Chapter 8

PRICE RISK AND AGRICULTURAL MARKETING PERFORMANCE

8.1 INTRODUCTION

Market price instability can influence agricultural marketing performance directly - by depressing the level of market throughput - and indirectly - by the transfer of export instability to the domestic agricultural marketing system. In this chapter, case studies are undertaken to test the importance of these impacts. The direct effects of export instability are assessed first by analysing export supply response to export price variance for three commodities in two South Pacific countries. The second section of the chapter follows a similar line of enquiry for the domestic market. The effects of price risk on levels of marketed surplus are studied for copra in Solomon Islands and Western Samoa, by extending the supply response models reported in Chapter 5, and for root crops in Tonga, by extending the simultaneous equations model estimated in Chapter 6. The final section contains an examination of the prospects for the transfer of export market instability onto domestic markets for three staple food products in Western Samoa.

8.2 EFFECTS OF PRICE INSTABILITY ON EXPORT SUPPLY RESPONSE

8.2.1 Export Instability and Economic Growth

The link between commodity trade instability and economic growth has occupied the minds of many economists in the past few decades. Since Caine (1954) listed his research proposals in the area, numerous studies have been undertaken on the effects of instability in export earnings on economic performance and a wide range of conclusions have been drawn.

Effects identified (and often contested) include:

(1) Adverse impacts on exporters' incomes and consumption levels, the most direct effect, resulting from a lower level of supply by exporters.

(2) Multiplier effects of reduced levels of spending by exporters (e.g. Rangarajan and Sundarajan 1976; SPC 1980) (although Lim (1972) found in the case of Malaysia that the transmission of instability from the export sector to the rest of the economy appears to be relatively small).

(3) Less private investment (e.g. Kenen and Voivodas 1972), disputed by Knudsen and Yotopoulos (1976), who found that export instability in a sample of 38 developing countries produced higher rates of investment than would otherwise be the case, and Lim (1980) who concluded that there does seem to be some support for the contention that savings rates are positively related to levels of export instability in developing countries.

(4) Resource misallocation (e.g. Brainard and Cooper 1968).

(5) Destabilisation of internal prices (e.g. SPC 1980) and greater food insecurity (e.g. Bigman and Reutlinger 1979; Roumasset 1982).

(6) Unequal distributional effects, especially small, poor farmers and landless labourers being more severely affected than large farmers (e.g. SPC 1980); there may also be distributional effects between producers and consumers but who gains or loses depends critically on the source of export price instability (Hueth and Schmitz 1972).

(7) Foreign exchange effects that limit the ability of the nation to import items essential for increased economic activity but which cannot be produced economically domestically (e.g. Lim 1976; Adams, Behrman and Roldan 1979); however, Voivodas (1974) found no significant relationship between the instability of foreign capital inflow and the rate of growth of national product.

(8) Liquidity effects, restricting money supply in the economy (e.g. Adams, Behrman and Roldan 1979; SPC 1980).

(9) Adverse influences on social cohesion (e.g. Brainard and Cooper 1968).

Despite this long list of deleterious effects of export instability on economic growth, there is still considerable dispute and conflicting evidence. Those who have argued that there is no general negative relationship between export instability and economic growth in developing countries include MacBean (1966), Erb and Schiavo-Campo (1969), Knudsen and Yotopoulos (1976), Yotopoulos and Nugent (1976), Khalaf (1976), Stein (1979), Lam (1980) and Tan (1983). Those who have disputed this argument include Brainard and Cooper (1968), Maizels (1968), Voivodas (1974) and, implicitly, SPC (1980). Further, the crucial first effect has been one of the least researched assertions which have been made.

Lim (1976) pointed to deficiencies in earlier studies and suggested that the 'hypothesis that export instability affects economic growth of LDCs adversely consists of three distinct but related parts ... that LDCs have a high degree of export instability ... that such instability is transmitted to the rest of the economy, and ... that economic instability *per se* is detrimental to economic growth' (p. 311). He concluded that the first two parts of the hypothesis have been given little thought and that the third 'has not been properly tested in spite of all the attention it has received' (p. 322). These criticisms and the list of research topics suggested by Caine (1954) remain relevant today.

Three further unsatisfactory conclusions are drawn from a review of the studies mentioned above. First, it is very difficult to generalise about the effects of export instability for all developing countries - impossible if developed countries are included (e.g. see MacBean 1966; Lim 1974; Rangarajan and Sundarajan 1976; Bigman and Reutlinger 1979). Second, the choice of time period can significantly influence results (e.g. see Kenen and Voivodas 1972; Lawson 1974; Moran

1983). Third, the effects of export instability can vary according to which export commodities exhibit instability. For example, instability in tin and rubber exports from Malaysia may not have a great effect on economic growth because of the lack of linkages between these industries and the rest of the economy (Lim 1972). Nziramasanga and Obidegwu (1981) found a similar lack of correlation between copper export price instability and indicators of economic growth in Zambia.

8.2.2 Effects of Export Instability on Agricultural Marketing Performance

It would appear from the above review that perhaps the most fundamental and fertile area of further research on the issue of the effects of commodity export instability on agricultural marketing performance is at the micro- rather than macro-level. In particular, the response of exporters themselves to world price instability is likely to be a major factor impeding agricultural market development in countries at an early stage of economic development.

Considerable work has been undertaken over the past decade on the risk attitudes and perceptions of small farmers in developing countries. A tentative conclusion is that small farmers tend to be moderately risk averse (Binswanger 1979). However, surprisingly few export supply response studies have included price risk variables as a measure of export producers' response to changing world price risks. Behrman (1968) studied kenaf supply response in Thailand and included a moving average standard deviation of price variable as a proxy for price risk. His estimates of producer response to risk at mean values were low: -0.10 for price risk and -0.03 for yield risk. Sengupta and Sen (1969) analysed export supply response of jute producers in India, employing a portfolio selection model. They found some evidence for risk averse behaviour among producers but concluded that specification problems still existed in the estimated models. Another important study in the area of risk was that of Hazell and Scandizzo (1977) in which mathematical programming models were used to demonstrate how 'alternative assumptions about the way in which farmers form their price and yield expectations have important consequences for the ensuing market equilibrium when

production is risky' (pp. 208-9). Anderson et al. (1980) used an expected price variance as a factor determining jute acreage in India, Bangladesh and Thailand. They found that area planted responds negatively to increased variance in jute prices, as expected. Mean long-run elasticities of supply in response to price variance for the three countries were estimated to be -0.38, -1.50 and -1.11 respectively.

The conclusions drawn from these studies together with the general view on small farmers' attitudes to risk lead to an expectation that price risk adversely affects economic performance in smallholder agricultural sectors in developing countries. However, nothing is known of the attitudes of market participants to price risk. A common feature of many agricultural export commodities in the South Pacific region is that producers and market participants supply three different markets with the same commodity (or a processed form thereof): the informal village market (mainly for subsistence consumption by the extended family), the relatively small local produce market and the export market. They therefore have a choice of outlets for their produce depending on the relative returns from each at any time. This is a different situation from that which exists for smallholder exporters who have previously been the subject of studies on response to price risk in world markets. For example, whereas jute producers supply predominantly the export market, copra producers can provide drinking and cooking nuts for village consumption or sell to market participants in local produce markets; or they can make copra for export. This choice might be an important factor in reducing the price risk faced in the South Pacific because suppliers depend only partly on the export market for income and can respond to world market price fluctuations to their own advantage with less risk of major losses even if the magnitudes of these fluctuations are large.

8.2.3 Method

Models previously estimated in Chapters 5 and 6 for export supply response in Solomon Islands (copra) and Western Samoa (copra, taro and bananas) were extended to include a price risk variable. It is hypothesised that response of producers and market participants to export price risk is significant and negative.

The price risk variable was included in the models to determine whether decisions to supply copra, taro and bananas to export markets are influenced by the degree of uncertainty about prices received. The possibility of the existence of yield uncertainty has been ignored.

The risk variable chosen takes the form of expected variance of price, similar to that used by Just (1974) and Anderson et al. (1980). It is estimated via nonlinear least squares regression using the Gauss-Newton algorithm (Griffiths 1980, p. 2). The general form of the model is

$$(8.1) \qquad Q_t = a_0 + \sum_{j=1}^{n} a_j Z_{jt} + \sum_{j=1}^{m} b_j P^*_{jt} + \sum_{j=1}^{m} c_j V^*_{jt} + u_t$$

where Q_t is the quantity of copra exported in time period t,

P^*_{jt} is the expected value of the price variable P_j in time period t,

V^*_{jt} is the expected variance of the price variable P_j in time period t,

Z_{jt} are other explanatory variables not subject to expectations in time period t, and

a_0, a_j, b_j and c_j are parameters to be estimated.

It was assumed that price risk expectations are formed in an adaptive manner. V^*_{jt} was expressed as a geometrically declining weighted average of all past values of V_j in the form

$$(8.2) \qquad V^*_{jt} = V_{jt-1} + (1-\Phi)\, V^*_{jt-1}, \qquad 0<\Phi<1$$

$$= \Phi \sum_{i=0}^{\infty} (1-\Phi)^i V_{jt-i-1},$$

$$= \Phi \sum_{i=0}^{t-1} (1-\Phi)^i V_{jt-i-1} + (1-\Phi)^t V^*_{j0}.$$

The four models estimated were:

(8.3) $Q_C = f_1[PX^*_C, V^*_C]$

(8.4) $Q_C = f_2[PX^*_C, V^*_C, H, A, D_1, SUN]$

(8.5) $Q_B = f_3[PX^*_B, V^*_B, PL_T, RF(t-2), SUN(t-2), Q_B(t-1)]$

(8.6) $Q_T = f_4[PX^*_T, V^*_T, RF(t-2), RF(t-4), SUN(t-1)\ Q_T(t-1)]$.

Equation (8.3) refers to the copra supply response models in Solomon Islands while equation (8.4) is the corresponding model in Western Samoa. Other notation is as specified in Chapters 5 and 6.

8.2.4 Results

Of equations (8.3) to (8.6), only equation (8.3) is reported in Table 8.1. This is for copra export supply response in Solomon Islands. The rejection of the expectations model for copra export supply response in Western Samoa was reinforced with the estimation of the same model including an expected price risk response variable. Three and four year moving average price variances were substituted for the expected price variance variable in the selected model but gave poor results that were not considered worthy of report. The inclusion of the price risk variable in the taro and banana supply response models led to unstable models, with insignificant coefficients on the price risk variables and with the values of Θ and Φ lying outside acceptable ranges. Again, the estimated models were not considered suitable for reporting purposes. It was concluded that export price risk was not a factor influencing decisions to supply taro and bananas onto export markets.

The estimated copra supply response model for Solomon Islands presented in Table 8.1 is after Cochrane-Orcutt procedures had been again used successfully to correct for autocorrelation. The results add nothing to our understanding of the determinants of copra export supply response, being similar to the results reported for the model reported in

Table 8.1

Logarithmic Supply Expectations Model with Price Variance Variable: Solomon Islands

Constant	ln PX_C^*	ln V_C^*	θ	Φ	$\bar{R}^2$	d
2.10 †	0.62 †	-0.69	0.46 †	0.26	0.49	2.05
(7.54)	(5.16)	(-0.57)	(3.40)	(0.40)		

† Significant at the one per cent level.

The d statistic is reported after correction for autocorrelation.

Figures in parentheses are t values.

Table 5.1. Price elasticity of supply response has increased slightly from 0.59 to 0.62 and is still highly significant. The coefficient of expectations also remains greater than zero at one per cent level of significance and has fallen to a small extent from 0.50 to 0.46. $\bar{R}^2$ values are the same for both equations, indicating that the addition of the price risk variable has added nothing to the explanatory power of the equation.

Although it is of expected sign, the estimated coefficient associated with the expected variance of the logarithm of export price is not different from zero at ten per cent level of significance and the inclusion of the variance adds nothing to the explanatory power of the export price expectations model. In fact, the t values are lower than in the model that includes only mean price expectations. Also, a test of the variance ratio using an F test indicates no significance difference between the two equations. On the basis of these results, the hypothesis that producers respond negatively and significantly to expected export price risk is rejected. It is concluded that smallholders and market participants are indifferent to the magnitude of export price fluctuations in making copra supply decisions in the copra export marketing system.

8.2.5 Discussion

Some caution is prudent in interpreting the result of the hypothesis testing concerning the relevance of the four export price risk variables. There are three alternative explanations for the failure of the price risk variable to improve the results of the estimated models:

(a) An inappropriate form of the price risk variable might have been used. In the first place, a particular magnitude of change at a high copra price is treated equally as risky as the same magnitude of change at a low price level. Given the relatively low cash income levels of smallholders, this is unlikely to be a true reflection of their attitudes to price risk. Second, upward variations in copra prices are treated as equally risky as corresponding downward variations when the latter alone are likely

to concern suppliers. Third, the variance includes some structural variations in copra price which may well be easy for smallholders to predict. Fourth, perception of risk may not be based on variance of past prices. However, the extent of these problems is unlikely to be great given previous findings that the choice of risk variable has little effect on results (e.g. Brennan 1982).

(b) The period of study (11 years) may not be sufficiently long to test the relevance of price risk in copra supply decision making processes.

(c) Price risk may not be an important factor in affecting copra export supply decisions.

If the third explanation is the true one, the null hypothesis is rejected in all four cases. The alternative hypothesis is accepted that export supply of copra, taro and bananas is unaffected by the extent of export price risk.

8.3 EFFECTS OF PRICE INSTABILITY ON DOMESTIC SUPPLY RESPONSE

8.3.1 Introduction

In domestic agricultural marketing systems, the major risks of price instability are likely to be felt by suppliers of perishable food products. Epstein (1982, p. 228) observed that fresh food suppliers (who are characteristically producer-sellers) face substantial risks of wastage of produce if the prices prevailing in the market do not match up to their expectations. These risks are likely to be least for trippers, for whom prices enter only marginally into their decision calculus, and for buyer-sellers in the situation when unexpectedly low prices are general throughout the market. They are likely to be greatest for profit-oriented and target income suppliers, for whom price is an important influence on their decision making, and perhaps also for those marginalists who are relatively remote from the market and therefore require high prices to meet their substantial marketing costs.

Brookfield (1969, p. 154) opined that suppliers to fresh produce markets 'place more emphasis on the minimisation of risk than on the maximisation of profit'.

A study of the response to price risk by root crop suppliers to Talamahu market in Tonga provides a useful test of the impact of price risk on suppliers of perishable products. In this market, it is apparent from the results of the supply response study undertaken in Chapter 6 that profit-oriented suppliers, marginalists and target income suppliers are well represented.

8.3.2 Extension of Model

In the previous section of this chapter, an expected price risk variable was based on adaptive expectations of price variance. Formulation of the model including this variable required nonlinear least squares regression using the Gauss-Newton algorithm. This procedure proved infeasible for 2SLS estimation and, therefore, a simpler representation of price risk was made. A three-period moving standard deviation of root crop price was included in each of the five supply equations formulated in Chapter 6 and reported in Table 6.5.

8.3.3 Results

Results are reported in Table 8.2 for the simultaneous equations model for root crops traded in Talamahu market, extended to include price risk variables. Only the cassava and yams supply equations are reported because there was no hint of significance of the variable coefficient in the taro, kape and kumara equations.

Using a one-tail t test, the price risk variable was found to be significant at five per cent level and of expected sign in the cassava equation. The coefficient was also of expected sign in the yams equation but the level of significance was much lower, being just significant at 15 per cent level.

Table 8.2

Root Crop Supply Equations with Price Risk Variable Included

(1) Cassava Supply Equation

Intercept	PM	PMSQ	SDM	WLAG4	DI	DII	CYCL
82.851†	-3.262†	0.084**	-3.513**	0.080**	30.592†	39.374†	-19.567†
(5.66)	(-2.55)	(2.20)	(-1.93)	(2.34)	(4.73)	(6.40)	(-2.65)

(2) Yams Supply Equation

Intercept	PY	PYSQ	SDY	DI	DII	CYCL
59.37†	-0.671**	0.002**	-0.102	5.025*	11.351†	-9.304†
(4.24)	(-2.42)	(2.06)	(-1.05)	(1.49)	(4.33)	(-2.60)

† Significant at one per cent level.

** Significant at five per cent level.

* Significant at ten per cent level.

These results are ambiguous. There is some evidence that price risk is a significant factor depressing levels of marketed surplus of root crops, but it is inconclusive. In defence of the hypothesis that price risk is a significant explanatory variable, the structure of the variable in the estimated equations might be inadequate. It might be better represented by estimating the standard deviations of root crop prices for more disaggregated periods. Daily or weekly price variations might be of more immediate concern to suppliers of crops that have a short shelf life - certainly, less than a month. Unfortunately, more disaggregated price data were not available and, therefore, it remains a matter for conjecture whether more significant coefficients of price risk variables could have been obtained.

One interesting aspect of this result is that the two equations in which the price risk variable is most significant are those in which there is most evidence of profit-oriented supply behaviour as prices increase. It may be, then, that price risk is of most concern to the profit-oriented supply category.

8.4 TRANSFER OF PRICE INSTABILITY IN EXPORT MARKETS TO DOMESTIC FOOD MARKETING SYSTEMS

8.4.1 Background

The purpose of this section is to assess the prospects for the transfer of export price instability in the export markets onto the domestic markets for three major export and staple food products. The commodities chosen are coconuts (copra), taro and bananas in Western Samoa. Already, analysis has been carried out in Chapters 5 and 6, and in previous sections of this chapter, to determine the effects of price and price variance on supply response for these commodities, and for root crops in general.

The economy of Western Samoa is typical of most economies in the South Pacific region in that there is a narrow range of (mainly primary) commodity exports the earnings from which are vital to economic development. Furthermore, these export commodities are commonly staple

food items in the domestic economy so that government policy decisions affecting either the domestic or export marketing systems necessarily influence activities in both systems.

In Western Samoa, the three main staple food items are coconuts, taro and bananas. During the past decade, these three commodities were also among the leading export items (Department of Statistics 1983). This interdependence in marketing systems has implications for the government in attempting to achieve national development objectives. On one hand, the attainment of greater economic independence and self-reliance 'by, for example, increased exports and ... strengthening the balance of payments' (Economic Development Department 1980, p. 5) is given priority in the current development plan. On the other hand, the government views as important the need 'to stabilise prices not only through measures aimed at ensuring an increased and steady supply of staple foods in the country but also through continued government supervision of price control' (Economic Development Department 1980, p. 55). Clearly there is a potential conflict between the attainment of a healthy balance of payments position through the export of staple food items and domestic food policies aimed at maintaining a regular domestic supply of food at stable prices because of the ability of food producers to switch their supplies between the domestic and export markets. When export prices rise, producers are likely to increase supplies to the export market, causing a leftward shift of the domestic supply function for the food commodity concerned and a rise in its local price. With a fall in the export price, the converse situation arises with a resulting fall in local price. The extent of the local price change would depend primarily on the elasticities of export and domestic supply response and domestic demand for the commodity. The main policy question is whether an increasing reliance on staple food exports to obtain foreign exchange earnings is likely to destabilise the domestic food marketing system.

While this is a quite common dilemma in developing countries, the strong interdependence between domestic and export markets in countries in the South Pacific region (and especially in Western Samoa) makes it a fine balancing act of policy making of special economic importance. In order for governments to resolve any potential policy conflict in this

regard, there are four pieces of essential information required: the price responsiveness of staple food producers in supplying the domestic and export markets; the elasticity of domestic demand for staple food items which are exported; and the willingness of staple food producers to trade off lower returns in the domestic market against higher but less certain returns commonly encountered in the export market. The acquisition of this information should enhance the ability of the government to implement policies which encourage steady supplies of food at stable prices onto the domestic market while increasing foreign exchange earnings. It is the purpose of this paper to demonstrate how this information can be used in Western Samoa.

8.4.2 Method

Information on export response to price risk has been discussed above. Estimation of the elasticities of export supply response was made in Chapters 5 and 6. These estimates are now used to derive elasticities of domestic demand and supply for coconuts, taro and bananas. In turn, the elasticities of domestic demand and supply provide the basis for assessing the destabilising influences of export price instability on domestic food marketing operations.

The transfer of instability from the export to the domestic market can arise from two sources. First, there is the case where a new export market is found for a product currently traded in the domestic market. If conditions in the export market are more unstable than in the domestic market, a decision by suppliers to sell on the export market can introduce greater instability in the domestic market. Because the export markets for major traditional food products are already well established in Western Samoa, this is not of concern in this study. The second means of introducing export instability into the domestic market arises from changes in world market conditions for the product concerned which lead to shifts in supply between the two markets. It is this source of destabilisation that is the subject of analysis here.

The possibility of these destabilising effects rests upon the existence of a cobweb system in domestic food markets. Certain

attributes of a cobweb system undoubtedly exist in the fresh produce markets in which coconuts, taro and bananas are traded. These attributes are lagged supply response to price changes, expected low price elasticities of supply, perishability of the commodities concerned and little opportunity for inexpensive storage for any substantial period. The question to be answered is whether such cobweb systems are exploding (and hence unstable), constantly oscillating or imploding (promoting a return to stable market conditions). The answer to this question rests on the relative price elasticities of domestic supply and demand. This picture, however, is complicated by the existence of price expectations for suppliers of taro and bananas. Procedures are available to account for expectations as well as partial adjustment in a cobweb model. These will be outlined below after domestic demand and supply elasticities are estimated.

Domestic demand response. The short-run price elasticities of export supply derived from the supply response equations were used to derive short-run domestic price elasticities of demand. Estimates were made indirectly because of a lack of domestic price and quantity data to enable direct estimation. Taking the simple identity

$$X = T - D - V \tag{8.7}$$

where X is export supply,
T is total supply,
D is domestic urban demand, and
V is domestic village demand,

the following identity holds:

$$[(dX/dP)(P/X)] = [(dT/dP).(P/X).(T/T)] - [(dD/dP).(P/X).(D/D)] - [(dV/dP).(P/X).(V/V)], \tag{8.8}$$

where P is price.

Equation (8.8) can be rearranged as

(8.9) $$[(dX/dP).(P/X)] = [(dT/dP).(P/T).(T/X) - [(dD/dP).(P/D).(D/X)] - [(dV/dP).(P/V).(V/X)].$$

This can be interpreted as

(8.10) $$\sigma_X = [\sigma_T.(T/X)] - [\sigma_D.(D/X)] - [\sigma_V.(V/X)],$$

where σ_X is the price elasticity of export supply,
σ_T is the price elasticity of total supply,
σ_D is the price elasticity of domestic urban demand, and
σ_V is the price elasticity of domestic village demand.

It is assumed for the present that the total supply elasticity for the three commodities is perfectly inelastic in the short run, given quarterly observations. It is also assumed that, given the likelihood that producers would satisfy subsistence needs first before considering the supply of any marketed surplus to the domestic and export markets (Epstein 1982, p. 129), village price elasticities of demand are close to zero (see later for qualifications of these assumptions). Hence, *ceteris paribus*, the first expression on the RHS of equation (8.10) becomes zero and the equation can be re-expressed as:

(8.11) $$\sigma_X = -\sigma_D . (D/X)$$

Given the estimates of export supply elasticity and the mean of the ratio (D/X) an estimate of the elasticity of domestic demand for a commodity can be derived.

The assumption of *ceteris paribus* implies that variables that shifters of the domestic demand functions remain unchanged. The main demand shifters are income, prices of related commodities, population, tastes and promotion. In their pioneering work on indirect estimation of the elasticity of marketed surplus, Krishna (1962, 1963) and Behrman (1968) attempted to take into account the effects of shifters of

household demand on levels of surplus. Krishna incorporated farm income effects, but only of the commodity being marketed. Behrman expanded Krishna's model to incorporate all sources of income and include as separate variables related commodities to the one for which elasticity of marketed surplus was being estimated.

Krishna and Behrman were attempting to develop an indirect method of measuring responsiveness of marketed surplus by using cross-sectional data on farm households. In this study, a similar procedure is adopted but from a different direction. Domestic demand is estimated indirectly from export supply data. Time series data are used rather than cross-sectional data. The export supply shifters that are assumed to remain unchanged are unlikely to be related to decisions to consume made in the domestic market in contrast to the situation studied by Krishna and Behrman. Hence, a simpler procedure is adopted than that specified by these authors (especially the rather complicated formula proposed by Behrman).

Domestic supply response. As for estimation of domestic demand response, there is a dearth of information on the supply and prices of the products in the local fresh produce markets in Western Samoa. The elasticity of domestic supply response can nevertheless be derived from the expected price elasticity of export supply. Given the existence of market-clearing conditions in the domestic market, the relationship between the marginal supply conditions in the domestic and export markets depends on which market producers decide to supply. If this decision depends mainly on the movements in expected export and local price relativity, the responsiveness of change in supplies between the two markets is governed by the elasticity of price transmission, *viz.* (dPL/dPX)/(PL/PX). The elasticity of domestic supply equation can now be expressed as

$$\sigma_S = \sigma_X \cdot \eta \quad , \tag{8.12}$$

where σ_S is the expected domestic supply elasticity, and
η = (dPL/dPX)/(PL/PX).

The value of η is expected to be less than unity because local prices are unlikely to be very responsive to changes in export prices as a result of the influences of other factors operating in the domestic market (such as seasonal conditions).

The decision on which market to supply coconut products may be influenced by some technical processes (extraction of coconut meat and drying for export). It is assumed that there is a fixed technological coefficient for copra processing during the study period in order that the simple decision process outlined above holds for this commodity (Bautista 1978).

The validity of the above procedures for indirectly estimating elasticities of domestic taro demand and supply can be verified to some extent by examining the results of the taro supply and demand equations in Talamahu market in Tonga. While prudence is demanded in extrapolating model results from one country to another, the Tongan estimates should at least provide a useful check on the taro elasticities in the Western Samoan domestic market.

Four results in the Tongan model are of relevance. First, there was found to be a significant negative effect of export taro price on domestic supply of taro. Second, domestic taro supply did not seem to be affected by the lagged local price of taro. Third, there is evidence of virtually instantaneous adjustment of taro supply, e.g. either by altering household consumption patterns or varying harvesting patterns, to changes in taro price. Fourth, the price elasticity of domestic demand for taro was found to be significantly less than zero and high (-5.16). These four points will be taken up below in the discussion of results.

8.4.3 Results

Domestic supply response. Estimates of expected domestic supply response are presented in Table 8.3, based on estimates of η of 0.26, 0.31 and 0.29 for copra, bananas and taro respectively. These estimates of η were

greater than zero at least at five per cent level of significance; in all cases, Cochrane-Orcutt procedures were applied successfully to overcome autocorrelation difficulties in estimation. All elasticity estimates are significantly less than unity and hence domestic supply elasticities are considerably less than the corresponding export supply elasticities. In terms of magnitude of elasticity of price transmissions, it can be seen that there is very little difference between the three crops. Thus, differences in domestic supply elasticities closely reflect the relativities in export supply elasticity estimates.

Domestic demand response. Estimates of price elasticities of demand are presented in Table 8.3. They were based on estimates of $(\bar{D}/\bar{X})$ of 0.003, 0.36 and 0.11 for coconuts, bananas and taro, respectively (Niu Leau 1983, p. 36). Only short-run elasticities can be estimated because of the restrictive assumptions underlying the derivation procedure. The high elasticities are to be expected in the case of taro and bananas because of the price competitiveness between the two products and in the case of all commodities again because of the small size of the domestic markets relative to the export markets, yielding very low price flexibilities and, hence, high price elasticities (Tomek and Robinson 1972, p.52).

In light of the results of short-term producer-household demand response for root crops in Tonga (Kingston 1985), it would be prudent to carry out some sensitivity analysis of estimates by varying total supply elasticities for each commodity. For taro and bananas, the possibility is recognised that subsistence requirements are not invariant to price changes. Levels of marketed surplus of these crops may vary slightly as farm household consumption varies with price changes. The extent of this response is not expected to be very great given the results obtained by Strauss (1984b) and Kingston et al. (1986). A range of price elasticity of total supply was chosen from zero to 0.3. In the case of domestic coconut demand, consumers as a whole are virtually price takers. Even so, there is possibly some overstatement of the coconut demand elasticity again because it is based on the assumption that, in the short run, the elasticity of supply at the village level is zero.

Table 8.3

Short-Run Elasticities of Domestic Demand and Supply

	Coconuts	Bananas	Taro
Supply	0.08	0.20	0.11
Demand	-103.33	-1.75	-3.45

There is likely to be some limited scope for changes not only in household demand but also in the level of intensity of search and collection of nuts which have dropped from the palms in more dense scrub and bush, thus allowing for some short-run supply response. The total elasticity of supply is unlikely to be very high; nevertheless, it would be prudent to examine the effects of varying it between zero and unity.

The ranges of estimates of elasticities of domestic demand arising from sensitivity analysis are presented in Table 8.4. The effect on elasticity of domestic demand for coconuts of varying total supply elasticity of coconuts is negligible (-102.0 to -103.3). This range of estimates was derived by using a calculation of ($\bar{S}/\bar{X}$) of 1.34. This figure was obtained by using estimates of total domestic consumption of coconuts made by Jensen and Van Wissen (1978, p.19) and knowledge of the domestic and export supply figures.

An estimate of ($\bar{S}/\bar{X}$) for bananas was based on data reported by Wickramasekara (1984, p. 53). The figure obtained was 3.60; it was substituted in equation (8.10) to calculate the upper limit of the range of estimates of the price elasticity of the domestic demand for taro, assuming a maximum total elasticity of supply of taro of 0.3. The resultant range of estimates was (-0.55 to -1.75).

A similar procedure was followed for taro based on an estimate of ($\bar{S}/\bar{X}$) of 8.16 derived from data reported by Wilson et al. (1984, p. 85). As the main staple food item, taro is consumed to a much greater extent in villages than are coconuts and bananas, so the higher value of ($\bar{S}/\bar{X}$) is to be expected. The range of estimates of price elasticity of domestic demand was -1.00 to -3.45.

8.4.4 Discussion

A check of the estimates of domestic price elasticities of supply and demand for taro against results for the Tongan model provides some useful information. First, with respect to the demand elasticity, the elastic response estimate obtained in Western Samoa is consistent with the high price elasticity of demand in Talamahu market. Second, with

Table 8.4

Ranges of Estimates of Domestic Demand Elasticities

Commodity	Range of Estimates		
Coconuts	-102.0	to	-103.3
Bananas	-0.55	to	-1.75
Taro	-1.00	to	-3.45

respect to the estimate of supply elasticity, the picture is less clear. Perhaps the easiest point to deal with concerns substitution of taro between the domestic and export markets. The results obtained in the Tongan model confirm that significant substitution does take place between markets, with a cross-price elasticity of domestic supply response of 0.77.

Two other results of the Tongan model complicate the interpretation of results in the taro equation in the Western Samoan model. The first is the failure to discern any supply response to expected price changes. The lack of significance of the adaptive expectations model, if transferred to taro supply response in Western Samoa, could mean either that adaptive expectations of price changes do not exist or that the Tongan model is not applicable to Western Samoan root crop marketing. A major reason that could explain the lack of taro supply response to expected price changes in Tonga is the apparent predominance of target income suppliers. If this were also the case in Western Samoa, the perverse supply response it invokes would be another compounding factor in the operations of a cobweb system in the domestic taro market in that country.

Even if the estimates of elasticities using the indirect approach were accurate, however, the results obtained provide some reassuring information for policy makers in Western Samoa. The desire to expand exports of staple food items is unlikely to have any long-term harmful effects on the stability of the domestic food marketing system. Given the recursive nature of the supply response to prices, the low price elasticities of supply and limited possibilities for long-term storage of the commodities under review, there would appear to be a *prima facie* case for the existence of a cobweb system in domestic markets. Ignoring for the moment the complicating matters of price expectations and lags in adjustment with domestic demand elasticities that are considerably greater than corresponding supply elasticities, any cobweb system would lead to an imploding, rather than exploding or constantly oscillating, situation (Nerlove 1958b). Furthermore, the high domestic demand elasticities limit the extent of local price fluctuations.

Therefore, the markets for both taro and coconuts clearly fall into the category of an imploding system. The picture is less clear for bananas because the lowest end of the range of estimates of domestic price elasticity of demand is slightly less than the estimate of price elasticity of supply. This case is examined more closely below.

It is possible to confirm the nature of a cobweb system when price expectations and partial adjustment feature in a supply response model by following the procedure outlined by Nerlove (1958b). As previously described in Chapter 6, a price expectations model was relevant in explaining supply response of taro and both the taro and banana models incorporated a partial adjustment variable. The coconuts supply response model, on the other hand, was based on actual price lagged one period (see Chapter 5). While a price expectations model was reported for bananas in Table 6.1, the coefficient of expectations was insigificantly different from unity, in which case a model with price lagged one period (three months) would have served equally as well as the reported model.

Nerlove (1958b, p. 233) found that a necessary and sufficient condition for an imploding cobweb model is

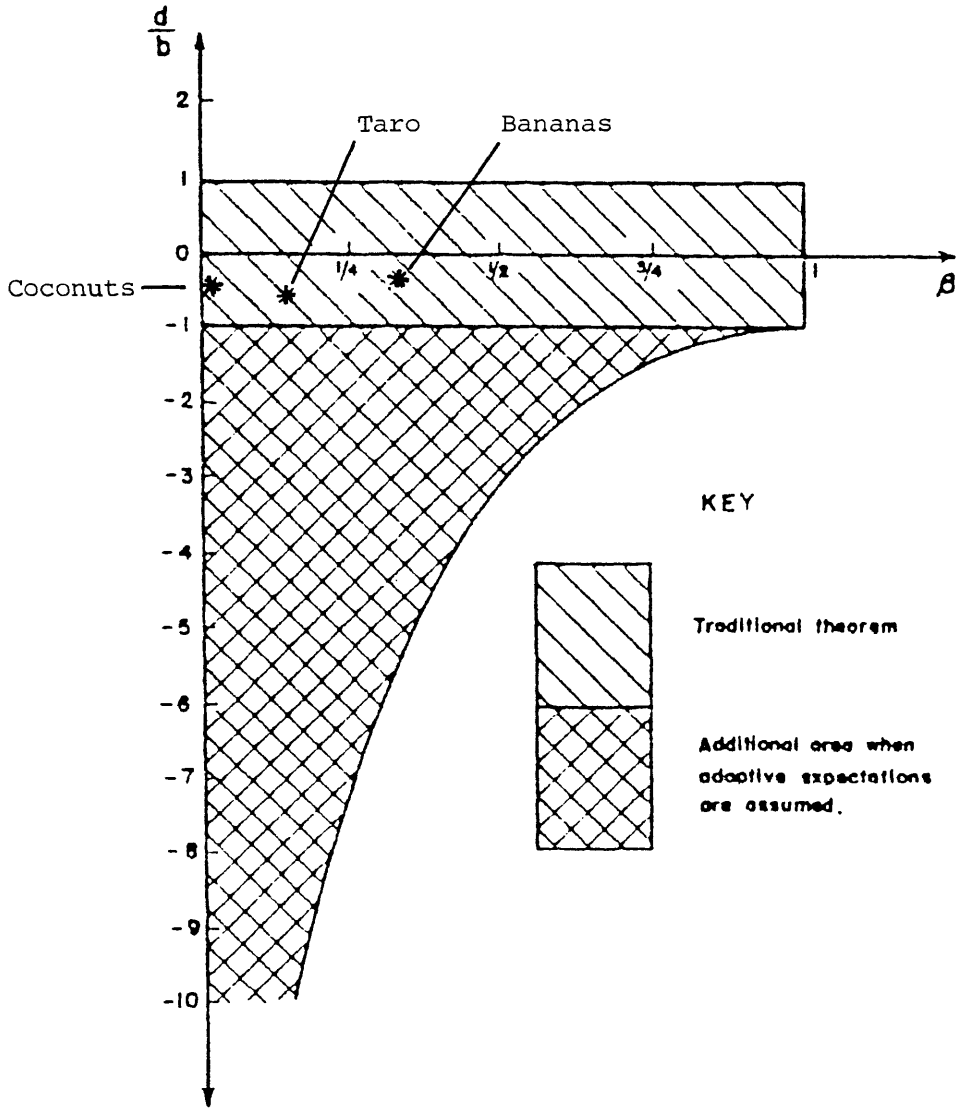
$$1 - 2/\theta < (d/b) < 1, \tag{8.13}$$

where θ is the coefficient of expectations,
d is the price elasticity of supply, and
b is the price elasticity of demand.

Equation (8.13) can be contrasted with the conditions for an ordinary imploding cobweb model:

$$-1 < (d/b) < 1. \tag{8.14}$$

Figure 8.1 is a reproduction of Nerlove's diagram showing the ranges of d/b compatible with an imploding situation under both the traditional cobweb theorem and when adaptive expectations are assumed. Because equation (8.13) also applies in the case of partial adjustment (with γ, the coefficient of adjustment replacing θ) (Nerlove 1958b, p. 235), the diagram also serves for the partial adjustment model.



Source: Nerlove (1958b, p. 234).

Figure 8.1 Stability of equilibria of supply and demand, taking account of coefficients of expectations and adjustment.

Superimposed in Figure 8.1 are the results obtained for the ranges of domestic demand elasticities (from Table 8.4) and the domestic supply elasticities (from Table 8.3). Ratios of (d/b) for each commodity are:

Coconuts	-0.0008
Bananas	-0.36 to -0.11
Taro	-0.11 to -0.03.

In the case of bananas, the product of the coefficient of adjustment times the coefficient of expectations is 0.3. The analogous estimate for taro is 0.09. As indicated in Figure 8.1, not only are all three estimates of ranges of (d/b) demonstrably well inside the range of stable cobweb models when adaptive expectations and partial adjustment are taken into account, they are also well inside the traditional range of a stable cobweb model. Hence, even if the upper estimates of the elasticities of total supply and the ratios ($\bar{S}/\bar{X}$) have been greatly underestimated, there is still no prospect of any of the cobweb models being other than imploding.

A glance at Figure 8.2, based on primary data on local prices of food staples (Department of Statistics 1983), confirms the above conclusion, even allowing for the difficulty in obtaining the *ceteris paribus* conditions required for the continuation of a cobweb cycle. Take the case, first, of taro and bananas. Drought conditions in late 1974 and 1975 were typical of the type of exogenous event that might set off a cycle of fluctuating local taro and banana prices. As expected, both prices rose sharply during this period but subsided equally as sharply towards an equilibrium level after the drought had passed. Second, and more pertinent to this study, rapid changes in export quantities of these items during the study period which have led to substantial changes in local prices were soon followed by a return to more stable domestic market prices. Third, as reported above, the estimate of the price elasticity of domestic demand for coconuts was very high. Consequently, the local price of coconuts has been maintained at a very stable level throughout the study period despite considerable variations in copra exports and export prices.

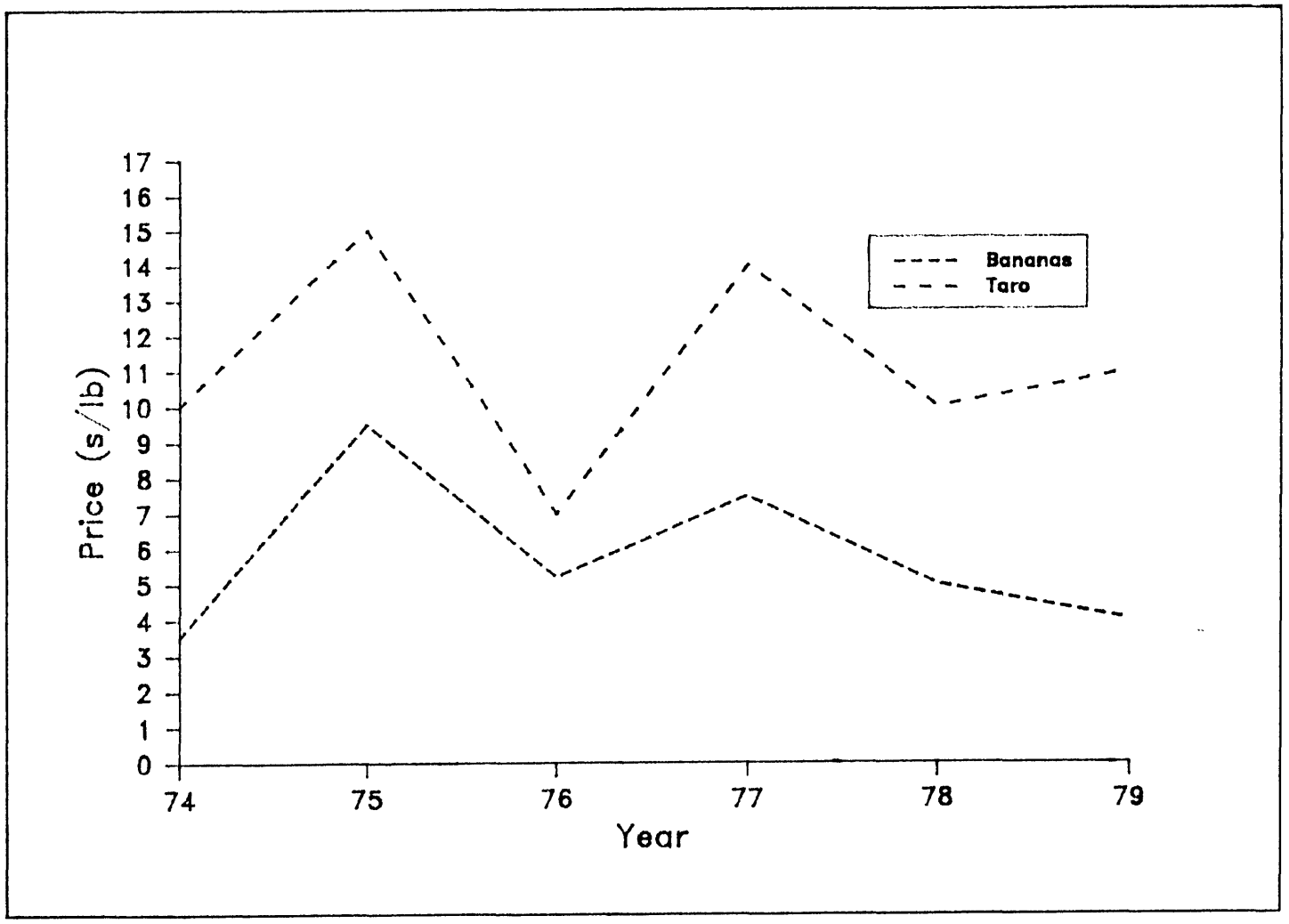


Figure 8.2 Prices of taro and bananas: 1974 to 1979.

Finally, there is the evidence from the Tongan taro supply equation which, if relevant to Western Samoa, confounds the operations of a cobweb system. Lack of a lagged supply response would make the workings of a cobweb system infeasible. Furthermore, even if such a lagged response were to exist, the predominantly negative, almost instantaneous supply response to current price would offset any cobweb effects, thus reducing its effects. Regardless of which conditions are assumed to exist in the taro market, the prospects for the operation of an exploding cobweb system are indeed slight.

Chapter 9

IMPACT OF INSTITUTIONAL RISK ON AGRICULTURAL MARKETED SURPLUS

9.1 INTRODUCTION

Institutional risk in agricultural marketing exists when the actions, and their consequences, of a certain institution (or set of institutions) are not known with certainty by other market participants and producers. The level of institutional risk in an agricultural marketing system may be influenced by five factors:

(1) The influence of the institution on the marketing system.

(2) The relative importance of the marketing function(s) being undertaken.

(3) The extent of the erratic behaviour of the institution.

(4) The standard of infrastructural facilities available to other market participants and producers.

(5) The storability of the commodity being marketed.

There is expected to be a positive association between institutional risk and the first three factors and a negative association in the last two instances.

Fragmentary evidence, much of it anecdotal, exists on the impact of the erratic behaviour of individual public agricultural marketing institutions on other market participants and producers in South Pacific countries. Because of the lack of rigorous analysis supporting this evidence, it is not substantial and, consequently, not very persuasive. Some instances which typify the observations made are outlined for one South Pacific country, Western Samoa.

Much of the criticism has been aimed at WSTEC which dominates many marketing functions in Western Samoa. Blackie et al. (1979) reported the erratic behaviour of WSTEC as a vertically integrated institution in the pigmeat market. Large variations in supply at the retail level of pigmeat products originating from WSTEC production units and sold through their retail outlets have made it difficult for other pigmeat producers to plan their schedules and for other retailers and wholesalers to plan their purchasing operations. As the owner of the only abattoir in Western Samoa, WSTEC has been criticised for the primitive conditions of the abattoir and the lack of chilling facilities (ISNAR 1983, p. 108). Further, the WSTEC-owned feed mill has failed to supply poultry feed in sufficient, regular quantities and of consistent quality (ISNAR, p. 107). Aside from WSTEC, Morris (1980, pp. 5-7) observed problems in the supply of transport services and irregular buying activities by marketing boards handling cocoa, copra, bananas and taro, and sub-standard packaging of bananas by agents of the Banana Board. Similar criticism to these examples no doubt could be found in most South Pacific countries.

The case study approach was chosen to test for the existence of institutional risk and its effect on the level of agricultural marketed surplus. The situation selected for case study was one which satisfies a demanding set of criteria. First, all five characteristics of institutional risk must be present: major agricultural marketing institutions fulfilling erratically the crucial functions of buying and the arrangement of sea transportation of a perishable crop grown by producers in a remote region poorly endowed with infrastructural facilities. Second, it should be possible to isolate the effects of institutional risk. This is accomplished by selecting a case study situation in which yield risk in production is minimal, price risk is absent because of the guarantee of assured prices, and technological risk is unimportant.

9.2 CASE STUDY OF DALO MARKETING IN TAVEUNI

Two of the major goals of the seventh and eighth development plans of Fiji (Government of Fiji 1975, 1980) were: (a) to 'decentralise economic activity by location ... and enhance opportunities, material

living standards and the social and cultural amenities of the rural areas' (Government of Fiji 1975, p. 5), thus recognising the need to 'strengthen and further diversify the economic base of the nation ... to promote a more equitable distribution of the benefits of development ... [and] to promote Regional ... co-operation' (Government of Fiji 1980, p. 17); and (b) to increase agricultural production in general and food production in particular. Given the importance of the agricultural sector in the Fiji economy, the government has given priority to the achievement of an increase in the rate of economic growth through a sustained increase in agricultural production, much of the potential for which is located in the poorer, more remote regions.

The government proposed to identify development projects under various regional programs as a means of achieving the first goal. Attainment of the second goal, according to the planners, necessitated the fostering of commercial attitudes among farmers as a first step in expanding agricultural output (Government of Fiji 1975, p. 6).

The strategies to attain both of these goals converged in programs designed to promote an increased agricultural marketed surplus of predominantly subsistence farmers on outer islands. As these farmers produced mainly for domestic consumption, the disposal of any increased agricultural output would depend almost exclusively on the availability of new commercial market outlets.

The government had been critical of farmers for failing to adopt a more commercial approach to their agricultural activities in the sixth Development Plan period. Farmers were accused of being 'unwilling to give their wholehearted co-operation to those who are trying to help them' (Government of Fiji, 1975, p. 65). They were thus exhorted in the later development plans to respond positively to the regional programs devised by the planners to expand agricultural output. The government was to provide an assured market for the agricultural marketed surplus produced by farmers on outer islands through the National Marketing Authority of Fiji (NMA). The Ministry of Agriculture and Fisheries (MAF) (now the Ministry of Primary Industry) was to provide the expertise needed to assist farmers in the production of agricultural output.

The alleged unwillingness of farmers from the outer islands to adopt a more commercial approach to their agricultural activities is dealt with in detail above in Chapters 8 and 9. The government recognised the problems of marketing agricultural products as a further obstacle to increased agricultural output. The physical geography of Fiji, with numerous islands dispersed over a large area, makes the marketing of agricultural produce costly. A lack of effectively operating agricultural marketing institutions and the need for considerable transportation and communications infrastructure to sustain an agricultural marketing system in the outer islands were seen by the government as major impediments to agricultural development in these regions.

The problem of a lack of effective marketing institutions had been tackled by the government prior to the commencement of the seventh Development Plan with the establishment of NMA in 1971. NMA was given the specific responsiblity of servicing the 'remote areas where farmers had no sure outlets for their produce and it was uneconomic for private enterprise to engage in marketing activities' (Government of Fiji 1975, p. 67). The problem of inadequate transportation and communications infrastructure was also recognised by Government planners and a number of *ad hoc* measures were taken to upgrade these facilities. It was apparent in the seventh Development Plan, however, that no systematic study had been made of the nature of difficulties caused by transportation and communications problems in marketing agricultural products in particular. It is the main purpose in this chapter to analyse the effects of the existing transportation and communications arrangements on the supply of a crop traditionally grown by subsistence farmers on an outer island. A queuing model is constructed to simulate the shipment of *dalo* (taro) from the outer island of Taveuni to the main island of Viti Levu.

Producers of *dalo* on Taveuni would arrange to supply their produce in excess of domestic requirements to NMA who in turn arrange the marketing of the produce on Viti Levu. The poor performance of the venture, exemplified by the fact that only a small proportion of quotas were fulfilled (Hardaker 1976), is studied to determine whether or not it

was an outcome of shortcomings in infrastructural facilities and the provision of services by marketing institutions which created a risky environment for producers and other market participants.

9.3 HYPOTHESIS

Four assumptions are made to enable the setting of an hypothesis to be tested. All assumptions are supported by the evidence available. They are:

(1) Because NMA encouraged increases in agricultural marketed surplus in outer islands such as Taveuni as part of its *raison d'être* (Government of Fiji 1975, p. 53), prices paid for *dalo* were subsidised to island suppliers (Baxter 1980, p. 126) and set at levels above the marginal costs of production and supply by producers.

(2) Based on the evidence educed in Chapter 6, there is little support for the contention that semi-subsistence root crop producers do not respond to commercial incentives provided producers can make use of specialist marketing services in the disposal of their surplus, as in the case of Western Samoan semi-subsistence taro export producers. (The 'perverse' supply response observed for a group of taro producer-sellers in Tonga casts some doubt on the validity of this assumption; however, the characteristics of the marketing channel for taro in Taveuni are more consistent with those in the Western Samoan taro export marketing channel.)

(3) There is little yield risk in growing *dalo* because *dalo* is grown in Taveuni under conditions relatively free of disease and of low moisture stress where 'transpiration loss seldom exceeds rainfall income' (Haynes 1976, p. 2).

(4) NMA notified assured prices in advance to *dalo* producers, thus ensuring there was no price risk.

If these conditions were to hold, it is reasonable to expect that *dalo* producers on Taveuni would continually fill the *dalo* quota to its upper limit unless institutional risk were to affect market activities. The hypothesis to be tested, then, is that a failure of *dalo* producers to fill the NMA quota is due to the existence of institutional risk.

9.4 DALO PRODUCTION ON TAVEUNI

Taveuni is situated about 250 km north-east of the main island of Viti Levu, with a population of 7700 in 1976 (Brookfield 1978a, p. 1) and covering an area of 42 772 ha (Brookfield 1978b, p. 59). The main commercial activity on the island is copra production while the staple crop of the people is *dalo*. The only formal market on the island is in Waiyero which provides an outlet for local produce in excess of family requirements. The Waiyero market was established only in 1974 (Baxter 1980, p. 49). Almost two-thirds of produce sold in the market in January 1976 were native staples of which *dalo* was the most important item (Baxter 1980, p. 89). The volume of market throughput at the time of the study was very small. Most commercial sales of *dalo* were made through NMA. The small size of the population and low income levels severely limit the potential for growth of commercial market outlets on the island so that surpluses have to be exported to other parts of Fiji or to foreign countries.

Dalo is grown by predominantly subsistence farmers in three districts on Taveuni - north (A1), central (A2) and south (A3). There were approximately 100 potential smallholder producers in districts A1 and A2 and 120 suppliers in district A3 at the time of data collection for the study in 1976 (UNFPA 1976). In addition to these 320 producers, there may have been more potential suppliers on the island as these estimates included only those farmers who planted *dalo* during the four years prior to the study period.

The post-harvest life of an unwashed, uncut *dalo* corm attached to the stem is approximately one week (Baxter 1980, p. 19). When left in the ground after reaching maturity, however, the estimated life of the

corm is increased to about eight weeks. It was estimated that a farmer could harvest about half a tonne of *dalo* per day (FAO 1977, p. 21).

With an estimated 320 *dalo* suppliers and an annual quota set at 794 182 kg or 388 267 *dalo*, this represented a hypothetical annual intake from each potential supplier in 1976 of 1213 *dalo* (2482 kg). Estimated yields were about 22t/ha for smallholder farmers (UNESCO/UNFPA 1976, p. 116), which means that just over 0.1 ha would need to be planted by each farmer each year to fulfil a share of the quota. Each farmer would be called upon to supply *dalo* to NMA about five times during a year according to this set of rules.

Sales of *dalo* to NMA from smallholder farms on Taveuni for the year ended 30th April, 1976 were 206 598 kg or 101 000 *dalo*. This was a supply rate of an average of 1942 *dalo* per week, which was well below the weekly quota of 7500 *dalo*. This shortfall could be due to a number of factors associated with institutional risk: (a) lack of regular shipping; (b) unreliable available shipment capacity; (c) poor communications and promotion by MAF field officers; (d) lack of adequate notice of supply to farmers; and (e) political influences favouring other islands during the 12 month period (notably the result of reconstruction programs after typhoon damage). All these factors are considered in the simulation model to be developed.

As mentioned above, there were major deficiencies in infrastructure available to producers and market participants. Communications facilities are poor both on Taveuni and between Taveuni and the rest of Fiji. Travel is difficult between the villages which are dispersed around the coastal fringe of the island. This restricted the impact that field officers from MAF could have in encouraging farmers to expand their agricultural activities and in advising farmers on the impending arrival of ships to transport surplus produce.

9.5 SYSTEM ANALYSIS

9.5.1 Outline of Dalo Marketing Procedure

There are two avenues open for the cash sale of *dalo* - within the local district or to Viti Levu through NMA, shipped from the various ports of the island. The latter is the concern of this study. NMA enforced *dalo* quotas for the whole island - at the time of the study set at 7500 *dalo* (14.8 t) per week. A number of ships on the islands run arrived at one of the Taveuni ports at seemingly random intervals to take on *dalo* and other cargo for shipment back to Viti Levu. As *dalo* can be planted all the year round, supplies to NMA could be kept up at all times. Production is more seasonal in other *dalo*-growing parts of Fiji but there did not exist any off-season price differential (Baxter 1980, p. 124). The selection of *dalo* to be purchased by NMA was made by field officers for their respective districts on receipt of advice from NMA. The farmers chosen to supply were selected by the officers who might be suspected of favouring some farmers for *dalo* shipment at the expense of others. In constructing the simulation model, however, it will be accepted that there was no such 'favoured farmer' treatment.

Because of the communications problems, only one day's notice of shipment could usually be given to producers so there was a limit to the amount of *dalo* which could be harvested to supply a given shipment. Given the quota level and the number of potential suppliers, the shortage of notice should not have been a problem as the quota for a week could have been filled ten times over from one district alone if all farmers in the district were to harvest *dalo* for one day. Because of the uncertain nature of ship arrivals and the limited storage life of harvested *dalo*, however, farmers were unlikely to have mature *dalo* consistently available for supply throughout the year. The lack of effective communications with farmers meant that only two districts could be notified in time to supply *dalo* for each shipment. To notify farmers in all three districts for each shipment within 24 hours would have been beyond the human resources of MAF field officers under the conditions existing at the time.

9.5.2 Description of the Simuland and Assumptions of the Model

The system comprises (1) the growing of *dalo* on Taveuni by farmers, (2) continuous harvesting of the *dalo* throughout the year, (3) the transport of *dalo* to the wharves for loading and (4) shipment to the main market on Viti Levu for (5) sale by NMA to the buyers.

The following simplifying assumptions are made in constructing a model of the system:

(1) The production of *dalo* is determined. There is no variation in production due to climatic factors, price expectations or other factors affecting farmers' willingness to supply *dalo* to NMA. This implies that, in aggregate, farmers in each district make available exactly 2500 *dalo* in a mature state every week being the upper limit of the quota set by NMA.

(2) The suppliers consist solely of the 320 smallholder farmers specified above. None of the quota is fulfilled by plantation or commercial farmers.

(3) The production of *dalo* by farmers for their own household consumption does not affect farmers' decisions to supply *dalo* to NMA.

(4) The sale of *dalo* to NMA is the only market outlet for the *dalo* farmers.

(5) Any surplus *dalo* not taken up by NMA after a duration of eight weeks of maturity will be regarded as rotted and of no commercial value.

(6) The farmers' costs of production and transport to wharves, demand for their produce and the price of *dalo* are fixed, the latter two being determined according to the quota regulations set by NMA.

(7) The frequency and capacity of shipments are determined outside the system, i.e., neither the farmers nor the NMA agency on Taveuni have any control over *dalo* shipment.

(8) All farms are approximately the same size.

9.5.3 A View of the Simuland after Assumptions

The system is defined in Table 9.1 on the basis of these assumptions. In brief, it reflects (a) the deterministic supply of *dalo* by farmers; (b) the arrival of ships at random intervals with stochastic available capacity; and (c) the selection of *dalo* for shipment, according to a set of logical selection rules. The objectives of the system concern the level of supply of *dalo* to NMA, the amount of unused shipping capacity and the amount of *dalo* lost through oversupply during a year (see Table 9.1).

There are three endogenous and one exogenous variables recognised in the model. The first endogenous variable, the number of weeks mature *dalo* can stand in the field before the corm rots, is set at eight weeks. Second, the amount of notice given to farmers of an impending shipment of one day sets a limit to the amount of *dalo* which can be made available for each shipment capacity. With increased quota limits, however, it may be an effective constraint. This matter will be taken up below when experiments are carried out on the model. The third endogenous variable is the initial level of *dalo* available to supply to NMA. The exogenous variable considered in the model is the number of farmers who can supply *dalo*, assumed to be 320 (see previous section). All farmers from the three districts are assumed to have sufficient available land on which to grow their share of aggregate *dalo* supplies.

In addition to the above-mentioned variables, there are considered to be two important decision variables which may affect the values of the performance variables. First, as mentioned above, the quota allotment for *dalo* to smallholder farmers on Taveuni is set by NMA. There are four major factors likely to influence the level at which the quota is set:

Table 9.1

Definition of Entities, Events and Relationships in Dalo Production, Shipment and Marketing (After Assumptions)

Endogenous variables

Number of weeks maturity of *dalo* before corm rot (D)
Amount of notice of supply given to farmers (D)
Initial supply of mature *dalo* available (D)

Decision variables

NMA quota allotment (D)
Storage and transport facilities (D)

Behavioural relationships

PDF for time interval between shipments
PDF for capacity per shipment

Exogenous variable

Number of farmers supplying *dalo* (D)

Performance variables

Total amount of *dalo* shipped per annum
Total excess shipment capacity per annum
Total *dalo* lost from oversupply per annum

Status variables

District selection rules (D)
Harvesting capacity per farmer per day (D)
Dalo planting routine (D)
Minimum level of *dalo* selection (D)

Parameters

Shipment interval period (S)
Shipment capacity (H) (S)

(D) - Deterministic
(S) - Stochastic
(H) - Hypothetical Construct

(a) The levels of *dalo* supply from other islands.

(b) The overall demand for *dalo* on Viti Levu.

(c) Competition for markets from plantation and commercial farms throughout Fiji.

(d) Political influences.

While all four of these influences are exogenous to the system as defined, the ability of NMA to adjust quota limits is recognised in the experimentation stage.

The second decision variable to be considered is the upgrading of storage and transport facilities. It is argued that NMA may make possible the storage of mature *dalo* for periods longer than the eight weeks period storage in the field by the introduction of a method of 'curing' *dalo* after harvest or by provision of cool stores.

There are two other areas where it is conceivable that NMA may have some control - the frequency of shipping and available capacity per shipment. However, these two variables are regarded as stochastic. Both will be the subject of closer examination below when exploratory and sensitivity analyses are carried out.

Three status variables have been recognised in the system as important factors in the construction of the simulation model. These have all been discussed above, and are:

(a) Harvesting capacity per farmer - estimated to be 250 *dalo* or half a tonne per day.

(b) *Dalo* planting routine - it is presumed that farmers plant *dalo* all the year round on the basis of their expected quota allocations so that in any week of the year, each farmer will have a certain level of mature *dalo* becoming available for supply.

(c) District selection rules - priorities given to each district are regarded as equal and farmers in districts will be given the option to supply on a consecutive basis. Logically, those farmers who have waited longest to supply in a district (those with the oldest supplies of mature *dalo* available) will be given first supply option. Given that farmers may receive only one day's notice to supply, only two of the three districts can supply *dalo* for any given shipment.

9.6 SYNTHESIS OF SIMULATION MODEL

9.6.1 Method

As stated above, the frequency of ship arrivals and the capacity of each shipment are two parameters which have been assumed to occur in a random manner. The stochastic nature of these variables has been presumed on the basis of observation (Hardaker 1976, p. 16) and by an evaluation of the way the system operates.

It was found that the stochastic nature of the two parameters could be approximated satisfactorily by using the following generators:

(1) For shipment capacity, a gamma distribution function was assumed. The form of the gamma density function was determined by two parameters, α (the shape parameter) and β (the scale parameter). The two-parameter density function takes the form (Phillips 1971, p. 191)

$$f(X) = \frac{1}{\Gamma(\alpha)\beta^{\alpha}} X^{\alpha-1} e^{-X/\beta} \qquad \alpha > 0, \ \beta > 0, \ X > 0$$

$$\text{where } \Gamma(\alpha) = \int_0^{\infty} X^{\alpha-1} e^{-X} dX.$$

(2) The ship arrival interval was best approximated by a Poisson distribution function.

For the gamma distribution function of shipment capacity, a scale parameter of 0.3 and shape parameter of 2.0 were chosen. This choice was made on the criterion of goodness of fit and was based on the application of Kolmogorov-Smirnov and χ^2 tests to a variety of sets of values of α and β. For the Poisson distribution function of ship arrival interval, a mean and variance of 0.5 shipments per week were selected again on goodness of fit.

9.6.2 Model Implementation

A flow diagram was drawn up to represent the sequence of processes from the time mature *dalo* becomes available until it is either selected for shipment to Viti Levu or else is left to rot in the ground. Four subsidiary flow diagrams depicted the events which occur and the resultant activities which comprise the whole process. These activities are (a) the arrival of a ship to collect *dalo* ; (b) the supply of *dalo* available for shipment; (c) the determination of the available capacity for shipment; and (d) the selection of *dalo* for shipment. A FORTRAN program was written based on these flow diagrams to simulate the defined system. The initial matrix of mature *dalo* available for selection is outlined in Table 9.2. Data on activities included in the flow diagrams of the system were derived from records collected in UNFPA (1976).

The model was run for a one-year period with the initial amount of mature *dalo* available for selection set at 30 000 (being 10 000 *dalo* per district). The decision rules for *dalo* selection were set such that the oldest mature *dalo* would be selected first from the district with the first choice for a given shipment. All available *dalo* would be taken until shipment capacity was fully used up. If capacity were still available after all *dalo* had been selected from the district of first choice, similar selection rules would be applied to the district of second choice.

Table 9.2

Initial Matrix of Mature Dalo Available for Selection

Number of Weeks of Mature Dalo	District		
	A1	A2	A3
T-1	2500	2500	2500
T-2	2500	2500	2500
T-3	2500	2500	2500
T-4	2500	2500	2500
T-5			
T-6			
T-7			
T-8			
Dalo lost (not selected after 8 weeks)			

9.7 ANALYSIS OF PARAMETERS OF MODEL

9.7.1 Exploratory Analysis

Exploratory analyis was used to find the simular parameters which would give the best combination of performance variables in the simuland. This 'optimum situation' then was used together with the 'existing situation' to carry out experimentation studies. The purpose of the exploratory analysis was to examine what happens to model performance when the two stochastic parameters in the model - number of ship arrivals and shipment capacity - were varied. If control over ship arrivals and shipment capacity were within the domain of the decision makers of the simuland, it is likely that a better overall performance could be achieved than is possible under the 'existing situation' imposed on the simuland. Ranges of levels of the two simular parameters were chosen and values of three performance variables (Table 9.1) were estimated.

The range of shipment capacity was determined by two factors which may influence it, namely, a permanent change in the means or volume of shipment of other cargo from Taveuni and the use of ships with larger cargo capacity. Changes in the frequency of ship arrivals may arise because of either a change in shipping routes and schedules or an increase in the number of ships on the route.

As a guide to the calculations of a range over which the simular parameters should be varied, the standard errors of the mean of each parameter were calculated:

$$SE_{M1} = 0.715, \quad \text{with } \bar{M}_1 = 0.511,$$

$$SE_{M2} = 4510, \quad \text{with } \bar{M}_2 = 6136,$$

where M_1 is number of runs per week,

M_2 is the capacity scale parameter in *dalo*.

A judgment was made that the parameters are more likely to vary upwards than downwards. Using standard errors as a guide, the ranges chosen were from 0.3 to 1.8 ship arrivals per week and from 1950 to 6450 *dalo* for shipment capacity. Expressing these ranges for four levels, an interval of 0.5 was chosen for ship arrival, giving parameter values of 0.3, 0.8, 1.3 and 1.8, while an interval of scale factor of 1500 was chosen for shipment capacity, giving parameter values of 1950, 3450, 4950 and 6450.

The results obtained from the 16 computer runs are listed in Table 9.3. The 'optimum situation' is considered to be Run No. 10 where M_1 = 3450 and M_2 = 1.3. For this combination of parameter values, the total amount of *dalo* shipped is close to the highest level attained in the analysis, there is very little *dalo* lost through oversupply and not a great deal of excess shipment capacity remains after taking account of *dalo* selected for shipment.

9.7.2 Sensitivity Analyses

The effects of changes in the two stochastic variables, ship arrival interval and shipment capacity, on the performance variables are presented in Table 9.4. The elasticities provide an indication of the sensitivity of the performance variables to changes in the two simular parameters. Sensitivity tests were carried out on two performance variables only - *dalo* shipped (Y_1) and *dalo* lost (Y_3) - as the third variable, excess capacity (Y_2), is equal to zero in the 'existing situation'. Elasticity estimates for *dalo* lost are possible only in some cases because no losses were recorded for some runs (see Table 9.3).

In the case of *dalo* shipped, when the capacity scale parameter is held constant, the elasticity of *dalo* shipped to changes in the number of ship runs per week declines as the shipment capacity is increased. *Dalo* shipped is elastic (1.25) to the changes in frequency of ships when shipment capacity is held at a low level (1950) and inelastic at higher levels of capacity. At the highest level of shipment capacity considered likely (6450), the amount of *dalo* shipped is quite insensitive (0.19) to changes in the number of ship runs. A similar pattern emerges when the number of ship runs per week is held constant.

Table 9.3

Exploratory Analysis Results

Computer Run No.	No. of Ship Runs per Week (M_1)	Capacity Scale Parameter (M_2)	Total Dalo Shipped (Y_1)	Total Excess Shipment Capacity (Y_2)	Total Dalo Lost (Y_3)
1	0.3	1950	47 342	-	312 658
2	0.3	3450	80 937	-	284 833
3	0.3	4950	147 146	4 298	212 854
4	0.3	6450	215 238	-	164 727
5	0.8	1950	175 646	-	184 354
6	0.8	3450	300 380	13 065	94 620
7	0.8	4950	386 585	129 453	22 981
8	0.8	6450	385 145	92 765	27 213
9	1.3	1950	275 593	-	97 394
10	1.3	3450	409 298	108 850	2 620 *
11	1.3	4950	416 594	316 407	-
12	1.3	6450	396 655	373 306	15 990
13	1.8	1950	342 553	-	53 519
14	1.8	3450	417 450	162 319	-
15	1.8	4950	420 000	642 955	-
16	1.8	6450	420 000	876 572	-

Table 9.4

Sensitivity Analysis Results

(i) With M_2 Held Constant:

Formulae used: $(dY_1/Y_1)/(dM_1/M_1)$; $(dY_3/Y_3)/(dM_1/M_1)$

Capacity Scale Parameter	M_2 Held Constant	
	(Y_1)	(Y_3)
1950	1.25	-0.16
3450	0.83	N.A.
4950	0.37	N.A.
6450	0.19	N.A.

(ii) With M_1 Held Constant:

Formulae used: $(dY_1/Y_1)/(dM_2/M_2)$; $(dY_3/Y_3)/(dM_2/M_2)$

No. of Ship Runs per Week	M_1 Held Constant	
	(Y_1)	(Y_3)
0.3	1.53	-0.67
0.8	0.52	-1.21
1.3	0.19	-1.19
1.8	0.10	N.A.

N.A. signifies no estimate was available.

An elastic response (1.53) in *dalo* shipped to changes in shipment capacity occurs when ships call at infrequent intervals. The elasticity of *dalo* shipped declines rapidly as the average number of ship runs per week is fixed at higher levels.

Dalo losses are quite sensitive to changes in shipment capacity. Losses decline quite dramatically in response to increases in shipping space available, particularly when ships call at Taveuni ports at frequent intervals.

9.8 MODEL EXPERIMENTATION

9.8.1 Experimental Design

The experimental design used for both the 'existing situation' and the 'optimum situation' consisted of 16 treatments of combinations of two decision variables in a 4^2 factorial design. The two decision variables varied were (a) NMA quota limits and (b) *dalo* storage and transport facilities.

It was considered possible for quota limits on *dalo* supply to NMA from Taveuni to be lifted to higher levels. It is important therefore, to examine the effects of such a change on model performance. The relevant variable to be treated at different levels is the amount of mature *dalo* per district becoming available each week (X_1). Besides the existing level of 2500 *dalo*, other levels used in this treatment were 3000, 3500 and 4000 *dalo* per week per district. The assumption made earlier about farmers' ability to supply *dalo* was not considered restrictive as there was potential for farmers to raise the aggregate level of supply well in excess of these levels. The initial *dalo* available was left at 2500 for each district for four weeks for all simular experimental treatments.

The introduction of improved storage and transport facilities may result in extending the useful life of mature *dalo*. This would have implications in two respects. First, it would enable an increase in the amount of *dalo* available for each shipment beyond the amount which

could be harvested in one day by farmers. Second, and more importantly for experimentation, it would mean that the period for which *dalo* is available for shipment before rotting would be increased. Four levels of the variable, number of weeks of mature *dalo* available (X_2), were included in the experimental design. These were the existing 8 week period, 9 weeks, 10 weeks and 11 weeks. Levels of the two factors beyond the upper limits of the experimental design (4000 *dalo* and 11 weeks respectively) were not considered feasible in the short term.

Given an upper limit of 4000 mature *dalo* becoming available per district per week according to revised quota limits, the maximum NMA quota allowance per week would be 12 000 *dalo*. The most it was assumed could be harvested in two districts in one day was 50 000 to 55 000 *dalo* per shipment. These volumes were well above the maximum of 12 000 *dalo* which may be supplied according to quota limits (i.e. assuming an upper limit of 4000 *dalo* per week). It was concluded that the constraint imposed on the level of mature *dalo* available for shipment was not (or should not have been) limiting and would not restrict the validity of results obtained for the proposed simuland experiments.

9.8.2 Results

The results obtained from experimentation on the model are presented in Table 9.5. In the 'existing situation', the best results were achieved in Model No. 14 where the values of the performance variables for the one-year period were:

Amount of *dalo* shipped	163 407
Amount of excess capacity	-
Amount of *dalo* lost	235 593.

The results illustrate the constraint on improving agricultural performance on Taveuni due to the lack of reliable shipping services and compare unfavourably with the best results obtained in the 'optimum situation', considered to be Model No. 10:

Table 9.5

Tabulation of Results of Simuland Experimentation[a]

(i) Existing Situation

(ii) *Optimum Situation*

Treatment Number	Levels of Decision Variables	Performance Variables		
		Y_1	Y_2	Y_3
1	X_1 = 2500 X_2 = 8	114 610 *405 782*	- *104 864*	263 087 *13 270*
2	X_1 = 3000 X_2 = 8	163 407 *444 758*	- *6 695*	262 593 *14 157*
3	X_1 = 3500 X_2 = 8	134 795 *431 782*	-	359 760 *91 260*
4	X_1 = 4000 X_2 = 8	158 158 *511 256*	-	401 236 *115 118*
5	X_1 = 2500 X_2 = 9	114 610 *412 913*	- *98 453*	255 587 *4 359*
6	X_1 = 3000 X_2 = 9	163 407 *447 758*	- *3 695*	253 593 *5 215*
7	X_1 = 3500 X_2 = 9	134 795 *431 782*	-	349 260 *80 760*
8	X_1 = 4000 X_2 = 9	158 158 *511 256*	-	391 842 *103 118*
9	X_1 = 2500 X_2 = 10	114 610 *415 396*	- *95 250*	248 087 *1 156*
10	X_1 = 3000 X_2 = 10	163 407 *460 242*	- *3 688*	244 593 *2 208*
11	X_1 = 3500 X_2 = 10	134 795 *431 782*	-	338 760 *70 000*
12	X_1 = 4000 X_2 = 10	158 158 *511 256*	-	377 236 *91 118*
13	X_1 = 2500 X_2 = 11	114 610 *416 552*	- *94 095*	240 587 -
14	X_1 = 3000 X_2 = 11	163 407 *447 765*	- *3 688*	235 593 -
15	X_1 = 3500 X_2 = 11	134 795 *431 782*	- -	328 260 *29 760*
16	X_1 = 4000 X_2 = 11	158 158 *511 256*	- -	365 236 *79 681*

a Within each treatment, values of the performance variables are given first for the existing situation, then for the optimum situation.

Amount of *dalo* shipped	460 242
Amount of excess capacity	3 688
Amount of *dalo* lost	2 208.

The experimentation work carried out indicates that there is much scope for improving performance in the simuland by altering the existing marketing organisation. All results obtained in the 'optimum situation' are shown to be superior to the results obtained from experimentation in the 'existing situation'.

9.9 INTERPRETATION OF RESULTS

The effects of institutional risk, which have been assumed to weigh heavily on the farmers' decisions to supply *dalo* to the market, are demonstrated in the results of both the exploratory analysis and experimentation. The hypothesis of the study is therefore not rejected.

In the exploratory analysis, results show that with low levels of shipment capacity, utility (especially farmers') derived from supplying *dalo* is likely to be low. This indicates not only uncertainty as to shipment capacity but also that the actual level of capacity itself may be a limiting factor in efforts to achieve maximum utility from *dalo* supply (see Table 9.3, Runs 1, 2, 5, 9, and 13).

If farmers were to supply to the full extent of their allocated quotas, their utility derived from supplying *dalo* would be relatively low because of the large quantities of *dalo* lost through rotting. Hence, it is no surprise that the aggregate amount of *dalo* supplied was well below quota limits under existing conditions.

Results also indicate that when the mean ship arrival interval was relatively long (that is, less than one ship per week), performance was relatively poor with significant losses of *dalo* and low volumes of *dalo* shipped. (Refer Table 9.3, Runs 1 to 6.)

Finally, better results were attained as ships arrived on a more frequent basis and with larger available capacities. However, once a

threshold level was reached (about 1.3 ship arrivals per week and capacity of 6780 *dalo*), the deterioration in performance resulting from excess capacity as it would affect shipping interests out-weighed the gains to farmers from increased *dalo* supply. Results of the sensitivity analysis show that the effects of increasing the levels of the two simular parameters on simuland performance quickly declined.

The following conclusions are reached from interpreting the results of the simuland experimentation:

(1) Little can be done to improve simuland performance through changing the levels of the decision variables under the existing shipping arrangements. The results gained in all simular experiments, given the 'existing situation', confirmed that it would not pay farmers to expand production of *dalo* unless this were accompanied by an improvement in the shipping services.

(2) In the 'optimum situation', there was scope to improve performance by increasing production and raising the level of *dalo* quotas.

(3) In both situations, the beneficial effect of increasing the length of life for which mature *dalo* may be kept was small. In the 'optimum situation', the amount of *dalo* lost through oversupply was reduced to some extent. In the 'existing situation', however, the only effect of increasing the life of the dalo appears to have been an increase in the delay before the *dalo* rots.

(4) The best results for both situations were achieved when the weekly *dalo* quota was 3000. When quota limits exceeded this level, *dalo* losses from rot outweighed any advantages from increased amounts of *dalo* shipped. There were advantages to be gained, however, by raising the quota limit from 2500 to 3000 and increasing the volume of *dalo* shipped.

(5) Excess shipment capacity did not appear to be an important factor in affecting overall performance. In fact, in the 'existing situation' there was no effect as capacity was insufficient to meet supply such that no excess capacity existed.

9.10 CONCLUSION

The study has demonstrated that the interaction of erratic institutional performance and deficiencies in transportation and communications facilities can play a major role in the seemingly poor agricultural performance of agricultural suppliers in the South Pacific. It appears that the *dalo* producers have been prudent not to respond to the requests by NMA for increased supplies of *dalo* to be marketed on Viti Levu. They may well have been left with the large quantities of *dalo* corms rotting in their fields. This result reinforces suspicion of the accuracy of criticism by the government of farmers' lack of commercial motivation under these circumstances. The importance of reliability in institutional services to the attainment of agricultural development is illustrated in the study undertaken. In particular, transportation services need to be reliable and tailored to the needs of the agricultural producers in a particular region in terms of shipment capacity and frequency. Otherwise, the degree of uncertainty engendered by shipping irregularities and inappropriate services is likely to deter producers from placing greater reliance on commercial activities.

The results of the study have important implications for achieving the two development goals mentioned in the introduction. First, attempts to decentralise economic activity by location are not likely to be effective unless they include both institutional and infrastructural development consistent with the needs of the people to be assisted in the regional programs implemented. Second, motivation of farmers to adopt a more commercial attitude usually means making sure that they operate in a reasonably certain environment and are given adequate incentives to persuade them that there is something worth being motivated about.

An essential element in the formation and impact of institutional risk would appear to be inadequate marketing infrastructure which impedes market integration and the consequent satisfaction of time, place and form utility of domestic and overseas consumers of agricultural products. It has been argued often that the remoteness to markets of many semi-subsistence smallholders is a major obstacle hindering smallholder agricultural development in the South Pacific (discussed in Chapter 4). The creation of a network of infrastructure to facilitate the marketing of output of these producers should help to overcome barriers created by distance and isolation.

PART 4

POLICY ALTERNATIVES AND IMPLICATIONS OF RESULTS OF THE STUDY FOR AGRICULTURAL MARKET DEVELOPMENT

Chapter 10

POLICY IMPLICATIONS

10.1 RESULT OF TEST OF DIAGNOSTIC HYPOTHESIS

In Chapter 1, a diagnostic null hypothesis was set, as follows:

> The productivity and incomes of South Pacific smallholders can be appreciably increased through feasible improvements in agricultural marketing.

An evaluation of the weight of evidence in Chapters 2 to 9 leads to the acceptance of the null hypothesis. There is clearly scope for increasing the productivity and incomes of smallholders through a variety of improvements in the agricultural marketing system, thereby raising levels of agricultural marketed surplus. Policy initiatives expected to promote such improvements are spelt out below. The only doubt cast upon acceptance of the null hypothesis was the evidence of target income market supply in the domestic fresh produce markets. This matter is examined again below to determine whether there might be ways of overcoming its constraining effect on the generation of an agricultural marketed surplus.

10.2 BASIS FOR FORMULATION OF AN AGRICULTURAL MARKETING POLICY

In Chapter 1, a case was made for the continued adoption of a VSI strategy. Agricultural policy formulation, therefore, should be consistent with such a strategy. The major premise on which agricultural policy formulation rests for governments in most South Pacific countries is 'that a prerequisite to strengthening village agriculture is the promotion of a more commercial outlook among local farmers' (Fairbairn 1985, p. 207). Fairbairn goes on to state that the fundamental requirement of this approach is the encouragement of producers (and, he should have stressed, market participants) to generate increased levels

of agricultural marketed surplus. It is in the spirit of this approach that agricultural marketing policy implications are derived from analyses made in this study.

There is considerable potential for growth of agricultural output to contribute to an expansion, particularly in rural areas, of agriculture-related industrial and service activities which form an integral part of an agricultural marketing system in developing countries. The role of infrastructural and institutional development in these activities is crucial (Mellor and Desai 1985, p. 209). Much of the thinking in the drafting of agricultural marketing policies, then, revolves around the questions of what infrastructure is required and what is the best way of promoting institutional development to generate an increased agricultural marketed surplus. Analyses related to institutional development in Part 2 of this study have been focused on two matters: the implications for agricultural market development of the structure of the agricultural marketing system and, relatedly, the operational aspects of marketing reflected in the behaviour, especially the motivation, of agricultural market participants. Only a modest amount of specific analysis has been made of the infrastructural needs for generating an increased agricultural marketed surplus, although the subject of infrastructural development impinges on much of the analysis undertaken of marketing institutions.

The starting point for identifying useful policy recommendations is the assessment of agricultural marketing performance across 5 South Pacific countries and over a period 12 years. Results reported in Chapter 2 showed that a number of factors were included in the estimated model in which it was sought to explain variations in performance. Three categories of factors were identified which were found to be significant in explaining agricultural marketing performance, as defined. Of these three categories, two contain factors that are determined exogenously to the agricultural marketing system. The first of these categories contains factors designated as exogenous and extrinsic. It is one of minor concern to marketing policy makers because there is little that can be done to influence its effects. Broader economic policies are needed. The second exogenous category contains factors considered to be exogenous

but intrinsic to the agricultural marketing system, meaning that policy makers can do little to influence the magnitude of these factors but can aid agricultural market participants to counter their effects. The factors in this category are of immediate concern to policy makers, as are those in the third category of endogenous, intrinsic factors: those that originate within the agricultural marketing system and can be influenced by agricultural marketing policies. The analyses that followed in Chapters 4 to 10 were concentrated on factors in these latter two categories. The policy implications arising from these analyses are now discussed under four headings.

10.3 ISSUES IN POLICY MAKING FOR AGRICULTURAL MARKET DEVELOPMENT

10.3.1 Market Dualism, Entrepreneurship and Government Intervention

The facilitative role in agricultural market development. The discussion in Chapters 3 and 4 raises a number of issues pertinent to policy making for agricultural market development in the South Pacific region. Virtually all countries in the region have mixed economies and follow capitalist development strategies in planning the agricultural development of village-based farmers (e.g. Government of Niue 1979; Central Planning Office 1980; Economic Development Department 1980; National Planning Office 1980; Central Planning Department 1981; National Planning and Statistics Office 1982). Therefore, it is assumed that governments wish to encourage the development of agricultural marketing systems that reflect what they perceive to be the good attributes of capitalist marketing systems based on smallholder output.

If such a strategy is to be followed, perhaps the most important policy outcome of the study in Chapters 3 and 4 of the evolution of South Pacific agricultural marketing systems is that there is considerable scope for policy makers in the economic sphere to gain a better understanding of the agricultural marketing systems, the ways in which they have evolved and particularly the nature and strength of linkages within them and between elements in the system and the rest of the economy. In this way, they should be better able to identify the effects of any particular policy initiative on market participants so that its

implementation has a more positive impact on agricultural development than has been the case in the past. In particular, greater understanding is needed of the influences of village organisations on marketing behaviour. The dualistic structure of the agricultural marketing system is somewhat anomalous in that the structures of the domestic and export marketing sectors have evolved separately and remained distinct despite the fact that small semi-subsistence producers commonly participate in both sectors (as described for copra, taro and banana supply in Chapters 5 and 6). Government intervention and the influence of village organisation are the two factors considered most influential in the persistence of the dualistic structure and it is in relation to these influences that policies will have to change if this structure is to alter.

The findings of this study support the conclusion drawn by Baxter (1980) that greater emphasis needs to be given to the role of the middleman - as an entrepreneur and in coordinating rural and urban economic activities - in the agricultural marketing system. These are catalytic functions which, at present, are largely performed inadequately by public marketing institutions in South Pacific economies. Rather than being eliminated as is commonly advocated, the role of middlemen should be encouraged through direct policy assistance. Examples could include the removal of unnecessary licensing restrictions or other regulations on traders, provisions of better credit facilities, and the general promotion of small businesses. This is in no way an advocacy of a return to the unimpeded operation of market forces in the agricultural sectors. It might mean more selective government intervention in agricultural marketing and might lead to the withdrawal of government from some areas of marketing where there is a need for a strong entrepreneurial role.

At present, agricultural development in South Pacific countries appears to be stifled by a circular causation between a lack of agricultural market development and inadequate growth in agricultural output. Crucial among economic policy measures to overcome this problem is the development of agricultural marketing facilities for the disposal of agricultural marketed surplus. Associated with this development is a need for recognition by policy makers that increased production potential

alone is insufficient to generate agricultural development. The fulfilment of rural marketing needs that are most pressing in South Pacific countries requires not just infrastructural development (such as storage, grading, transportation and local assembly facilities) but also greater institutional support to market participants (such as provision of agricultural market extension, information and technology, and better institutional performance in making infrastructural facilities available to market participants. Both of these points are taken up below in more detail with respect to domestic market policies.

Another area ripe for improvement in policy making is the careful identification of those marketing functions in certain industries that are not suitable for small market participants or in which large marketing organisations have a strong comparative advantage (due to the existence of substantial economies of size). Identification would also cover those functions for which it is desirable to have a strong bargaining capacity, such as in the negotiations of export commodity contracts. The latter requires that the institutions responsible for discharging these functions have knowledge, in the first instance, of the operations of world commodity markets and, in the second instance, of the capabilities of village market participants. Important in the latter respect is the influence of village organisation on supply response in rural marketing activities.

Finally, some commentators (e.g. Leung Wai 1978) have envisaged an expanded role for public marketing institutions. If policy makers persist in fostering the participatory role in large public marketing institutions, more consideration could be given to the promotion of two measures that might increase marketing efficiency and innovation. These are (a) the intrapreneurial role within these organisations, and (b) ensuring competition through overlap among services and facilities offered by public <u>and</u> private agricultural marketing institutions. By introducing an intrapreneurial role into the activities of these institutions, policy makers can help to offset the lack of innovation in creation of new services in the agricultural marketing system, caused by the suppression of scope for individual initiative and risk taking. This approach, recognised as vital for a long time (e.g. Abbott 1972) would

likely require some significant modifications in internal organisation of the institutions and a reframing of incentives to their personnel. In particular, the encouragement of an intrapreneurial role would require greater internal use by institutions of market pricing mechanisms to integrate marketing activities and less of an administrative coordination role (Leonard 1984).

One argument in favour of a continuing role for public marketing institutions concerns the prospect of conflict within village societies if the entrepreneurial role is to expand in village societies (Fisk 1978, p. 360). A dominant public marketing institution which is capable of nurturing an intrapreneurial role within its organisation might help lessen the conflicts of transition in the village marketing sector.

The reliance on monopolistic or monopsonistic public agricultural marketing institutions to provide facilities and services appears particularly prone to the creation of marketing inefficiencies and a particular danger is the practice of empowering these institutions with the task of licensing of private traders - their potential competitors. One way of minimising these inefficiencies and risks is to allow for overlapping and competing agencies to broaden the choice of market participants in demanding services and facilities (Leonard 1984).

In summary, South Pacific governments at present emphasise the crucial role of individual market participants (including producers) in agricultural development. At the same time, in practice they tend to promote the growth of direct participation by public institutions in agricultural marketing. This policy perpetuates the existing dualistic marketing systems. Policy makers would do better to concentrate more on the facilitative role of public institutions in promoting agricultural market development and, in consequence, agricultural and general economic development in the South Pacific region. Such facilitating efforts would need to be based upon a recognition that current marketing problems stem primarily from the way in which marketing systems in the region have evolved. The direction and nature of these efforts, therefore, might be quite different from those followed in developed countries.

Controlling undesirable marketing activities. There are two areas where policy makers could ensure that undesirable features of a capitalist agricultural marketing system do not detract from the attainment of goals of agricultural development in the South Pacific. First, governments could expand their controlling role by making public marketing institutions a stronger force in diluting monopolistic and monopsonistic practices and in acting against unfair trading practices of large commercial marketing organisations without actively having to compete against these organisations. Such a role, however, does require considerable marketing and pricing expertise and knowledge that is often lacking in South Pacific governments.

Second, any expansion in the area of market control by governments needs to be carefully defined *vis a vis* the participatory role of public institutions and to be accompanied by clear long-term definitions of the rights and obligations of large commercial organisations. To expand market control inevitably means greater emphasis in the agricultural development planning process should be given to planning market development, an area of development planning almost completely neglected if current plan documents are any guide. The accomplishment of this task should not prove difficult given the small size of the economies in question and the relatively few large organisations involved.

10.3.2 Satisfaction of Domestic Food Demand

The study in Chapter 6 of the demand for and supply of root crops in Talamahu fresh produce market raised a number of issues of importance for policy making. The evidence indicated that urban food consumers, who form the bulk of consumers purchasing food in the commercial fresh produce markets, respond significantly and negatively to price. The general problem of inadequate market response to changing domestic food demand was indicated in Chapter 2. It stems primarily from the limited resource base and small size of domestic markets (Shand 1980; Connell 1984), about which little can be done, and the inability or unwillingness of market participants to provide the types of food products that (particularly urban) consumers demand. The inability is mainly due to the difficulties created by a humid tropical climate and deficiencies in

marketing technology that lead to a lack of competitiveness in price, ease of storage and transport, and a lack of convenience in consumption compared with imported foods (Shaw 1983; Connell 1984; Harris 1984). The unwillingness could arise because of the way in which market participants respond to economic incentives.

Four domains of policy analysis can benefit from the results of the model of urban fresh produce marketing in Tonga. The first is in the realm of agricultural pricing policies and concerns the need (a) to provide producers and other market participants with incentives to supply products in sufficient quantities to satisfy increasing urban food demands, and (b) to promote agricultural processing industries.

Second, an evaluation is made of the adverse effects of price risks on supply to fresh produce markets and of ways of overcoming any such effects. Third, given the present dualistic structure of agricultural marketing systems in South Pacific countries, the potential and the future prospects of fresh produce markets, as prototypes for agricultural market development, need to be assessed. Finally, entrepreneurship and infrastructural development have provided major impetuses to agricultural market development in most developed economies: to what extent might they be important in generating increased marketed surplus of food in South Pacific countries?

Agricultural pricing policies. Three model results are pertinent in helping policy makers to formulate domestic agricultural pricing policies: the existence of diverse categories of sellers, the nature of supply response, and the lack of evidence of production response to changes in prices of domestic food products.

The evidence in support of the existence of distinct categories of sellers in fresh produce markets with different motives for participation obviously means that sellers will react in diverse ways to any domestic food pricing policies that are introduced. Such diverse reaction makes it less easy to identify and gauge the relative strengths of these categories; furthermore, it is unlikely that the composition and relative strengths of these groups are static. At present, it appears that the

influence of target income sellers prevails over that of other categories of suppliers. What is crucial for the future formulation of pricing policies is to assess whether profit-oriented supply behaviour will soon gain the ascendancy as a greater degree of commercialisation affects the attitudes of participants in fresh produce markets.

The arc-shaped supply functions estimated for root crops can influence the success of certain pricing policies. Those policies based on the normal conception of positively-sloped supply functions dictated by economic theory may have the opposite results to those intended under certain circumstances. For instance, it is quite possible that any attempt to increase root crop prices to suppliers from low levels may lead initially to reduced levels of marketed surplus rather than the anticipated increased levels. Further, attempts to maintain prices for a particular root crop at artificially high levels to induce a more positive response are likely to have considerable depressing effects on urban demand for that commodity.

The shape of supply functions might be crucial to managers in food processing industries relying for key inputs on local agricultural production. These industries often form the basis of a fledgling manufacturing sector in developing countries and require reliable and fairly constant supplies of inputs to operate profitably. Price paid for inputs is the major weapon available to processors to ensure regular supply and quality. For instance, higher prices paid during the off-season for a particular raw material input may be essential to secure sufficient supplies for processing throughout the year. Perverse supply response at certain price levels makes the task of ensuring regular year-round supplies very difficult unless the nature of this response is well understood by the processor.

The apparent lack of production response by root crop producers to price changes is somewhat ominous for policy makers concerned with enlarging the product contribution of the agricultural sector to economic growth. The evidence that there is no production response is by no means conclusive. If it is found to be true, however, it could mean that semi-subsistence producers, who make up the bulk of farmers supplying

fresh produce for domestic processing and consumption in South Pacific countries, respond to price incentives not by planting more crops but by altering the timing of harvesting, the extent of their participation in the gift exchange economy or the mix of food items in farm household consumption. Further, if locally-produced products are then replaced by imported food items, the gain in product contribution by the agricultural sector may be lessened. That such behaviour might exist should encourage policy analysts to research further in this field. In particular, there is a need to pursue further studies into farm household consumption behaviour in South Pacific countries.

Effects of price risk on levels of marketed surplus. A tentative conclusion was reached that sellers of yams and cassava in the fresh produce market react to increased price risk by reducing supplies. If this conclusion is correct, it has implications for the development of fresh produce marketing systems because it means that the dominant producer-sellers are being discouraged from committing themselves more to profit-oriented market supply, for two reasons. First, producer-sellers are often only intermittent market participants and, as a result, are likely to have imperfect knowledge of short-run price variations. Second, most producer-sellers handle only small quantities and a narrow range of produce. Given the effort and time taken in getting this produce to the market and selling it, resource inputs per unit of sales are likely to be considerable. The risk of losses on these sales (after imputing costs for unpriced inputs such as family labour) can be quite high.

Given the indications that negative response to price risk is greatest for those root crops markets most patronised by profit-oriented suppliers, any trend towards a more commercial approach to the supply of fresh produce is likely to exacerbate the problem of market risk unless changes are forthcoming in market operations. The presence of specialist market participants may help to overcome these problems. Specialists are more likely to handle larger quantities and a wider range of fresh produce. Also, they are almost certainly more regular attenders at the market-place and so are in a better position to follow product price variations. These factors should lessen the adverse effects of price risks on supply decisions.

Fresh produce markets as a prototype for agricultural market development. The nature of selling operations in the fresh produce markets clearly shows that such markets are still characterised by village marketing organisation with little discernible specialisation of marketing functions. Yet it is in these fresh produce markets that most local initiative in marketing activities is to be found.

Unfortunately, the predominant influence of producer-sellers who are target income suppliers at all but high product prices does not augur well for the development of fresh produce markets to the stage where the barriers that maintain the dualistic export-domestic market structure are broken down. The conclusions of Fisk (1975) are important in this regard. If most of the suppliers to fresh produce markets 'are left experimenting with minor supplementary cash-cropping enterprises grafted onto their main subsistence activities' (p. 83), the main beneficiaries of agricultural market development will be non-indigenous individuals and enterprises involved primarily in export marketing activities. As indicated above, the prospects for future development of fresh produce markets depend on the relative strengths of target income suppliers and profit-oriented suppliers. Crucial to the ascendancy of the latter group is the scope that exists in the fresh produce marketing system for profit-taking from marketing activities. This, in turn, depends primarily upon the ability of participants in fresh produce marketing sectors to raise levels of productivity in either subsistence or commercial production (Fisk, p. 77), or to improve efficiency in marketing activities. If little scope exists because the rewards are insufficient, this system might be consigned to a state of terminal agricultural market development. Domestic food marketing would then remain the stagnant part of a dualistic agricultural marketing system in which any dynamism is confined to the export marketing and food importing sectors that have been traditionally dominated by large private and public marketing institutions.

For target income suppliers to prevail in the future, it would imply that the transition from the second to the third stage of market participation would not be made. This is equivalent to the failure to emerge of the third stage of agricultural market development, discussed

in Chapter 3. In order to determine whether target income suppliers will prevail in the future, four questions need to be answered. First, what makes producers switch from being target income producers to become profit-oriented suppliers? Second, why have specialist market participants not yet emerged to any significant degree in the domestic fresh produce marketing systems? Third, can policy makers encourage their emergence through, for example, improving the facilities available in market-places? Fourth, if specialist marketing services did become available in abundance, would this alter supply behaviour, and lead to a more profit-oriented approach by producers to food supply? There are as yet no clear answers to any of these questions.

In respect of the answer to the first question, Stent (1984, p. 150) outlined two ways in which 'subsistence affluence' can be removed. First, a per caput tax could be placed on village members. A second approach, recognised by Fisk (1975), is to raise the demand ceilings of producers by increasing their marginal utility of cash income. Stent argued that this would come about as consumer goods become more readily available and cheaper relative to the prices of agricultural marketed surplus. Ward (1982, p. 19) also argued that the switch to profit-oriented supply is likely to be demand-induced. It would come when 'rural dwellers extend their range of perceived needs, only attainable through cash income...'. In respect of the third question, however, Kunert (1986) hinted that it might also be supply-induced in the sense of availability of marketing services. She found that food producers in a village near Honiara in Solomon Islands reacted favourably to the idea that specialist market participants would collect and pay for fresh produce at the 'village gate'. Whether this would, in turn, elicit a more profit-oriented approach by these producers to supply remains to be seen. Crucial in the answer to this question would be the ability of specialist market participants to introduce more efficient marketing methods that would lead to reduced marketing costs per unit of market throughput, thereby increasing 'village gate' prices to producers.

Producer-sellers may contribute to the persistence of low 'village gate' prices in another respect. Target income suppliers and trippers are likely to accept lower returns than profit-oriented suppliers and

marginalists, thus discouraging the latter groups from market participation. In the opinion of Lam (1984, p. 199), a lack of 'producer commitment serves both as a partial cause and effect of the general absence of a middleman class of merchants for the better distribution and more efficient regulation of food supplies across markets or localities...'. To encourage participation, improvements are needed in the fresh produce marketing sector of the kinds outlined in Figure 1.2 on p. 10. Two avenues that might promote such improvements are now discussed.

Entrepreneurship and infrastructural development. One way of boosting agricultural market development through infrastructural development was implied in the previous section: improvements in fresh produce market-place facilities may hasten the growth of specialist market participants. Other infrastructural improvements, especially those that improve transportation, handling, storage and communications facilities, and reduce the costs to market participants of using them, may encourage increased marketed surplus by leading to an increase in 'village gate' prices paid to fresh produce suppliers, perhaps shifting prices to the zone of positive response. Also, they may increase income targets because of the wider choice of items for purchase, made possible by closer contact with the commodity exchange economy. If a substantial increase in levels of marketed surplus of fresh produce is a goal of agricultural policy makers, reducing marketing costs by improving marketing infrastructure could be an avenue well worth exploring given the evidence of rapidly increasing supply elasticities as prices increase above the mean, most likely brought about to some extent by the entry of marginalists into the commercial food marketing system.

A growth in entrepreneurial activities in the early stages of agricultural market development provides another means of reducing market costs (and of increasing 'village gate' prices), through the exploitation of previously unrecognised opportunities for providing services to other market participants. Sit (1985, p. 91) outlined various steps that can be taken by policy makers to create an environment that stimulates, supports and sustains entrepreneurial development. As for the effects of infrastructural development, any entrepreneurial initiatives that lead to

increased 'village gate' prices should help in the generation of a larger agricultural marketed surplus if it encourages more marginalists to sell a marketed surplus. Success in these endeavours, however, is not guaranteed unless the higher 'village gate' prices elicit a positive response - as indicated above, not guaranteed - or unless the presence of marketing entrepreneurs encourages a more commercial approach to agricultural production and supply by village producers. The evidence on export supply is encouraging in this respect. It appears that in export markets, at least, there is an overwhelming predominance of profit-oriented suppliers. The key to increased food marketed surplus might rest, therefore, on replicating this behaviour in domestic markets.

10.3.3 Market Response to Economic Incentives in Agricultural Export Markets

Export market expansion. Two key findings in Chapter 2 and in Chapters 5 and 6, respectively, are: (a) the agricultural terms of trade - and agricultural export prices in particular - are significant explanators of agricultural marketing performance in all five countries under study; and (b) smallholder market participants respond positively to expected export prices in determining quantities of agricultural products to be exported. These findings provide a useful pointer to policy makers: find export niches in which long-term market prospects are good (ideally those in which real prices of goods exported will increase, thereby ensuring marketing performance will be raised, not just because of positive price effects but also through the efforts of smallholders supplying more produce).

This finding, while crucial, is hardly a novel one. When linked to other results in the analyses undertaken, however, there are some important guidelines that need to be established. First, technological performance in the village marketing sector has not been promising and many of the potentially lucrative export markets are demanding in terms of requirements of products (quality control, grading, timing and levels of processing). Second, while remoteness does not appear to be a major limiting factor for storable commodities, it has been shown to be important for perishable and bulky commodities in Chapter 9. Many of the

most attractive specialist export markets are for perishable commodities. Further, price responsiveness of regular copra producers in Solomon Islands was found to be significantly greater after the provision of graduated freight subsidies to counter the effects of remoteness. Third, the establishment of new export market outlets requires considerable effort and expertise by marketing institutions. The history of agricultural marketing in South Pacific countries does not engender confidence in the ability of public marketing institutions to behave as innovators in creating and building up new markets. Nor does the existing dualistic structure of the agricultural marketing systems provide much scope for village-based market participants to offer much in this endeavour.

It is unwise to be dogmatic in offering solutions to the establishment of profitable new export markets: the problem is a difficult, yet vital, one in the pursuit of agricultural market development (Abbott 1981, 1982, 1985). The guidelines for success are fairly straightforward: the best export prospects are for storable commodities with high value-weight ratios and post-harvest activities that require straightforward technologies. The next vital step is to create a marketing environment in which there are strong incentives to market participants to seek out prospective markets and to establish efficient marketing channels. These guidelines are deceptively simple in that they are not easy to comply with; yet the vanilla industry in Tonga has developed over the past decade in line with these principles. Perhaps the most difficult point on which it is unwise to be dogmatic concerns the relative merits of public and private marketing institutions as innovators in this sphere. The conservative approach adopted in this respect is to eschew making a choice regardless of circumstances but to recommend strongly that whichever mode of marketing is chosen, policy makers have a facilitative role in ensuring that the incentives provided are sufficient for the institutions to pursue a course consistent with the goal of expanding export marketing opportunities.

There is one more interesting conclusion from Chapter 6 that can influence the use of pricing policies. The low adjustment coefficient estimates in the taro and banana export equations imply that short-run

elasticities are much more meaningful for interpretation than the corresponding long-run elasticities. This is particularly so in the case of copra (where the rate of adjustment appears to be negligible). Manipulation of price as an economic policy instrument to influence domestic supply is therefore unlikely to be greatly effective given the inelasticity of short-run supply response for these crops. If this characteristic of export supply response for taro and bananas is common among all export crops, prospects for the use of price as a short-run policy instrument in export markets appear limited.

Dealing with export price risk. A marketing issue that has taxed the minds of policy makers and politicians alike in South Pacific countries has been the effect of price risk in export markets on agricultural market, and general economic, development.

In recent years, the South Pacific Commission (SPC) has been considering the introduction of different types of regional agricultural stabilisation schemes. A feasibility study was undertaken and it was recommended (SPC 1980, p. 76) that there is scope for introducing a regional revenue reserve fund. The recommendations of the feasibility study team are still on the drawing board for implementation.

In presenting the case for stabilisation, it was argued, *inter alia*, that the economies of South Pacific countries depend greatly on agricultural exports both for increasing national income and for earning foreign exchange (SPC 1980, p. 6). Copra is a particularly important export in virtually all countries, not only because of its economic contributions to export earnings but also because it is a commodity that is produced predominantly by smallholders living in the villages. Improving the welfare of the village population is the major thrust of the development programs in the region. Hence, it was argued that the regional stabilisation scheme should first be introduced for copra, with other crops to be added later (SPC 1980, p. 74).

In the meantime, national governments have either persevered with their own stabilisation schemes (SPC 1980; ESCAP 1983) or are in the process of reviewing the merits of export stabilisation (Dalton 1985).

Three shortcomings of the SPC report and the approaches by policy makers in national governments to export price or revenue stabilisation have been:

(a) neglect of the fundamental issue of whether export price instability is in fact harmful to economic growth;

(b) failure to ascertain the precise causes of export instability; and

(c) lack of consideration given to the possibilities of transfer of instability from the export to the domestic market.

(1) Export supply response to price risk

In respect of the first shortcoming, the evidence educed in Chapter 8 provides no compelling case that export price instability has a negative effect on levels of agricultural marketed surplus entering the export markets. This result indicates that there is a need for careful research before going ahead with any price stabilisation schemes for export commodities if the main aims are to protect producers from world price variability and to maintain exports in times of instability in world markets. The lack of significance of expected export price variance in all models in Section 8.2.4 does not provide any grounds for being concerned about such price variability. This finding by itself does not warrant the conclusion that price stabilisation yields no benefits to South Pacific exporters; nevertheless, because there are always resource costs associated with such schemes, policy makers should first satisfy themselves that some benefits are going to be derived from their implementation. So far, no such evidence is available. The evidence required concerns not only short-term effects of market instability on producers' supply decisions but also long-term effects on their planting decisions and, for tree crops such as coconuts, decisions that affect the levels of maintenance of plantations.

(2) Causes of export instability

The second shortcoming is important for policy analysis because the causes of export instability determine whether and to what extent

governments can intervene to remove or mitigate the effects of such instability.

(a) Relative strengths of direct price and quantity effects.

The evidence accumulated in Chapter 7 is quite revealing in this respect. It was concluded, in particular, that quantity instability is important as well as price instability. This result indicates that it would be prudent of policy makers to direct at least some attention to the stabilisation of export throughput if the aim is to stabilise export revenue earnings. The usual explanation of unstable agricultural markets is in terms of inelastic demand functions and highly inelastic and volatile supply functions. It is true that these conditions tend to generate highly unstable prices relative to quantities traded. In the context of small exporting countries, the usual explanation has to be amended considerably to take account of the fact that export demand functions are probably highly elastic in most cases. Price instability is still generated, but it tends to be the result of volatility in the level of the highly elastic export demand function. Moreover, in situations where export demand remains relatively stable for short periods, one can expect to observe greater instability in quantities traded than in prices as a result of shifting supply in the face of the highly elastic but relatively stable demand.

(b) Interaction effects.

In general, interaction between export revenue earnings from different products worked in the direction of increasing TERV for the countries studied. The only exception to this generalisation is in relation to Tonga where there was a significant negative interaction between export earnings from copra and bananas. Hence, diversification of the export base in PNG and Solomon Islands has not worked to decrease TERV through the offsetting effects of fluctuations in earnings from different commodities. Moreover, these positive revenue interaction effects were significant in both these countries as well as in Western Samoa.

If the analysis had revealed that revenue interaction effects had been strongly negative, one would be reluctant to suggest stabilisation programs aimed at stabilising export earnings from particular commodities; such a policy might well be destabilising in terms of TERV. Given that strong positive revenue interactions seem to be the norm, stabilising the export revenue earned from particular commodities is also likely to be stabilising in terms of TERV. Moreover, while there were some strong negative interaction effects between price and quantity variability in the first half of the study period, in recent years these interactions have tended to be positive. The import of this observation lies in the fact that a price or quantity stabilisation program would, intuitively, be more effective in stabilising revenue if the price-quantity interaction is positive.

(c) Importance of copra.

The contribution of copra exports to TERV is still large for the two countries that have been least successful in diversifying their exports away from coconut products, namely, Tonga and Western Samoa. For PNG and Solomon Islands, the direct contributions of copra exports to TERV were less than ten per cent in the 1970s. Comparable figures for Tonga and Western Samoa were 92 per cent and 40 per cent, respectively.

Despite the fact that PNG and Solomon Islands have achieved a significant degree of export diversification during the study period, copra is still a major export commodity of smallholders in both countries. If one were to accept the premise that smallholders encounter greater difficulties in coping with revenue instability than do large, private or public export corporations, a case could be made for a regional stabilisation program for copra export revenues even though its relative contribution to TERV within the region has declined substantially over the past 20 years. A difficulty in operating such a scheme, however, is that copra export instability varies substantially in causes and importance among South Pacific countries.

(d) Selection of period for analysis.

The contrast in decomposition results for the different sub-periods chosen demonstrates the dangers inherent in formulating export stabilisation schemes on the basis of historical data. It is not uncommon for substantial effects in one sub-period to disappear in the next sub-period, or even to change signs. These changes reflect shifts in the underlying export supply and demand parameters; shifts that are not detected in the studies on export instability in which regression analysis is carried out either on cross-sectional data or time series data. In the former case, detection of changes in export demand and supply within a country is not possible. In the latter case, the time series might include data from earlier periods that are not useful for forecasting future events. The dangers involved in using historical data have been demonstrated by Piggott et al. (1986, p. 16). Using data on copra export earnings in Western Samoa, they showed how the choice of time period was crucial for the formulation of copra stabilisation policies during the mid-1960s. Direct demand and supply effects and demand-supply interaction changed vastly from one year to the next.

(e) Conclusions.

The analysis presented in Chapter 7 is more helpful from the point of view of determining what will not be effective, rather than what will be effective in terms of export revenue stabilisation programs for the five countries studied.

First, it is by no means certain that further export diversification should be pursued as a stabilisation policy. This is based on the observation that in three of the countries studied, revenue interactions tended to be strongly positive. A similar conclusion was reached by most of the authors who have studied the relationship between diversification and export instability. Most notably, Massell (1964) concluded in his pioneering study that the case for diversification received little support from his investigation and Naya (1973) found in his study of 17 Asian countries that concentration of exports and a high

level of specialisation in primary commodities did not affect export instability significantly. Other studies that supported these results include Askari and Weil (1974), Khalaf (1976) and Lloyd and Procter (1983). The evidence in the studies by Katrak (1973) and Tuong and Yeats (1976) was inconclusive while the results of the studies by Michaely (1962), Lee (1977) and Soutar (1977) supported the hypothesis that there exists a positive relationship between commodity concentration and export instability in developing countries. The nature of this relationship clearly will depend upon the export commodity mix of a particular country, as reflected in the revenue covariances. This demonstrates, in the words of one of the authors who found evidence contrary to that reported here, 'how important the commodity interrelationships are and how they affect the values obtained for commodity concentration' (Soutar 1977, p. 290). There is usually a cost associated with diversification in that average returns over time are not as great as they would be under a purely profit-maximising pattern of resource allocation. Given that diversification does not appear to have a stabilising influence on total export earnings in the cases studied, one has to question the efficacy of such a policy.

Second, the fact that there exist strong positive interactions between revenues from different sources suggests that stabilising the export earnings from particular industries will not have a negative impact in terms of decreasing the stability of total export earnings. However, there appear to be no obvious choices for such a stabilisation program if the program is to take the form of a price or quantity stabilisation program. The reason for this is that in some cases it is difficult to decide whether it is price or quantity variability that is the main cause of revenue instability while in others, strong negative interactions exist between prices and quantities. If commodity-based stabilisation programs are to be introduced, there would seem to be a case for trying to reduce both price and quantity instability.

Third, basing an export stabilisation scheme on results obtained using historical data is fraught with danger. Different decisions would be made according to the time period chosen for analysis. It is therefore vitally important that policy makers understand the nature of

export demand and supply shifts that have occurred in the past and are likely to occur in the future.

The final conclusion is that it will be extremely difficult to operate a South Pacific regional export revenue stabilisation program. The reason for this conclusion is that patterns and causes of variability differ among countries and retaining support for a regional scheme might well be impossible, even if initially countries agree to its formulation.

(3) Transfer of export instability

The results of the study of instability transfer from export to domestic markets in Chapter 8 are not completely reassuring to policy makers, despite the finding that any cobweb system that does exist in the domestic market is likely to be an imploding one. Short jolts to the domestic taro and banana marketing systems that have occurred in the past are likely to occur in the future. These short-term effects may indeed lead to major welfare costs (although there is no evidence on the extent of such costs). However, the nature of these marketing systems is such as to ensure that these periods of instability will be of short duration and unlikely to be eliminated solely through the direct control of prices of staple food items. Given the alternative markets available to producers, any attempts at price control will be likely to transform price fluctuations into quantity fluctuations with a consequent destabilising effect on throughput.

There are four alternative avenues open to the marketing institutions responsible for promoting stable marketing conditions in the short run for staple food products. One possible approach to follow would be to let market forces operate freely in the domestic food marketing system, and to allow price and volume fluctuations to subside of their own accord. A second approach is again to let market forces operate but to be ready to act quickly, and for short periods only, to facilitate the import of food items (notably rice) to offset the disruptive effects of exogenous events such as drought or marked, synchronised increases in export supplies of all staple food commodities. The effectiveness of this policy will depend upon whether

rice is a significant substitute for either taro or bananas. The evidence from the modelling of taro demand in Talamahu market in Tonga casts some doubt on the presence of such a relationship.

Third, institutions can operate a domestic price stabilisation scheme in an attempt to limit the effects of extreme price fluctuations. Such a scheme might be concentrated on one of the food commodities (say, taro as the most important staple food items in the diets of Western Samoans). Shalit (1984) analysed agricultural price stabilisation policies for eight vegetables in Israel and estimated price elasticities of demand of similar order to those estimated in this study. He found that, because of substitution effects between the commodities analysed, the stabilisation of prices of one commodity had stabilising effects on the prices of the other commodities. While the degree of substitutability among crops has not been estimated in the study of supply response in Western Samoa, it was estimated in the Talamahu fresh produce market in Tonga. The demand interrelationships observed indicate that a similar result to that in Israel could occur in the local food produce markets in South Pacific countries. However, the low correlations between taro price and other root crop prices observed in Table 6.7 casts some doubt on the effectiveness of stabilising just one major staple crop price. The other major problem with this approach is likely to be an operational one, given the scarcity of skilled and experienced public marketing managers in South Pacific countries (e.g. ADB 1985). As mentioned above, low adjustment coefficient estimates imply that short-run elasticities are much more meaningful for interpretation than the corresponding long-run elasticities. Manipulation of price as an economic policy instrument to influence relative quantities of domestic and export supply is therefore likely to be quite ineffective given the inelasticity of short-run supply response for the crops studied.

Any form of price control is likely to be difficult to achieve also because the government has virtually no control over the informal village marketing sector which forms a significant part of the overall marketing system. Because the fresh produce marketing system is partly an extension of the village system (on the supply side), difficulties

have also been observed in understanding the nature of the supply response in these markets, as noted above.

The task facing policy makers of assessing the effects of price control is made more difficult by a lack of information on the ways in which producers and market participants respond to changing incentives. An essential first step of any attempt at price control of domestic food products is to improve vastly knowledge of the circumstances under which producers and market participants make their decisions.

Fourth, governments may intervene directly in export marketing operations in times of very high export prices. They can do this either by regulating the maximum level of exports allowed (by licensing or export taxation) or, where feasible, by using the discretionary powers available to monopolistic public marketing institutions. This is possibly the best approach to follow because it forces governments explicitly to make a trade-off between the two policy goals of increased foreign exchange earnings and domestic market stability. Given lags in export supply responses, however, policy makers need skills in making decisions on intervention. First, there is the question of timing. It is necessary for policy makers to forecast the length of time high export prices will prevail. If only a short period of high prices is envisaged, a more effective approach might be to allow the fluctuations to work through the domestic marketing system than to impose any embargo on exports.

A second difficulty facing government in regulating exports is in forecasting the price effects (and consequent changes induced in supply decisions) that result from intervention. Also, it is likely to be trickier for governments to keep local prices up during depressed market conditions. This endeavour relies on inducement which in turn means manipulation of the pricing mechanism. Any attempt to maintain local prices during depressed periods will involve an element of subsidy, possibly paid for by any explicit or implicit taxes imposed on exports during periods of buoyant market conditions. Such a policy introduces new distortions into the marketing system and is likely to lead to some resource misallocation; also, it is not guaranteed of success in

eliciting the response needed because of the difficulties in predicting how village producers are likely to respond at different price levels.

10.3.4 Market Response for Traditional versus Introduced Crops

In Chapter 4, one of the propositions put forward was that the pace of development has been greater for introduced cash crops than for traditional crops and livestock. The validity and importance of such a distinction at least has to be questioned in the light of results obtained for taro supply response.

Taro has been a major item in traditional village production and consumption activities in Tonga and Western Samoa for a long time. Supply response studies of taro can therefore be assumed to be fairly typical of those for traditional village crops. If it is assumed that market supply response provides a suitable proxy for the pace of commercial development of a crop, the perverse domestic supply response observed for taro in Tonga would seem to support the contention that producers and market participants are unlikely to be commercially oriented.

On the other hand, the positive and quite substantial supply response for taro exports in Western Samoa (elasticities of 0.38 in the short run and 2.78 in the long run) belies this contention. An alternative explanation of variations in rates of commercialisation of crop production and marketing could be that the nature of supply response depends on the market structure. The dualistic structure of agricultural marketing systems in South Pacific countries appears to be a more important determinant of supply response and attitudes towards commercial marketing than the nature of the product being marketed.

10.3.5 Policy Implications of Institutional Risk

The results reported in Chapter 9 concerning the effects of institutional risk on agricultural marketing performance substantiate the observation made by Breimyer (1976, p. 178) on the importance of the

duality between infrastructure and institutions in agricultural market development. As Breimyer noted,

> Both infrastructure and well-designed institutions are essential to a good system of marketing. In a given case, the greater deficiency and more pressing need may be for a certain infrastructure. But if institutions are deficient, their improvement may take priority. Not infrequently the two will be inseparate and equal: new public commercial warehouses, to be fully useful, will likely require (1) an inspection service to assure integrity and (2) lending practices by banks that accept warehouse receipts as collateral. All these become empirical questions...

In the empirical study undertaken, it is evident that the adequacy of certain types of infrastructure is of little benefit if other infrastructural items are lacking or if institutional services are unreliable. Alternatively, the presence of certain sound institutional services counts for little if they are not complemented by other services, or if some infrastructure is lacking. Both of these situations were found to exist in the case study in Chapter 9. Considerable expenditures had been made on the upgrading of sea transportation facilities; yet poor internal transportation and communications facilities on Taveuni negated the benefits derived from them. Also, the NMA had opened up new marketing opportunities for *dalo* producers on Taveuni; however, unreliability of other institutional services prevented producers from capitalising on these opportunities.

Two policy implications can be derived from these conclusions. First, infrastructure and institutions are often 'inseparate' in facilitating agricultural market development, both in terms of the extent and quality of the facilities and services they provide to agricultural market participants. There is a second implication that was implicit in Breimyer's observations: the provision of certain types of infrastructural facilities or of institutional services may provide little impetus to agricultural market development without the presence of other types of infrastructure or institutional services. When planning for agricultural market development, therefore, it is inadvisable to focus narrowly on one particular infrastructural item or one specific

marketing institution. Development is only likely to be maximised by viewing the structural features of the agricultural marketing system as a whole.

A third important policy implication bears upon the imbalance of concern commonly encountered in dealing with market risk. Most attention has typically been paid to countering the effects of price risk and, in particular, export price risk. Results of the studies in Chapters 8 and 9 indicate that there is a case for policy makers at least to reassess priorities in dealing with market risk. There would appear to be more need for concern about risks faced by market participants which are created by the activities of marketing institutions. An important argument in support of such a reassessment is that institutional risk is an NI factor influencing agricultural marketing performance. That is, it is something that emanates from within the marketing system and its occurrence can be modified by policy makers. Export price risk, on the other hand, is usually outside the sphere of control of policy makers; the best they can do is to mitigate its effects.

A final cautionary observation is required. The influence of institutional risk is likely to vary from one situation to another, or from one stage of market development to another, as the relative influences of different infrastructural items and types of institutions vary. There is unlikely to be one universal policy blueprint that can be employed as a panacea to all institutional deficiencies.