroeconomy.

- Since the mid-1980s, the **forestry industry** has been expected to shortly emerge as one of country's major growth sectors. Pine exports, in particular, have been forecast to eventually compete with sugar as the country's prime export. However, in practice, Fiji Pine, at least, has consistently under-performed in meeting both plantation and timber production targets, largely as a consequence of natural disasters. Between 1983 and 1994, forest damage as a result of cyclones and fires,

in turn part drought-related, totalled over F$34.2m (at 1994 prices) compared with gross profits over the same period of F$32.4m.

- As with the agricultural sector, the **manufacturing sector** has become increasingly vulnerable to natural disasters since the early 1980s, principally reflecting the increased vulnerability of the sugar industry. However, sugar's importance in total manufacturing output has declined since the late 1980s due to the growth of various (less disaster-vulnerable) industries. If this trend continues, the sector's overall vulnerability to natural disasters could decline although this trend would not represent the result of any deliberate policy on the part of the government.

- Levels of **investment** have been consistently low despite its particular importance in securing future growth. However, natural disasters do not appear to have acted a constraining factor. There is little evidence of any post-disaster construction booms linked to the construction industry.

- The overall **balance of payments** has been relatively immune to natural disasters, primarily reflecting higher reinsurance inflows and the export of sugar reserves during disaster years, both of which have helped maintain foreign exchange earnings. However, the current pattern of diversification in the agricultural sector together with anticipated future declines in sugar production, in turn implying lower sugar reserves, could render the balance of payments increasingly vulnerable to natural disasters. The projected increase in timber and wood product exports could also contribute to this trend.

- The **tourist industry** has apparently been relatively immune to natural disasters to date, at least as reflected in annual data. Further development of the sector therefore offers some opportunity to reduce the economy's vulnerability to disasters. However, any upper limits imposed by natural disasters on the potential extent of expansion of the industry, from the perspective of both potential investors and visitors, should be investigated. Efforts should also be undertaken to ensure that tourists are adequately protected in the event of a disaster, in part to avoid any damaging publicity.

- Natural disasters appear to have had little **inflationary impact** but there is some evidence that they may result in more permanent price increases for certain domestically-produced food items.

- Severe disasters can have potentially profound **budgetary implications** although it is typically difficult to ascertain much impact from overall annual expenditure data. This partly reflects the fact that the government has limited their net impact by redeploying allocated resources to meet disaster relief and rehabilitation needs,

despite partly thwarting efforts to increase the ratio of capital to operating expenditure as a consequence. Disasters have also had an adverse impact on certain categories of government revenue whilst recent tax changes, including a relative shift away from import duties, may have increased the vulnerability of the tax base to natural disasters.

- Businesses and households should continue to be encouraged to take out **insurance** policies to help spread the cost of natural disasters and ensure a speedy recovery. Efforts should also be undertaken to ensure that insurance risks are not under-assessed and thus that insurers and reinsurers do not incur substantial losses, either driving away potential reinsurers or increasing premiums to such an extent that there is a large decline in insurance coverage. High levels of reinsurance coverage are particularly important in ensuring the continued flow of substantial foreign exchange earnings in the aftermath of natural disasters, thus helping to prevent major balance-of-payments crises. Fiji is widely quoted as a successful example of a country which has used the insurance industry to promote improved building standards. Although this claim may be marginally premature, the insurance industry should continue to be used to encourage improved building standards.

- Considerable attention has been paid to **disaster management**, but efforts have concentrated largely on preparedness, post-disaster response and specific disaster mitigation and preparedness projects whilst broader strategies to mitigate the economic impacts of natural disasters have been largely neglected. Similarly, hazard risks have not been incorporated into overall **economic policies.** Preparedness and disaster response measures are clearly very important and efforts should certainly be continued to improve them even further. However, more attention also needs to be paid to disaster prevention and mitigation.

- Fiji requires a comprehensive **water strategy**, identifying water resources and appropriate techniques to exploit those resources on a systematic, national basis and covering all aspects of water usage. Such a strategy should include the introduction of marginal cost pricing of water.

- At the **community and household level**, there has been a gradual breakdown in traditional mitigation and coping mechanisms and the apparently simultaneous emergence of a relief-dependency syndrome, with communities increasingly reliant on outside help in the aftermath of a disaster. Various factors have contributed to the disintegration in coping mechanisms including changing agricultural practices; increasing poverty; population and land pressures; expansion of the market economy and financial services; changing types of housing; and the breakdown of the extended family system. Poverty and disaster vulnerability appear to be mutually self-reinforcing but little research has been

undertaken on the economic impact of disasters at the household level, either in Fiji or elsewhere in the Pacific. Such studies should form a fundamental component of preliminary investigations to design anti-poverty strategies.

- The **risk of a major earthquake**, which could cause extensive economic damage, appears to have been largely discounted although an earthquake risk mapping pilot survey is currently being conducted which could increase risk awareness. All potential investors should be encouraged to undertake full disaster risk assessments before deciding on the location of manufacturing plants. The extent of insurance cover against earthquakes should also be ascertained and such policies promoted where possible.

The evidence presented in this paper indicates that the structure of the Fijian economy, including the importance of the sugar industry, has effectively helped mitigate some of the potentially more serious economic impacts of natural disasters, particularly on the balance of payments. However, this should not engender complacency. Indeed, it is conceivable that the adverse economic, and perhaps even the social, impacts of disasters could increase in the future if government policy-makers and others do not undertake appropriate counteracting measures.

The favourable sugar price environment which Fiji has enjoyed for many years is expected to be partially eroded up to the year 2001 as agricultural support and protection is gradually reduced in accordance with the Uruguay Round of the GATT Agreement, in turn precipitating the diversification out of sugar production in Fiji. This is therefore a particularly opportune moment to develop a detailed strategy both for the agricultural sector and the economy more generally which aims to reduce hazard vulnerability as well as to address other major economic concerns – namely (as specified by the World Bank, 1995), the restoration of economic growth to a level sufficient to provide jobs for the expanding labour force and to improve standards of living; diversification of the economy to reduce vulnerability to volatile export markets and take advantage of new export opportunities; and the creation of a domestic environment which encourages investment in human and physical capital.

The World Bank (1991) has advocated a development strategy for the Pacific Islands which focuses on areas of comparative advantage in each country. In practice, it is often difficult to identify such sectors because the Pacific islands face substantial import and export transportation costs, forcing up the price of exports and the domestic cost of living, as reflected by unskilled wage levels some 3–7 times higher than those for comparable workers in Southeast Asia (ADB, 1995). However, Fiji is favoured by a good natural resource base, including tourism potential and, of the Pacific islands, is considered to have one of best chances of achieving improvements in standard of living and greater self-reliance (Ibid.). Given the high transport costs, it is also widely held that some of the strongest opportunities for growth of the

manufacturing sector must lie in industries based on domestic natural resources. A 1996 ADB agricultural review of the Pacific therefore included efforts to strengthen linkages between the agriculture and manufacturing/processing sectors as one of its main areas of concern. However, such a strategy could imply increased vulnerability to natural disasters by implying increasing dependence on potentially the most disaster-vulnerable sector of the economy. It is therefore essential that hazard risks are assessed as part of the multi-sectoral strategic planning process and that a strategy is adopted which aims to minimise risks from all potential sources, including natural hazards as well as, for example, adverse commodity price shocks. Although increased emphasis has been placed on the integration of sectoral policies into the government's overall strategy since the late 1980s, hazard risk assessments have yet to be undertaken at either the sectoral level or for the overall economy.

Appendix 1 Quantitative regression analysis of the impact of natural disasters on GDP

The sensitivity of sectoral economic performance to natural disasters over the period 1971–94 was examined quantitatively for the purpose of this study using ordinary least squares regression analysis and focussing specifically on the impact of cyclones and droughts.

The country's major productive economic activities are located on Fiji's two main islands, Viti Levu and Vanua Levu. A cyclone series was therefore constructed assigning values of 0 for years in which no cyclone occurred; one for years of either moderate cyclones or severe ones which did not affect major parts of the two main islands; and 2 for years when severe cyclones affected large parts of the main islands (see Appendix Table 1). Cyclones which occurred between September and December were taken into account in the cyclone dummy variable for the following, rather than current, calendar year as their effects were largely expected to be felt at the point of harvest. A drought dummy variable was also constructed with values of 1 in years of severe drought affecting large parts of the country and 0 in others.[60] A disaster dummy variable combining cyclones and droughts in one series and a coup dummy variable were also constructed. The latter was assigned values of 2 in 1987, 1 in 1988 and 0 in other years.

Preliminary examination of Fijian sectoral GDP data indicated an apparent slowdown in the average economic growth rate over the period of analysis. Growth rates averaged 4.4% per annum for the period 1971–82 compared with 2.2% for 1982–94. The difference in growth rates was confirmed by Chow (analysis of variance) tests on regressions of sectoral GDP and GDP at factor cost against time for the two periods. In analysing the impact of natural disasters on growth rates, separate regressions were therefore run for the periods 1972–82 and 1982–4 as well as for the full period 1972–94.[61]

Regressions were undertaken on annual growth rates of sectoral GDP at factor cost. More specifically, separate regressions were run for agricultural, manufacturing, industrial, services and non-agricultural output as well as for overall GDP against the various dummies. For the later period, 1982–94, data were also available on the value

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[60] Floods were not considered as severe flooding typically occurs in the context of a cyclone. As the country has not experienced a major earthquake since 1953, earthquakes were also excluded from the analysis.

[61] It should be noted that the results of any analysis are partly dependent upon the choice of base and end years. The base and end years used here were partly chosen because they were "normal" (ie, non-disaster) years.

of sugar production in agricultural and manufacturing value-added. Separate regressions were therefore run for these as well as for agricultural and manufacturing output excluding sugar.

The highest overall levels of explanatory power (as measured by the adjusted R^2) were generally obtained for regressions against the combined cyclone/drought and coup dummies. The results confirm that both the manufacturing and agricultural sectors as well as overall GDP have become increasingly vulnerable to natural disasters since the early 1980s (see Appendix Table 2). Regressions for the later period, 1982–94, excluding sugar in agricultural and manufacturing production indicate that the sugar industry is responsible for the increasing vulnerability of the manufacturing sector but that sugar alone cannot explain the increasing vulnerability of the agricultural sector (see Appendix Table 3).

The explanatory power of the cyclone dummy lagged one year was also examined to see if cyclones created a prolonged economic downturn or, alternatively, whether disasters led to mini-boom conditions in the following year. However, results were generally insignificant.

Appendix Table 1: Cyclone. drought and coup dummy variable series constructed for the purposes of the regression analysis

Year*	Typhoon dummy	Drought dummy	Coup dummy	Notes
1970	0	0	0	
1971	0	0	0	
1972	0	0	0	
1973	2	0	0	Bebe (severe; Vitu Levu incl. Suva & west coast)
1974	1	0	0	Lottie (severe; small islands in extreme south-east)
1975	1	0	0	Val (severe; south-east smaller islands), Betty (moderate; western half Kandavu & v. far south Fiji area; gale force winds in SW Viti Levu incl. Nandi)
1976	0	0	0	
1977	0	0	0	
1978	1	1	0	Anne (moderate; in eastern small islands), Bob (moderate; western side of Viti Levu), drought 1977/8
1979	1	0	0	Meli (severe; far south islands)
1980	1	0	0	Wally (severe; far southern corner of Viti Levu and islands further south)
1981	2	0	0	Arthur (severe; severe over west including western third of Viti Levu; storm winds in rest of Viti Levu)
1982	0	0	0	
1983	2	1	0	Oscar (severe; severe in south-west Viti Levu; storm force over western half Viti Levu); drought 1982/3
1984	0	0	0	
1985	2	0	0	Eric (severe; severe over much of Viti Levu except extreme north), Nigel (moderate; moderate over small coastal region of Viti Levu plus north-west islands); Hina (moderate; severe over south-east corner of Viti Levu incl. Nadi; storm force winds over western third Viti Levu)
1986	0	0	0	
1987	1	1	2	Martin (severee; north-east of Fiji area including narrow strip of north-eastern Vanua Levu), drought 1986/7
1988	1	0	1	Raja (severe; north-eastern extremity of Vanua Levu and islands in strip in south-easterly direction from here))
1989	0	0	0	
1990	0	0	0	
1991	1	0	0	Sina (moderate; Viti Levu, especially west)
1992	0	1	0	Drought 1991/2
1993	2	0	0	Joni (moderate; worst in Mananuca's and Yasawa's; high winds in parts of Viti Levu), Kina (very severe; severe in north-western and eastern Viti Levu as well as Yasawa's and Lau group)
1994	0	0	0	
1995	0	0	0	

* Cyclone seasons (1970 - October 1969 to September 1970 etc.)

Appendix Table 2: Fiji - Results of regressions to examine the relationship between sectoral growth performance and natural disasters

Dependent variable	Regression Period	Constant	Typhoon & drought dummy	Coup dummy	Dependent variable lagged 1 period	DW	F	Adjusted R2
GDP	1972-82	4.571	1.451 (0.737)		-0.278 (-0.781)	1.834	0.55	0.000
	1982-94	6.753	-3.496 (-3.599) **	-2.155 (-1.283)	-0.342 (-1.986)	1.696	8.17 **	0.642
	1972-94	6.596	-1.916 (-1.731)	-3.835 (-1.714) *	-0.234 (-1.248)	1.840	3.18	0.229
Agriculture	1982-92	5.727	0.235 (0.080)		-0.476 (-1.658)	1.850	1.38	0.070
	1982-94	9.194	-6.697 (-3.236) **	1.293 (0.376)	-0.500 (-2.922)	2.003	10.29 **	0.699
	1972-94	8.356	-3.956 (-2.088) *	-0.749 (-0.201)	-0.531 (-3.212)	2.004	7.47 *	0.469
Industry	1982-92	3.671	1.358 (0.433)		-0.305 (-0.765)	1.783	0.31	0.000
	1982-94	5.940	-4.455 (-2.728)	-4.527 (-1.594)	-0.292 (-1.468)	1.344	5.72	0.541
	1972-94	6.310	-2.933 (-1.861) *	-6.495 (-2.069) *	-0.153 (-0.822)	1.886	3.87 *	0.281
Manufacturing	1982-92	5.754	0.836 (0.312)		-0.364 (-1.267)	1.964	0.85	0.000
	1982-94	9.929	-6.071 (-3.876) **	-2.109 (-0.773)	-0.452 (-2.932)	2.052	12.11 **	0.735
	1972-94	9.508	-3.889 (-2.468) *	-4.331 (-1.355)	-0.399 (-2.534)	2.117	6.99 **	0.450
Services	1982-92	-1.004	2.476 (1.451)		0.572 (2.593)	2.280	4.08 *	0.381
	1982-94	4.704	-1.202 (-0.962)	-2.244 (-1.050)	-0.003 (-0.011)	1.402	1.01	0.003
	1972-94	2.472	0.172 (0.160)	-2.349 (-1.070)	0.386 (2.173) *	1.848	2.46	0.166
Non-agricultural G	1982-92	1.312	1.556 (0.765)		0.323 (0.975)	2.049	0.81	0.168
	1982-94	5.483	-2.175 (-1.852) *	-2.968 (-1.472)	0.251 (-0.649)	1.271	2.58	0.283
	1972-94	4.463	-0.923 (-0.834)	-3.753 (-1.650)	0.140 (0.718)	1.766	1.82	0.101

Notes: T-statistics are given in parantheses. T-statistics and F-statistics which are statistically significant at the 5% level of significance are indicated by * and at the 1% level of significance by ** (using one-tailed t-tests for dummy variables and two-tailed t-tests for dependent variables lagged one period).

Appendix Table 3: Fiji - Results of regressions to examine the relationship between sectoral growth performance and natural disas

Dependent variable	Regression Period	Constant	Typhoon & drought dummy	Coup dummy	Dependent variable lagged 1 period	DW	F	Adjusted R2
GDP	1982-94	6.753	-3.496 (-3.599) **	-2.155 (-1.283)	-0.342 (-1.986)	1.696	8.17 **	0.642
GDP excl. sugar	1982-94	6.203	-2.946 (-3.074) **	-2.228 (-1.342)	-0.303 (-1.568)	1.506	5.80 *	0.545
Manufacturing	1982-94	9.929	-6.071 (-3.876) **	-2.109 (-0.773)	-0.452 (-2.932)	2.052	12.11 **	0.735
Manufacturing excl. sugar	1982-94	6.217	-1.116 (-0.591)	-4.457 (-1.425)	-0.072 (-1.869)	2.088	1.88	0.181
Agriculture	1982-94	9.194	-6.697 (-3.236) **	1.293 (0.376)	-0.500 (-2.922)	2.003	10.29 **	0.699
Agriculture excl. sugar cane	1982-94	7.368	-5.012 (-3.446) **	1.538 (0.626)	-0.510 (-3.126) *	2.067	10.83 **	0.711
Sugar	1982-94	21.687	-15.525 (-2.469) *	-0.413 (-0.041)	-0.469 (-2.290) *	1.753	7.07 **	0.603
Sugarcane	1982-94	21.457	-15.458 (-2.502) *	-0.496 (-0.050)	-0.470 (-2.323) *	1.782	7.19 **	0.607

See notes for Appendix Table 2

Appendix 2 Quantitative regression analysis of the impact of natural disasters on the agricultural sector

The hazard sensitivity of five major food, agro-industrial and export crops – sugar, coconut, roots and tubers, cassava and ginger – was formally examined using ordinary least squares analysis in logarithmic form. Regressions were run over varying time periods, depending on the availability of data,[62] to explore the statistical significance of a current and lagged rainfall series, a current and lagged cyclone dummy and a time series.

Rainfall series were based on available data for selected rainfall stations in the more important growing regions of each crop.[63] Separate series were constructed for the rainy season (November–April) and the dry season (May–October), the latter of which could be significant for crops with longer growing seasons (see section 4.1). The cyclone dummy used in Appendix 1 was adjusted to take account of cyclones in the main growing regions only. Rainfall and cyclone dummy series lagged one year were also included in the analysis to capture the extent to which natural disasters affect both subsequent cropping patterns and yields.

The results of the analysis are presented in section 4.1, as part of the discussion of individual crops. It should be borne in mind that in some cases the results could have been strengthened by the inclusion of additional explanatory variables in the analysis, such as changes in the level of production under irrigation, movements in the cost and availability of agricultural inputs and credit facilities, changes in marketing arrangements or outbreaks of pestilence or disease.

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[62] Analysis of some crops was seriously constrained by data limitations. Annual reports are produced by the Ministry of Agriculture containing several years' data but back issues are difficult to locate. Meanwhile, production and acreage data reported by the FAO are rounded up to the nearest thousand tonnes or hectares, making them of little value in analysing crops produced on only a limited scale.

[63] The most complete rainfall records were available for stations located in coastal areas, presumably reflecting the fact that a large proportion of the population is also located in these areas. Coastal rainfall patterns can vary significantly from those further inland. However, available data for particular areas of the country indicated that fluctuations in rainfall at different (coastal) stations were broadly synchronised and, thus, probably reflected overall rainfall patterns in the hinterland as well rather than highly localised ones.

Appendix Table 4: Fiji Government budget expenditure, revenue and sources of deficit financing (real 1994 F$m.)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Expenditure												
Actual	**n.a.**	**640.8**	**612.3**	**625.9**	**592.5**	**625.8**	**697.7**	**697.6**	**732.9**	**770.7**	**816.5**	**804.1**
Forecast	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**626.6**	**521.3**	**655.5**	**628.0**	**663.6**	**731.5**	**812.9**	**832.1**
Actual as % forecast	***n.a.***	***n.a.***	***n.a.***	***n.a.***	***94.6***	***120.1***	***106.4***	***111.1***	***110.4***	***105.4***	***100.5***	***96.6***
Operating												
Actual	508.7	547.3	518.5	522.7	516.8	538.3	551.6	584.4	603.6	641.5	686.9	664.0
Forecast	451.0	454.9	529.5	516.3	504.8	451.4	511.4	521.6	538.1	586.5	647.9	678.3
Actual as % forecast	*112.8*	*120.3*	*97.9*	*101.3*	*102.4*	*119.2*	*107.9*	*112.0*	*112.2*	*109.4*	*106.0*	*97.9*
Capital												
External												
Actual	82.4	78.6	79.0	79.2	65.6	78.6	111.6	105.3	118.1	101.3	81.8	88.8
Forecast	102.0	128.2	118.8	125.3	104.6	60.8	108.7	104.6	108.3	112.5	108.7	93.6
Actual as % forecast	*80.7*	*61.3*	*66.5*	*63.2*	*62.7*	*129.3*	*102.7*	*100.7*	*109.0*	*90.1*	*75.2*	*94.9*
Capital loans												
Actual	n.a.	14.9	14.7	24.1	10.1	8.9	34.5	7.9	11.2	10.1	12.4	17.9
Forecast	n.a.	n.a.	n.a.	n.a.	17.3	9.2	35.3	1.9	17.2	10.0	17.6	18.7
Actual as % forecast	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*58.3*	*97.3*	*97.6*	*425.0*	*65.0*	*101.1*	*70.1*	*95.7*
Value-added tax												
External												
Actual	-	-	-	-	-	-	-	-	-	17.8	35.5	33.4
Forecast	-	-	-	-	-	-	-	-	-	22.5	38.6	41.5
Actual as % forecast	-	-	-	-	-	-	-	-	-	*79.1*	*92.0*	*80.5*
Revenue & grants												
Actual	484.8	537.0	518.0	508.4	465.5	518.1	582.8	643.3	631.8	641.9	652.1	697.8
Forecast	468.6	492.0	527.8	528.2	524.5	373.8 *b*	519.3 *b*	540.7	587.1	651.7	678.1	694.9
Actual as % forecast	***103.5***	***109.1***	***98.1***	***96.2***	***88.7***	***138.6***	***112.2***	***119.0***	***107.6***	***98.5***	***96.2***	***100.4***
General												
Actual	468.4	517.7	503.2	490.6	447.6	482.8	560.6	628.1	618.0	627.5	643.8	689.0
Forecast	441.4	469.2	503.5	503.3	505.2	351.0	486.0	519.7	563.3	627.6	665.2	684.5
Actual as % forecast	*106.1*	*110.3*	*99.9*	*97.5*	*88.6*	*137.5*	*115.3*	*120.9*	*109.7*	*100.0*	*96.8*	*100.7*
Capital												
Actual	16.4	19.1	16.3	17.8	17.8	35.3	22.2	15.2	13.8	14.4	8.3	8.8
Forecast	27.2	22.7	24.3	24.9	19.3	7.9	21.9	21.0	23.8	24.0	13.0	10.3
Actual as % forecast	*60.2*	*83.9*	*67.1*	*71.2*	*92.5*	*445.3*	*101.7*	*72.2*	*58.1*	*60.0*	*63.8*	*85.4*

Appendix Table 4: Fiji Government budget expenditure, revenue and sources of deficit financing (real 1994 F$m.) (a) (contd.)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Net deficit												
Actual	75.0	66.3	54.2	89.2	90.8	2.4	49.3	-2.3	31.7	73.2	87.2	39.2
Forecast	84.5	91.1	74.8	59.7	64.5	55.0	66.9	32.8	22.5	24.0	55.7	68.9
Actual as % forecast	***88.8***	***72.8***	***72.4***	***149.3***	***140.7***	***4.3***	***73.7***	***-7.1***	***141.0***	***305.3***	***156.5***	***56.9***
Deficit as % of GDP												
Actual	**4.4**	**3.6**	**2.8**	**4.8**	**5.2**	**0.1**	**2.4**	**-0.1**	**1.5**	**3.3**	**3.9**	**1.7**
Forecast	**n.a.**	**5.5**	**3.9**	**3.5**	**3.2**	**3.3**	**3.2**	**1.6**	**1.0**	**1.0**	**2.5**	**2.9**
Net financing												
Overseas (net												
Actual	-9.3	-8.6	0.4	0.1	19.3	17.2	-6.2	6.4	23.6	15.7	12.0	-8.3
Forecast	n.a.	n.a.	22.4	-7.6	14.0	-26.9	13.7	0.8	11.5	6.2	2.5	-1.8
Actual as % forecast	n.a.	n.a.	*2.0*	*-1.9*	*137.4*	*-64.1*	*-45.1*	*785.7*	*204.8*	*253.4*	*480.0*	*461.1*
Borrowing												
Actual	19.8	29.6	21.1	24.1	10.4	14.0	41.3	23.8	24.9	12.0	11.8	31.1
Forecast	n.a.	n.a.	47.9	36.5	13.8	60.8	24.4	29.5	19.7	21.6	23.0	25.7
Actual as % forecast	n.a.	n.a.	*44.0*	*66.0*	*75.2*	*23.0*	*169.2*	*80.6*	*126.1*	*55.7*	*51.1*	*121.0*
Repayment												
Actual	10.5	21.0	21.4	24.2	29.7	31.2	35.1	30.2	48.4	27.7	23.7	22.8
Forecast	n.a.	n.a.	25.5	28.2	27.8	33.9	38.1	30.3	31.2	27.8	25.5	23.9
Actual as % forecast	n.a.	n.a.	*83.7*	*86.0*	*106.6*	*92.0*	*92.0*	*99.6*	*155.1*	*99.6*	*93.0*	*95.4*
Domestic (net)												
Actual	65.7	57.6	54.6	89.3	110.1	19.6	43.1	4.1	55.2	88.9	99.2	31.0
Forecast	71.2	80.9	52.4	52.1	72.4	28.1	80.7	33.3	33.9	29.2	58.2	67.1
Actual as % forecast	*92.2*	*71.1*	*104.2*	*171.4*	*152.0*	*69.6*	*53.4*	*12.3*	*163.1*	*304.4*	*170.4*	*46.2*

Source: Fiji Government 'Supplement to the Budget Address', various. 2/2

a From the 1988 Budget onwards, budgetary data are presented in accordance with the IMF format. Actual figures for 1983 and estimates for 1983 to 1987 are based on a different format so caution should be taken in interpreting the figures

b Including F$9.8m in new revenue measures

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