5 Economic Factors influencing the Shark Fin Trade

5.1 Chapter Overview and Purpose

The preceding chapters describe the present state of the global shark fin trade and attempt to determine whether shark resources can sustain the trade at existing levels. This supply-side approach is now complemented by a demand-side analysis which explores linkages between the quantity of shark fins in trade and a number of economic indicators. This analysis is intended to elucidate potential factors underlying shark fin trade expansion as well as anticipate future levels of market demand. Given the absence of supply-side constraints, such as catch limits or quotas in most shark fisheries, market demand as determined by price, consumer income, substitutes and/or other factors is likely to drive exploitation rates. Identifying the key determinants of market demand is thus essential for understanding future pressures on shark resources and for evaluating the usefulness of market-based conservation strategies.

A connection between the liberalisation of Mainland China and the growth of the shark fin trade was first proposed in the early 1990s (Cook 1990). Since that time, China's economy has expanded to become the world's seventh largest, and some sources claim that in terms of purchasing power parity China's consumers now rank second only to those in the United States (Wang and Wong 1999). Concomitantly, the quantity of shark fins in trade has also increased despite changes in product form and complexities in trade routings that tend to falsely inflate official customs statistics (see Chapter 4). This chapter uses the latest adjusted trade statistics and economic data from Hong Kong and Mainland China (the Mainland) to test the hypothesis that economic growth in China is driving the shark fin trade. The results, in conjunction with a survey-based characterisation of the Hong Kong shark fin trade community, are used to identify the most important factors contributing to market demand and to indicate the prospects for trader- and consumer-based conservation initiatives.

5.2 Econometric Exploration of Market Demand

5.2.1 *Introduction*

Econometrics involves applying mathematical statistics to economic data for the purpose of lending empirical support to theoretical models. The models specify the relationship between a dependent variable and one or more independent, or explanatory, variables based on economic principles (Gujarati 1995). A variety of model forms may be specified but all are evaluated based on their ability to explain both the overall trend, and any short-term deviations from the overall trend, in the dependent variable. In this analysis, shark fin imports, the dependent variable, are modelled using available indicators of consumer spending and economic conditions. While it is recognized that econometric studies based on short time series from transitional economies pose considerable challenges, such studies are valuable because they provide a quantitative approach to what may otherwise be personal and judgmental assessments (Url and Wörgötter 1995).

Econometric analysis of Asian demand for wildlife, fish or other food products has been conducted for elephant ivory and rhino horn in Hong Kong and Japan (Milner-Gulland 1993), for seafood in Japan (Price and Gislason 2001, Wessells and Wilen 1994) and rice in Mainland China (Peterson et al. 1991). However, previous studies of markets for shark fins have been largely descriptive. Parry-Jones (1996) discussed international trade routes and prices in Hong Kong, while Fong and Anderson (2000) characterized dealer distribution channels and shark fin grading, also in Hong Kong. Other studies of the shark fin trade based outside of Hong Kong have assessed its economic importance to fishing fleets (McCoy and Ishihara 1999), and global reach, diversification and value (Rose 1996, TRAFFIC 1996). Quantitative studies of shark fin trade economics include Fong and Anderson's (2002) work using trader preference information to model optimal shark sizes for harvest.

5.2.2 Model Conceptualization

The analytical framework for this study is based on the assumption that the demand for shark fins in Hong Kong and Mainland China, and the supply of shark fins by Hong Kong traders and their subsidiaries in the Mainland, represents a single, coherent market. Although it is obvious that economic conditions between the two areas differ, the shark fin trade flows between Hong Kong and the Mainland are open and multi-channelled. The only available records of the quantities of goods passing through this market consist of customs statistics, however, as discussed in Chapter 4, major discrepancies have been observed between Hong Kong and Mainland customs data for shark fin. These discrepancies cast doubt on the reliability of the Mainland China data for enumerating shark fin imports and partitioning consumption of processed shark fin between the two areas. As a result, an integrated model is proposed, with imports of shark fin to Hong Kong as the dependent variable, and time series data from both Hong Kong and the Mainland as explanatory variables.

A general form for the model was defined based on principles underlying the economic theory of demand (Dubin 1998). In its simplest form, the demand function for a particular good is defined by its price. Therefore, price is expected to be a critical determinant of demand for shark fin in Hong Kong and Mainland China. Another important demand determinant in most markets is consumer income, or similar factors such as consumer spending. Economic expansion in Mainland China in recent years is assumed to have led to rising per capita income which may in turn have caused an increase in demand for shark fins. The relative change in quantity demanded associated with the relative change in income, i.e. the income elasticity, would be expected to be positive, implying shark fin is a 'normal' good, and possibly greater than 1, implying shark fin is a 'luxury' good. Models of demand also must consider substitute goods since the availability and quality of substitutes often directly influences demand elasticities for the particular good of interest. In Chinese cuisine shark fin is served at wedding banquets, important business functions and other special occasions (Rose 1996), therefore other foodstuffs served on these occasions may be possible substitutes for shark fin. Finally, the model should account for the influence of past consumption patterns on current consumption. A linkage between past and present consumption may arise from consumers forming a habit of eating shark fin on certain occasions or delays in the reaction of traders to market forces. Incorporating past values (i.e. lags) of the quantity of shark fin demanded into the model is one simple way of addressing this potential demand determinant.

The demand for shark fins can thus be expressed as:

$$Y_t = f(Y_{t-i}, P_t, I_t, S_t, u_t) \qquad \text{(Eq. 5.1)}$$

where *Y* is the quantity of shark fin demanded,

P is price of shark fin,

I is income,

S is the price(s) of substitute good(s),

u is the error term,

subscript *t* indicates the time period, and

subscript *i* indicates the lag period.

Although there are few empirical studies of fishery supply curves (Nøstbakken and Bjørndal 2003), the supply function for shark fins is an important consideration when estimating demand. The assumption underlying this conceptual model is that demand, as a function of quantity and price, is stable even as the supply curve shifts over time (Figure 5.1). Despite recent blurring of categories, fisheries supplying shark fin can be broadly classified into two types: bycatch fisheries, which have an incidental catch of sharks alongside target species; and target fisheries which are catching sharks for meat and fins (Appendix 1). In both cases, the supply curve for shark fins would be expected to shift over time with natural fluctuations or changes in the abundance of the target species. However, these shifts would be exogenous to changes in price for shark fin as symbolised by the lines S_1 through S_3 in Figure 5.1. Since the demand curve, as represented by the points of intersection with the constant slope of the supply curves, is also exogenous, it is therefore identified, and the conceptual model proposed here is estimating demand rather than supply.

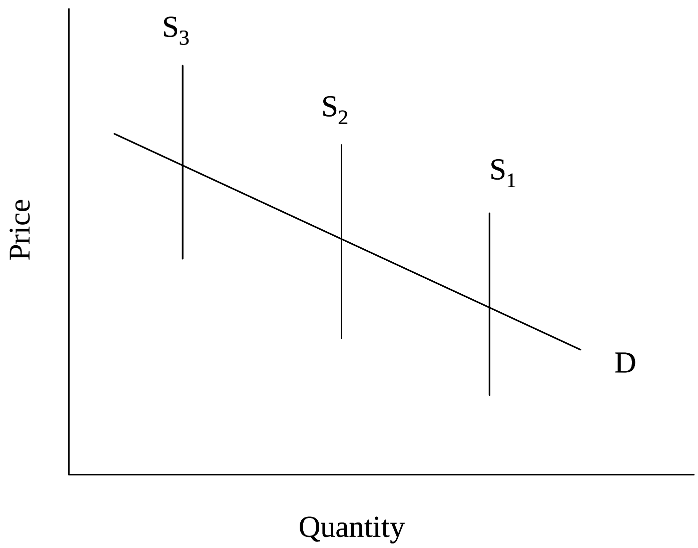

Figure 5.1 Theoretical supply (S) and demand (D) functions under the assumption that as the supply function shifts (S_1 - S_3), the demand function remains stable. The demand is thus identified.

As stated above, the dependent variable *Y*, representing quantity demanded, was specified as imports of shark fin to Hong Kong due to data deficiencies for Mainland China imports. However, for variables *P*, *I* and *S*, it was acknowledged that conditions in Hong Kong (HK) and Mainland China (MC) may be sufficiently different to warrant specification of separate explanatory variables for each variable, e.g. P_{HK} and P_{MC}, etc. Substitutes are expected to be identified among other traditional Chinese luxury foodstuffs served on special occasions and may differ between the two systems. The need and justification for separate specification for the Mainland and Hong Kong prices and the selection of substitutes was evaluated in light of available data as discussed below.

5.2.3 Data Sources

Compilation of data was undertaken in Hong Kong and Mainland China through library and online searches, visits to government departments, and enquiries at intergovernmental and private data clearing houses. Some data were made freely available in digital form, whereas other datasets required purchase and manual data entry (e.g. shark fin price data). Searches were conducted for relevant data extending as far back as 1980 and with the maximum reporting frequency possible (Table 5.1).

Hong Kong's shark fin import data is published monthly by the Hong Kong Special Administrative Region Government based on traders' self-declared quantities (Hong Kong Government 2002). Some illegal trade, conducted to avoid import tariffs levied by the Mainland China government, is suspected but, as documented in Chapter 4, does not appear to have a strong effect on import quantities declared in Hong Kong where the trade is legal and duty-free. Inventory stockpiling is a potential drawback to the use of import data as a proxy for market demand as it may interfere with detecting the response of traders to the other variables in the model. However, given the limited warehousing

Table 5.1 Data sources and descriptive statistics for the econometric model. The time period refers to the availability of data from the quoted source; additional historical records may be available from other sources. Conceptual relevance: Y = quantity demanded; P = price; I = income or alternative measure of spending; S = substitutes; A = adjustment data for per capita measures or exchange rates.

Available Data Set (* indicates data series was adjusted to constant 1990 prices)	**Conceptual Relevance**	**Time Period**	**Frequency** (number of data points)	**Source**	**Unit**	**Descriptive Statistics for 1992-2001** (half yearly data points)		
						Mean	**Standard Deviation**	**Range (Min.-Max.)**
Hong Kong								
Imports of Processed and Unprocessed Shark Fin	Y	1980-2001	Monthly (n=264)	Hong Kong Govt. 2002	kg half-year^{-1}	2,530,502	497,689	1,848,781 – 3,449,398
Private Consumption (total)*	I	1989-2001	Quarterly (n=52)	Hong Kong Govt. 2002	HK$ M half-year^{-1}	229,659	19,084	184,609 – 258,138
Total Restaurant Receipts (value)*	I	1983-2001	Quarterly (n=76)	Hong Kong Govt. 2002	HK$ M half-year^{-1}	16,046	872	14,435 – 17,845
Prices of Marine Fish (garoupa, retail)*	S	1980-2001	Monthly (n=396)	Hong Kong Govt. 2002	HK$ kg^{-1}	52.64	7.79	44.40 – 69.48
Population	A	1980-2001	Half-yearly (n=70)	Hong Kong Govt. 2002	‘000 Persons	6,362	320	5,800 – 6,759
Hong Kong Dollar to United States Dollar Exchange Rates	A	1980-2001	Monthly (n=336)	HKMA 2002	NA	7.751	0.024	7.727 – 7.799

Table 5.1 (continued)

Available Data Set (* indicates data series was adjusted to constant 1990 prices)	**Conceptual Relevance**	**Time Period**	**Frequency** (number of data points)	**Source**	**Unit**	**Descriptive Statistics for 1992-2001** (half yearly data points)		
						Mean	**Standard Deviation**	**Range (Min.-Max.)**
Mainland China								
Per Capita Disposable Income (urban areas)*	I	1992-2001	Monthly (n=120)	CSICSC 2002	PRC Yuan half-year^{-1}	1,413.00	437.23	643.40 – 2,120.92
Total Retail Sales, Food Services Sector (urban areas)*	I	1994-2001	Monthly (n=96)	CSICSC 2002	Billion PRC Yuan half-year^{-1}	61.81 (1994-2001)	24.19 (1994-2001)	27.91 – 108.68 (1994-2001)
Chinese Yuan to United States Dollar Exchange Rates	A	1990-2001	Daily (n=4,382)	TSC 2002	na	7.794	1.114	5.475 – 8.687
Population (People's Republic of China, i.e. Mainland China, Hong Kong and Macau)	A	1980-2001	Annually (n=41)	FAO 2002	'000 persons	1,239,871	34,390	1,182,804 – 1,293,851
Other								
Shark Fin Prices Quoted in India for Delivery to Hong Kong*	P	1982-2001	Bi-weekly (n=480)	INFOFISH 2002	US$ kg^{-1}	30.58	3.97	21.19 – 36.92

space in Hong Kong and the expressed desire of traders for quick turnover of inventory to feed their cash-based businesses (see Section 5.3), stockpiling was expected to be a rare and short term (e.g. less than 3 month) phenomenon which would not measurably affect import rates.

Datasets for potentially relevant economic and demographic variables and population were compiled in Hong Kong from the Census and Statistics Department and the Monetary Authority (Hong Kong Government 2002 and HKMA 2002). There was no direct measure of income available for Hong Kong, therefore, data on private consumption were obtained. Private consumption is calculated as the component of gross domestic product consisting of expenditure less investment; it therefore represents personal, mainly household, expenditures on goods and services (The Economist 1994). The only available price data on potential substitute foodstuffs comprised figures on wholesale and retail prices of three fresh fish (Hong Kong Government 2002). Of these, retail prices of garoupa (or grouper, Froese and Pauly 2002), were compiled as this is a large reef fish commonly eaten at business dinners and banquets in Hong Kong and the Mainland (Lee and Sadovy 1998), and is believed to be a possible substitute for shark fin.

Complementary data sets for Mainland China were more limited, particularly those available for the early 1990s and published more than once per year. Measures of general economic performance such as gross domestic product (GDP) or gross national product (GNP) were of interest but are published only annually (Keidel 2001). Monthly figures were however available for per capita disposable income and total retail food receipts, as well as data on exchange rates (CSICSC 2002, TSC 2002). Income and food sales data were compiled for this study from urban areas only, as it was considered that only urban Chinese residents would have the opportunity to purchase shark fin dishes. Population data on the People's Republic of China, including Hong Kong and Macau Special Administrative Regions, was compiled for use in per capita adjustments.

Relevant price data for shark fin proved elusive, as the price data contained on the Hong Kong auction data sheets (Chapter 2) represented only a short timeframe, and there were no other existing, long-term data sources identified in either Hong Kong or the Mainland. The most useful available dataset consisted of bi-monthly price quotes in US dollars for various seafood products from around the world (INFOFISH 2002). The dataset was examined for consistent shark fin types, gradings and countries of origin, but no price quotes were available for shark fin offered for sale specifically in Hong Kong or Mainland China. A time series of price quotes for 'black shark fins other than tails', quoted in India for delivery to South East/Far East Asian ports was compiled as the best proxy for price of unprocessed shark fin in Hong Kong and the Mainland.

5.2.4 Data Adjustment

Adjustment was required to establish a common frequency for all data series, to account for inflation in financial data, and to standardize units between data series. This section describes the background and rationale for each of these adjustments.

In order to make maximum use of all available datasets in a consistent time format, data were first prepared in quarterly intervals. For data series representing quantities, such as imports of shark fin, private consumption, disposable income and restaurant receipts, this required summing all available values into quarterly totals. Price and exchange rate data were averaged over the quarter[1], and population figures were generated by applying a

[1] Agglomeration of price data is usually accomplished via weighted averages, but in this case the measures of price (P) and quantity (Y) were unrelated and thus simple averages of price were used.

linear extrapolation to annual or mid-year figures. The model time frame was limited to 1992-2001 (n=40) due to the lack of published data for the Mainland China variables prior to 1992.

As presented in Chapter 4, the dependent variable, imports of shark fin to Hong Kong, required two adjustments in order to normalise import figures to dried unprocessed quantities, and thus reflect market demand accurately. Declared imports were first adjusted to remove processed fins in order to avoid counting the same fin twice, i.e. once when imported in unprocessed form, and again when re-imported from the Mainland in processed form. A second adjustment was applied to adjust for water content of frozen fins using a factor of 1 kg frozen fins to 0.25 kg of dried fins. The quarterly data series for the dependent variable, imports, is shown in Figure 5.2.

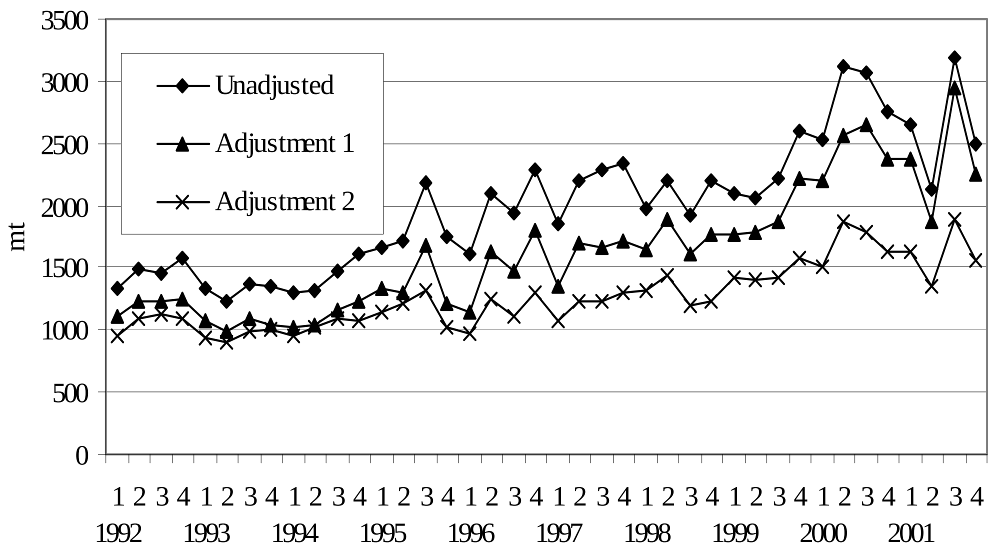

Figure 5.2 Quarterly imports of unprocessed shark fins to Hong Kong, 1992-2001, with adjustments for double counting (Adjustment 1) and water content (Adjustment 2).

In contrast to the annual data analysis presented in Chapter 4, when plotted on a quarterly basis, these adjustments did not change the trends in the data. The quarterly data series also differs from the annual series in displaying considerable short-term variability. This variability could potentially arise from seasonal patterns of shark fishing (i.e. market supply), spikes in demand preceding Chinese holidays such as the New Year festival, or other factors.

Data on shark catches were not available at the required frequency or level of detail to evaluate whether fin supplies may explain the variability, but given that at least 85 countries export fins to Hong Kong, seasonal supply patterns are not expected to a major factor. Variable holiday demand alone also fails to explain the trends. A surge in unprocessed imports would be expected at the beginning of the last quarter of each year, accompanied by a rise in processed imports in November - December in preparation for the Chinese New Year holiday held in late January to mid February, but neither these nor other patterns are discernable in the data (Figure 5.3).

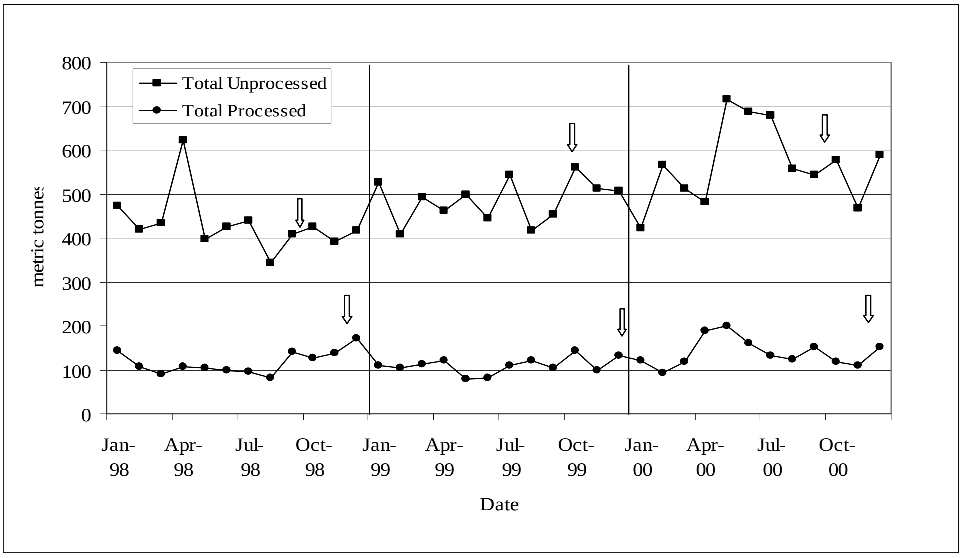

Figure 5.3 Monthly unprocessed and processed shark fin imports to Hong Kong 1998-2000. Arrows indicate expected increases in imports of each product in anticipation of the Chinese New Year holiday.

Other factors contributing to variability may include customs enforcement. For example, the particularly large variability in the second and third quarters of 2001 (Figure 5.2) is known from interviews with traders to be the result of increased enforcement of customs duties by Mainland officials in the first and second quarters, causing a backlog of unprocessed fins in Hong Kong, and thereby slowing imports. By the third quarter, traders reported they had re-opened channels for re-export of unprocessed fins to the Mainland and resumed imports, possibly even increasing shipments to compensate as indicated by the data. An additional erratic factor driving import patterns may be weather. Shark fins require thorough sun-drying before shipment (if shipped in dried form) and/or prior to processing (for both dried and frozen forms) therefore weather may influence the quantities of fins available for shipment and ability of warehouses to accommodate product stocks.

This variability in the regressand introduced by the use of quarterly data was initially a concern since the regressors would not be expected to reflect any of the factors believed to contribute to the variability. In such cases, dummy variables can be introduced to the model if the variability follows a cyclic or otherwise distinct pattern, but apparent patterns on which to base dummy variables were lacking. Therefore, further agglomeration of the data to remove unnecessary noise in the trend was considered. Half-yearly values were selected as the best option to balance the dampening of short-term variation and the maintenance of sufficient degrees of freedom for the model. Agglomeration from quarterly to half-yearly values followed the same guidelines articulated above for compiling quarterly data from monthly data.

All financial data reported in nominal prices were adjusted for inflation using consumer price indices (CPIs) with a common base year (1990). This technique sets the CPI in 1990 at a value of 100 and reflects all values in subsequent time periods as a proportional change from the value in 1990. The figures representing proportional change are used as deflators according to the following formula:

$$dv_t = \frac{1}{\left(deflator_t/100\right)} \times ov_t \qquad \text{(Eq. 5.2)}$$

where *dv* is the deflated value,

ov is the original value, and

t is the time period.

Hong Kong dollar prices of shark fin (converted from unadjusted INFOFISH US dollar values) and garoupa, and total restaurant receipts, were adjusted using Hong Kong composite CPIs (Figure 5.4). Hong Kong private consumption data were published in constant 1990 prices and did not require further adjustment (Hong Kong Government 2002).

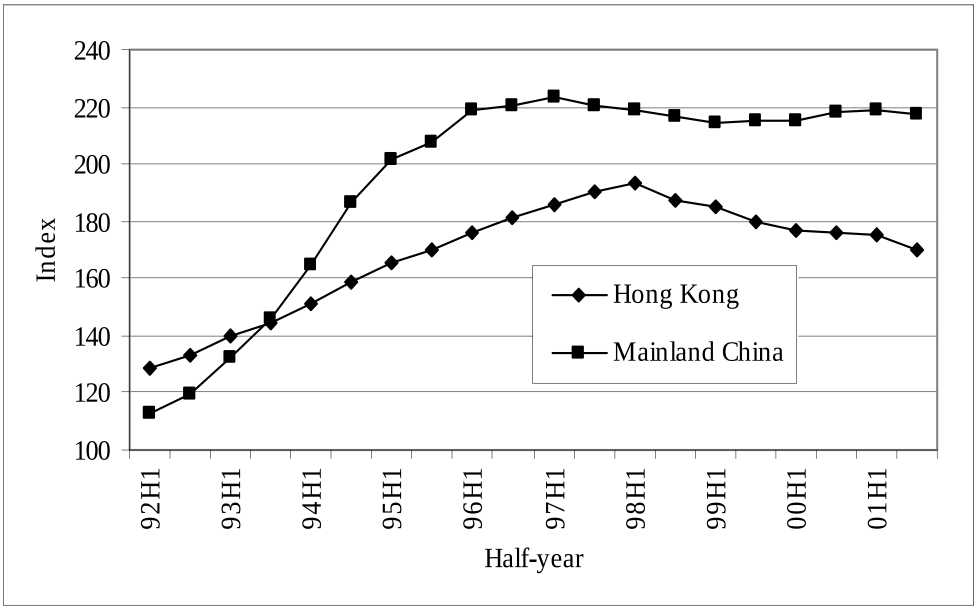

Figure 5.4 Half-yearly consumer price index data used for Hong Kong and Mainland China inflationary adjustments (base (100) = January 1990).

As the Mainland China government only publishes annual CPI series, higher frequency figures are difficult to obtain and considered sensitive information in the Mainland.

Inflation indices for Chinese yuan prices in this study are based on unpublished data obtained from a major international financial organization on a confidential basis (Figure 5.4). Adjustments were applied to Mainland per capita disposable income and food services receipts according to Equation 5.2. The substantial rise in the Mainland China consumer price index between 1994 and 1996 corresponds to a period of structural inflation and monetary crisis led by food price increases, producing inflationary effects common in transitional economies (Chang and Hou 1997).

A final adjustment was applied to convert some data series to per capita units. This adjustment was necessary to standardize those Hong Kong and Mainland China variables which were expected to trend upwards with increasing population, and to provide an equal basis for comparison with Mainland China disposable income data that are reported in per capita units. Private consumption and restaurant receipts for Hong Kong, and retail food expenditures in the Mainland, were converted to per capita values using Hong Kong or Mainland China (i.e. People's Republic of China excluding Hong Kong) population

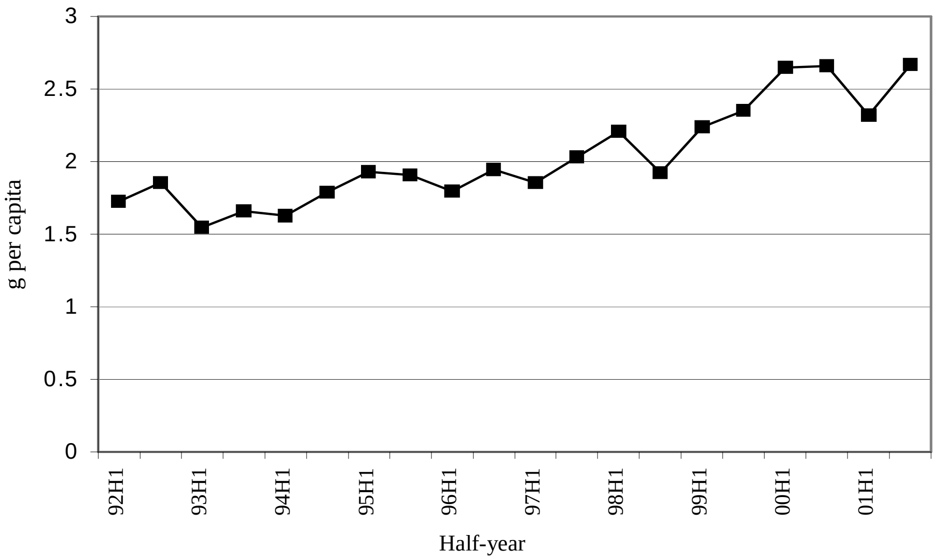

Figure 5.5 Half-yearly adjusted imports of unprocessed shark fin to Hong Kong in grams per capita**.**

data, respectively. The dependent variable, imports, was designated to represent both Hong Kong and the Mainland, and so was adjusted using People's Republic of China(PRC) total population figures (Figure 5.5).

5.2.5 Data Exploration

Datasets were explored using simple time series plots and diagnostics in order to interpret trends and determine whether the time series were stationary or non-stationary. Stationary data series are those for which the mean and the variance are constant over time, and the autocorrelation in the error term is near zero for any lag greater than zero. A unit root test such as the Dickey-Fuller (DF) test can be used to determine whether the time series is stationary (i.e. the unit root is zero). If the absolute value of the DF test statistic is greater than the critical value of the test, the null hypothesis of stationarity is not rejected.

In some cases, non-stationarity is due to the presence of a deterministic time trend that alters the mean and variance consistently and proportionally over time. Time series which are non-stationary due to the presence of a deterministic time trend will behave as stationary time series as long as the time trend is accounted for in the regression. However, if the series is found to have a unit root even when a deterministic trend is included, it is advisable to attempt transforming the data to a stationary series by differencing (i.e. using the difference between the current value and a previous value as the variable). The series can usually be differenced over the interval indicated by the unit root (i.e. a unit root of 2 would suggest differencing over two time steps) to achieve stationarity. If the series remains non-stationary despite differencing over all potential unit roots, the OLS model may still be employed but the possibility of a spurious regression between two or more non-stationary variables must be addressed through cointegration tests (Gujarati 1995).

The time series for the dependent variable, imports per capita (Figure 5.5), was non-stationary in log form based on the Dickey-Fuller (DF) test for time series with and without trends and up to four lags (unit root of order 4) (DF test statistic of |-1.29| < DF critical value of |-3.08| for no trend and DF test statistic of |-3.52| < DF critical value of |-3.76| for trended). Differencing was explored for this and all other non-stationary time series identified below, but a clear unit root could not be identified for any of the non-stationary series, and stationarity could not be achieved.

The explanatory variables representing income and spending were also examined (Figure 5.6). Mainland disposable income per capita, which shows anomalously high values in January or February each year due to Chinese New Year bonuses when plotted on a monthly or quarterly basis, showed a more stable upward trend when plotted on a half-yearly basis. Hong Kong private consumption data indicates that spending is highest in the fourth quarter of each year contributing to higher half-yearly values in the second half of each year, perhaps reflecting anticipation of the Lunar New Year holiday. Mainland retail food expenditure data were not available prior to 1994 but also showed higher second half spending possibly resulting from restaurant closures during the Chinese New Year affecting first half receipts. The value of Hong Kong restaurant receipts declined during the period without demonstrating seasonal trends. In both of the Hong Kong datasets, the effects of the Asian financial crisis are visible beginning in early 1998. The Asian financial crisis did not exert as strong an influence on the Mainland economy (Wang 1999) and its effects are not apparent in either of the Mainland datasets.

In terms of stationarity, the Mainland disposable income data series was stationary in log form when a trend was included (|-8.18| > |-3.76|), as was the log form of the Mainland food expenditure time series (|-8.56| > |-3.76|). Hong Kong private consumption and Hong Kong restaurant receipts in log form were non-stationary both with (|-2.82| < |-3.76|

and |-2.31| < |-3.76|) and without a trend (|-2.93| < |-3.08| and |-2.92| < |-3.08|), respectively.

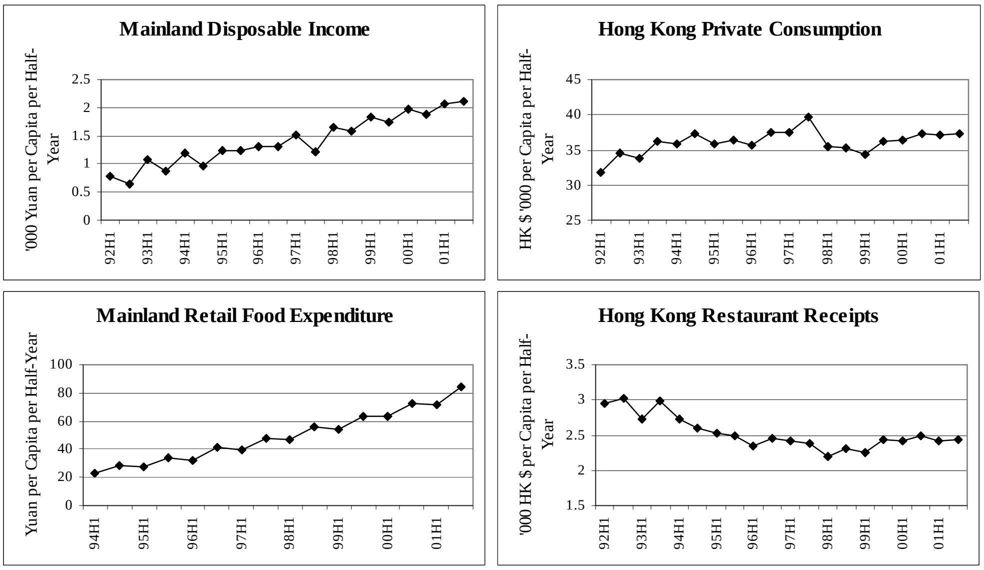

Figure 5.6 Time series for Hong Kong and Mainland variables relating to income and consumer spending at half-yearly intervals. All data are in constant 1990 prices. Mainland data were compiled for urban areas only.

Plots of the other explanatory variables illustrate less strongly trended time series (Figure 5.7). Prices of shark fin show no clear time trend and cannot be interpreted using existing information. The price data series is non-stationary in log form (DF of |-2.34| < |-3.08| with no trend). Chinese yuan to United States (US) dollar exchange rates exhibit a step function reflecting China's scrapping of separate foreign exchange currency in January 1994 (Kaye 1994) and are stationary (DF of |-6.08| < |-3.76| with no trend). Prices of the substitute good, garoupa, decline with time and are non-stationary in log form (DF of |-1.55| < |-3.76| with a trend, DF of |-2.34| < |-3.08| with no trend). Hong Kong dollar to US dollar exchange rates show a pronounced increase over the period 1999-2000, however the net change is very small due to a peg between the two currencies (Kueh and Ng 2002) and the series is non-stationary (DF of |-1.24| < |-3.76| with a trend, DF of |-0.56| < |-3.08| with no trend).

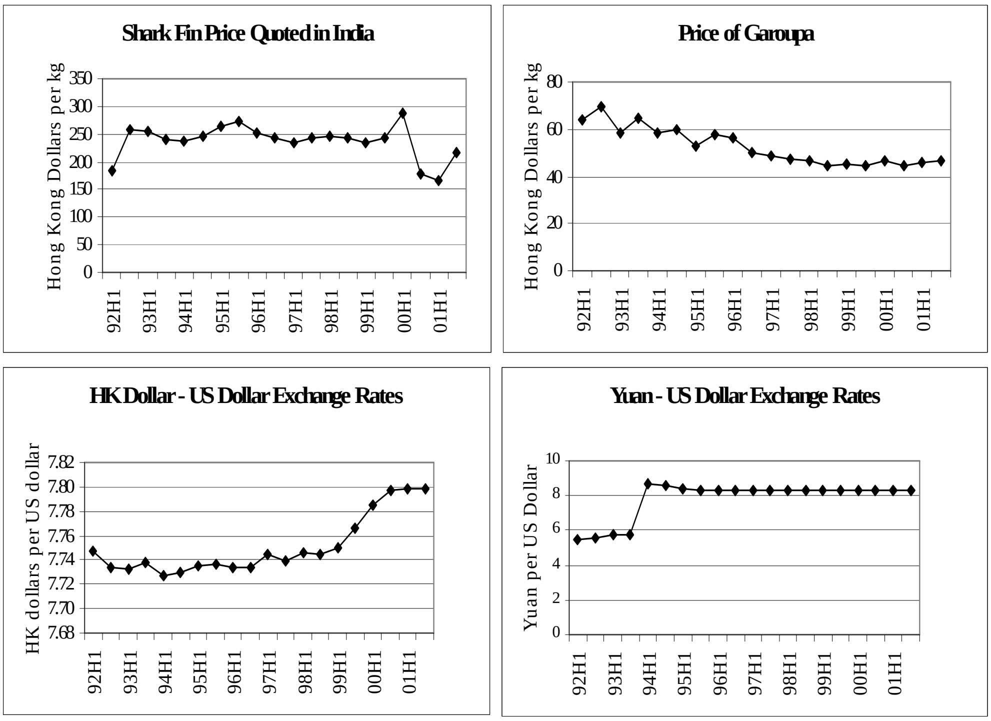

Figure 5.7 Time series for Hong Kong and Mainland variables relating to prices and exchange rates at half-yearly intervals (note restricted y-axis in Hong Kong dollar – US dollar exchange rates results from limited fluctuation of pegged Hong Kong dollar). Price data in constant 1990 prices.

5.2.6 Model Specification, Estimation and Interpretation

In selecting the functional form of the model, consideration was given to the limited number of degrees of freedom as well as ease of interpretation of results. The Cobb-Douglas production function, a double-log model, is useful functional form in such cases because it removes effects due to inconsistent variable units and allows model coefficients to represent elasticities. An ordinary least squares (OLS) estimation of the Cobb-Douglas model was selected on the basis that it is commonly used for demand functions, and is straightforward in application and interpretation. However, the OLS formulation requires that several underlying assumptions are met, and these assumptions are discussed in the context of this model below (Maddala 2001, Gujarati 1995).

OLS models require that all variables must be exogenous, or independent of each other. This is considered to be true for price variables utilised in this study on the basis that the shark fin market fits the definition of a perfectly competitive market[2], and thus prices are neither determined by, nor a determinant of, other variables. The shark fin market is also small in scale relative to the economy of Hong Kong and the Mainland; it is thus not expected to influence measures of consumer spending such as restaurant receipts, disposable income or private consumption.

Another concern when using an OLS model is that there is no autocorrelation (serial correlation) between the explanatory variables and the error term of the model. This is particularly important in autoregressive specifications (i.e. where a lagged value of the dependent variable is used as an explanatory variable) and special tests are required to distinguish this form of autocorrelation. If such a correlation is observed, the OLS model cannot be validly applied. Since most economic time series exhibit a high degree of correlation between successive values, autocorrelation within individual time series is often another major concern.

Perhaps the most critical assumption of the OLS estimation is that the data series are stationary. If the data series are non-stationary, the regression may be spurious due to violation of the OLS assumption of homoscedasticity of variance. It is, however, possible to apply non-stationary variables in the regression model as long as the residuals of the model are stationary. In this case, the regression is considered to be cointegrated and not spurious.

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[2] A market is considered to be perfectly competitive when four conditions hold: 1) there are many buyers and sellers; 2) there are no different product brands; 3) there is free entry and exit; and 4) consumers and sellers are considered to have perfect information about the product and the market price (Eastwood 1985).

The theoretical model defined in Equation 5.1 was specified using the OLS estimation of the Cobb-Douglas model, and the available datasets, as follows:

$$Y_t = \beta_0 Y_{t-1}^{\beta_1} Y_{t-2}^{\beta_2} P_t^{\beta_3} I_t^{\beta_4} C_t^{\beta_6} S_t^{\beta_7} E_t^{\beta_8} D_t^{\beta_{10}} e^{ut} \qquad \text{(Eq. 5.3)}$$

where *Y* is per capita imports of adjusted unprocessed shark fin to Hong Kong,

P is price of shark fin delivered to Hong Kong,

I is Mainland disposable income per capita,

C is Hong Kong private consumption per capita

S is the retail price of garoupa in Hong Kong,

E is the exchange rate for Chinese yuan against the US dollar,

D is a seasonal dummy for the first half of each year,

e is the base of the natural logarithm,

u is the stochastic disturbance term,

subscript *t* indicates the time period, and

β represents constants such as the intercept and variable coefficients.

Log-transforming this model gives the functional form applied here:

$$\begin{aligned} \ln Y_t = \beta_0 + \beta_1 \ln(Y_{t-1}) + \beta_2 \ln(Y_{t-2}) + \beta_3 \ln(P_t) + \beta_4 \ln(I_t) + \beta_5 \ln(C_t) \\ + \beta_6 \ln(S_t) + \beta_7 E_t + \beta_8 D_t + u_t \qquad \text{(Eq. 5.4)} \end{aligned}$$

All variables were transformed by natural logarithm except for exchange rates (*E*), which already represent rates, and the dummy variable (*D*) which is a constant (0 or 1). The coefficients of *E* and *D* therefore represent semi-elasticities rather than elasticities.

This approach begins with a general model which is iteratively simplified until only essential explanatory variables remain. This model does not, however, specify lags on all variables due to the potential for double-counting the effects of a single explanatory variable by including it more than once in the general model. First and second order lags on imports (*Y*) were however specified, based on theory, to account for the potential effects of consumer purchasing habits, or trader stocking contracts or routines. Based on the observed rapid turn-over of inventory in the shark fin market, and the half-yearly periodicity of the data, two lags on imports (*Y*) were considered sufficient.

This model assigns separate variables to represent income or spending in Mainland China (*I*) and Hong Kong (*C*). The use of these variables and also restaurant receipts in either economy would violate economic theory, as well as the assumption of exogeneity, due to double-counting of spending and an expected correlation between income/spending and restaurant spending. Therefore, only Mainland disposable income and Hong Kong private consumption were selected for the model as they better represent broad economic trends and are available for the full period 1992-2001. Although one variable is a measure of income (*I*) and the other is a measure of spending (*C*), they are indicators in separate economies and are not expected to be correlated. The dummy variable (*D*) was included in the model to account for observed seasonal cycles in Mainland disposable income and Hong Kong private consumption.

Single price variables for shark fin (*P*) and the substitute (*S*) were specified since there is considered to be a single supply chain for these products extending through Hong Kong and the Mainland. However, to allow for potential disparities in purchasing power between the two economies, a variable representing exchange rates was included in the model (*E*). Given the currency peg between the US dollar and the Hong Kong dollar, it was considered that fluctuations between these two currencies need not be accounted for, therefore only Chinese yuan to US dollar exchange rates were included in the model.

This model was tested against the data using Microfit (v. 4.0) software (Pesaran and Pesaran 1997). The results indicated the model was significant and demonstrated no misspecification errors (Table 5.2). A plot of actual and predicted values indicates that the model fits the long-term trend in the data but does not always predict the short-term variations in demand (Figure 5.8). The difference between the r-squared (0.88) and adjusted r-squared (0.77) values indicates that this general model is over parameterized, since the goodness of fit statistic decreases when the degrees of freedom in the model is taken into account.

None of the coefficients in the model are statistically significant (Table 5.2). This result suggests that either none of the explanatory variables are informative, or unnecessary variables in the model are obscuring the influence of actual determinants. The latter possibility was investigated by iteratively removing variables with large (non-significant) probabilities, small coefficients, and/or for which the theoretical basis for variable inclusion was weak, following a modified Hendry approach (Hendry and Richards 1983). After each iteration, the model was re-tested for validity and misspecification errors using F-tests for serial correlation, functional form, and heteroscedasticity, and χ^2 tests for normality. Durbin's *h* test was also applied to test for serial correlation between the dependent variable and its lags, which if present would violate the assumption of exogeneity. The model simplification exercise did not proceed if any of the tests indicated significant violations of the assumptions.

Table 5.2 Model of per capita imports of unprocessed shark fin to Hong Kong (*Y*), where *P* = price of shark fin delivered to Hong Kong, *I* = per capita disposable income in Mainland China, *C* = per capita private consumption in Hong Kong, *S* = retail price of garoupa, a potential substitute, *E* = exchange rates of Chinese Yuan to the US dollar, and *D* = first half-year seasonal dummy. Note that the adjusted R^2, $\overline{R}^2$, adjusts for the degrees of freedom in the model and is calculated according to the formula:

$$\overline{R}^2 = 1 - \left[\left(\frac{SS_{error}}{df_{error}} \right) / \left(\frac{SS_{total}}{df_{total}} \right) \right]$$

Model	$\ln(Y_t) = \beta_0 + \beta_1 \ln(Y_{t-1}) + \beta_2 \ln(Y_{t-2}) + \beta_3 \ln(P_t) + \beta_4 \ln(I_t) + \beta_5 \ln(C_t) + \beta_6 \ln(S_t) + \beta_7 (E_t) + \beta_8 (D_t) + u_t$			
Regressor	**Coefficient**	**S.E.**	**t-ratio**	**p-value**
Intercept	-20.451	12.659	-1.616	0.141
Y_{t-1}	0.048	0.334	0.144	0.889
Y_{t-2}	0.141	0.355	0.397	0.701
P_t	0.214	0.204	1.048	0.322
I_t	0.567	0.373	1.521	0.163
C_t	0.951	0.822	1.157	0.277
S_t	0.061	0.395	0.155	0.880
E_t	-0.008	0.041	-0.199	0.847
D_t	-0.055	0.052	-1.051	0.321

Statistics	
R^2 = 0.87684	F –statistic (8, 9) = 8.0097 [0.003]
$\overline{R}^2$ = 0.76737	S.E. of Regression = 0.081744
RSS = 0.060139	S.D. of Dependent Variable = 0.16948
Durbin-Watson *d* statistic = 2.0438	
Diagnostics	
Serial Correlation:	F (2, 7) = 0.33205 [0.728]
Functional Form:	F (1, 8) = 0.76077 [0.409]
Normality:	$\chi^2(2)$ = 0.51917 [0.771]
Heteroscedasticity:	F(1,16) = 0.15173 [0.702]

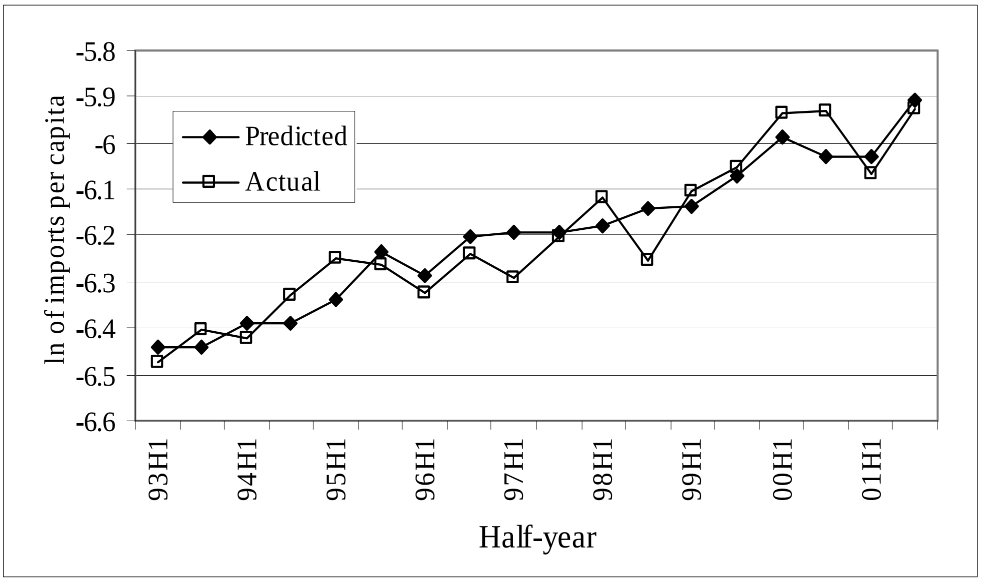

Figure 5.8 Plot of actual and predicted values from the full model of imports per capita with explanatory variables of lagged imports, price, Mainland disposable income, Hong Kong private consumption, price of garoupa (substitute), Chinese yuan-US dollar exchange rates and a seasonal dummy.

As indicated by the results for the full model (Table 5.2 and Table 5.3, Model I), the first lag on imports (Y_{t-1})displayed the highest p-value of all the variables as well as a small coefficient within one standard error of zero. The existence of habit would create an expectation that an increase in previous imports of shark fins would lead to an increase in future imports, thus a positive coefficient is anticipated and observed. However, on the basis of non-significant coefficient, the first lag on imports was removed from the model (Table 5.3, Model II).

The exchange rate variable was the next variable examined based on its high p-value and its near-zero coefficient. The exchange rate variable's sign is negative as expected since if the value of the Chinese yuan deflates (i.e. the exchange rate increases), the quantity demanded should decline. However, the theoretical basis for inclusion of exchange rates

Table 5.3 Results of the model simplification exercise. Each cell gives the coefficient, its standard error (in parentheses) and the p-value indicating its significance (in brackets). *Y* = imports per capita, *P* = price of shark fin, *I* = per capita disposable income in Mainland China, *C* = per capita private consumption in Hong Kong, *S* = retail price of garoupa, a potential substitute, *E* = exchange rates of Chinese Yuan to the US dollar, and *D* = first half-year seasonal dummy.

Model	Intercept	$\ln Y_{t-1}$	$\ln Y_{t-2}$	$\ln P_t$	$\ln I_t$	$\ln C_t$	$\ln S_t$	$\ln E_t$	$\ln D_t$
I	-20.451 (12.659) [0.141]	0.048 (0.334) [0.889]	0.141 (0.355) [0.701]	0.214 (0.204) [0.322]	0.567 (0.373) [0.163]	0.951 (0.822) [0.277]	0.061 (0.395) [0.880]	-0.008 (0.041) [0.847]	-0.055 (0.052) [0.321]
II	-21.071 (11.302) [0.092]	removed	0.136 (0.336) [0.694]	0.204 (0.182) [0.289]	0.596 (0.296) [0.071]	0.964 (0.776) [0.242]	0.064 (0.375) [0.869]	-0.010 (0.037) [0.797]	-0.057 (0.048) [0.267]
III	-19.131 (8.210) [0.040]		0.190 (0.254) [0.471]	0.204 (0.174) [0.268]	0.550 (0.226) [0.033]	0.843 (0.599) [0.187]	0.046 (0.353) [0.899]	removed	-0.055 (0.046) [0.253]
IV	-18.511 (6.417) [0.014]		0.201 (0.229) [0.396]	0.204 (0.167) [0.246]	0.525 (0.121) [0.001]	0.825 (0.558) [0.165]	removed		-0.053 (0.042) [0.223]
V	-20.046 (6.121) [0.006]		removed	0.138 (0.148) [0.367]	0.609 (0.073) [0.000]	0.828 (0.553) [0.158]			-0.066 (0.039) [0.115]
VI	-17.748 (5.579) [0.007]			removed	0.579 (0.066) [0.000]	0.702 (0.534) [0.210]			-0.064 (0.039) [0.117]

was relatively weak since the currency value over the timeframe of the model was generally stable. Once the exchange rate variable was removed and all model diagnostics were checked, the statistical significance of the current value of Mainland disposable income became apparent (Table 5.3, Model III).

The coefficient on substitute prices (*S*) is positive as expected since as substitute prices increase, the quantity demanded of shark fin should also increase. Despite this, the price of the substitute was the next variable selected for removal on the basis of an highly non-significant p-value and a coefficient within one standard error of zero (Table 5.3, Model IV). The second lag of imports (Y_{t-2}), which also showed a high p-value and a coefficient within one standard error of zero, was then deleted (Table 5.3, Model V). Notwithstanding its theoretical relevance, price of shark fin was next deleted as it displayed a clearly non-significant p-value and was within one standard error of zero. Furthermore, according to theory, the price and quantity demanded of a good should have opposite signs, but the coefficient of price is positive in this model (Table 5.3, Model VI). The removal of price from the equation implies that the effects of price on demand are constant and represented in the model by the intercept term.

The resulting model (Table 5.3, Model VI) comprised three variables: a significant Mainland disposable income term (*I*), and marginally non-significant Hong Kong private consumption (*C*) and seasonal dummy (*D*) terms (Table 5.4, Figure 5.9). The signs on Mainland disposable income (*I*) and Hong Kong private consumption (*C*) are positive and consistent with theory since increases in income and spending should cause imports to rise. The sign of the seasonal dummy is negative indicating that imports are lower in the first half of the year. This result corresponds to an anticipated pattern of higher imports in the autumn in order to prepare for the Chinese New Year holiday season in January-February. Deleting either of the two non-significant variables (*C* or *D*) changed the

Table 5.4 Model of per capita imports of unprocessed shark fin to Hong Kong (*Y*) based Mainland disposable income (*I*), Hong Kong private consumption (*C*) and a seasonal dummy (*D*).

Model	$\ln(Y) = \beta_0 + \beta_1\ln(I_t) + \beta_2\ln(C_t) + \beta_3(D_t) + u_t$			
Regressor	**Coefficient**	**S.E.**	**t-ratio**	**p-value**
Intercept	-17.748	5.579	-3.181	0.007
I_t	0.579	0.066	8.814	0.000
C_t	0.702	0.534	1.314	0.210
D_t	-0.064	0.039	-1.671	0.117
Statistics				
R^2 = 0.858		F –statistic (3,14) = 28.3329 [0.000]		
$\overline{R}^2$ = 0.828		S.E. of Regression = 0.702		
RSS = 0.069056		S.D. of Dependent Variable = 0.16948		
Durbin-Watson *d* statistic = 2.1465				
Diagnostics				
Serial Correlation		F (2, 12) = 0.20631 [0.816]		
Functional Form		F (1, 13) = 0.70553 [0.416]		
Normality		$\chi^2(2)$ = 0.44800 [0.799]		
Heteroscedasticity		F(1, 16) = 0.40903 [0.532]		

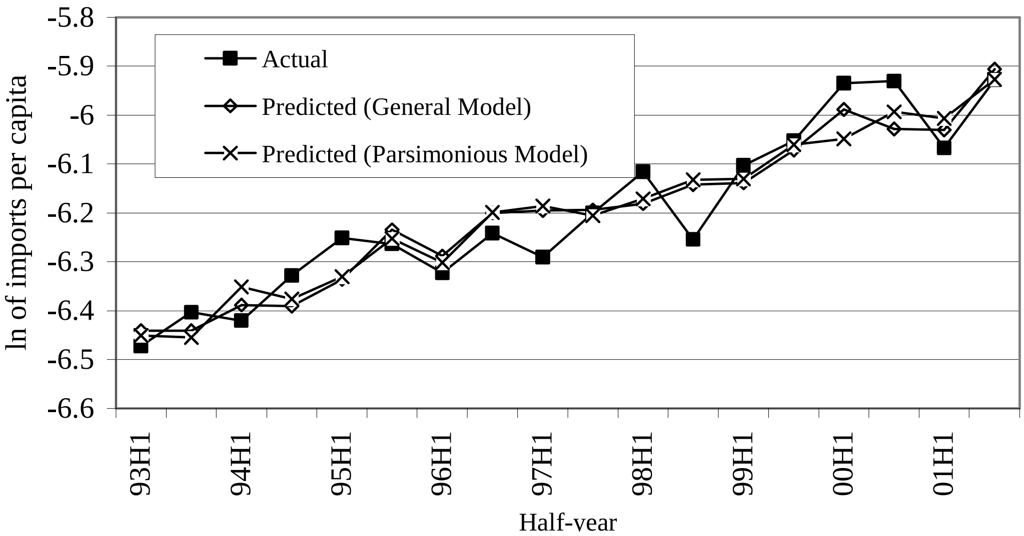

Figure 5.9 Plot of actual values, predicted values from the general model (see Figure 5.8), and predicted values from the parsimonious model of imports per capita with explanatory variables Mainland disposable income, Hong Kong private consumption and a seasonal dummy.

coefficient and resulted in a significant (α=0.05) p-value for the other previously non-significant variable. Therefore all three variables were believed to be contributing meaningful information to the model and were retained. The overall model was significant with no evidence of misspecification and an $\overline{R}^2$ of 0.828.

Of the three variables, Mainland disposable income (*I*) demonstrated the highest significance (p=0.000) and the lowest coefficient of variation (i.e. standard error/estimator or 0.066/0.579 = 0.114), and was considered a highly robust regressor. The influence of Hong Kong private consumption (*C*) on imports was less clear due to a higher p-value (0.210) and a higher coefficient of variation (0.534/0.702 = 0.761). A 95% confidence interval for the coefficient of *C* was calculated under the null hypothesis that the elasticity of *C* equals the elasticity of *I*. This confidence interval is given by:

$$\Pr\left[\beta^* - t_{\alpha/2} se(\hat{\beta}) \le \hat{\beta} \le \beta^* + t_{\alpha/2} se(\hat{\beta})\right] \qquad \text{(Eq. 5.5)}$$

where

β^* is the elasticity (coefficient) of *I*, 0.579

$\hat{\beta}$ is the elasticity (coefficient) of *C*, 0.702

se($\hat{\beta}$) is the standard error of the elasticity of *C*, 0.534

$t_{\alpha/2}$ is the two-tailed t-statistic, in this case, $t_{0.05,16}$=2.120

and is calculated as $-0.553 \le \hat{\beta} \le 1.711$.

This result indicates firstly that the coefficient on Hong Kong private consumption (*C*) is not significantly different from zero and that there is no statistically significant difference between the coefficients of *C* and *I*. These income elasticities suggest that in contrast to reputation and marketing, shark fin is a normal good in both Mainland China and Hong Kong. The coefficient on the dummy variable, though technically non-significant and within two standard errors of zero, appears to play an important structuring role in the model. Removal of the dummy increases the significance and the coefficient on *C* but does not affect the results for *I*.

Since the model regresses one nonstationary time series on another, there is a risk that the regression is spurious. Therefore, testing was conducted to determine whether the deviations in the residuals are stationary and the regression is cointegrated. A simple test for cointegration involves using the augmented Dickey-Fuller (ADF) test for unit roots in the residuals. The fourth order ADF statistic did not exceed the critical value ($|-3.739| > |-5.0542|$), indicating that a unit root is present and therefore the null hypothesis that the residuals are nonstationary (and the regression is thus not cointegrated) cannot be rejected.

Another means of testing for unit roots is to compute the autocorrelation function (ρ), where ρ_k is equal to the covariance at lag *k* divided by the variance, and statistically test whether the values of ρ_k are jointly significantly different from zero. A plot of the autocorrelation function (Figure 5.10) suggests that from lag 1 onward, with the exception of a slight increase at lag 7, ρ_k is near zero.

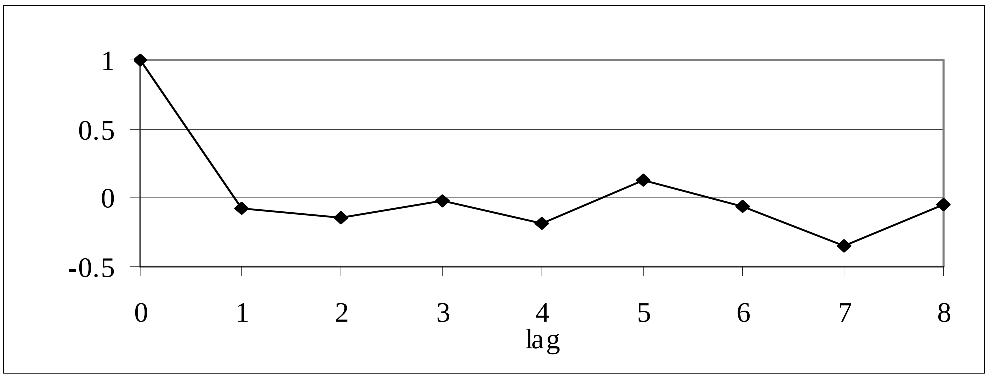

Figure 5.10 Plot of autocorrelation function (ρ) of the residuals from the simplified model (Table 5.4) against 8 lags. The reduction of ρ to near zero at the first and subsequent lags is consistent with the hypothesis that the residuals are stationary.

This suggestion was formally tested using the Box-Pierce Q and Ljung-Box statistics calculated as follows (Gujarati 1995, Pesaran and Pesaran 1997):

$$Q = n\sum_{k=1}^{m}\hat{\rho}_k^2 \sim \chi_m^2 \qquad \text{(Eq. 5.6)}$$

$$LB = n(n+2)\sum_{k=1}^{m}\left(\frac{\hat{\rho}_k^2}{n-k}\right) \sim \chi_m^2 \qquad \text{(Eq. 5.7)}$$

where

n is the number of observations, 18

m is the total number of lags, 8

k is the lag number

$\hat{\rho}_k$ is the autocorrelation function at each lag, and

χ^2_m is the value of the chi-squared distribution at m degrees of freedom.

Both statistics test the joint null hypothesis that all of the autocorrelation functions for the residuals are not statistically significant from zero (Table 5.5). Although the Ljung-Box test is believed to be more robust than the Box-Pierce Q test at low sample sizes, the null hypothesis could not be rejected by either test (p-values of 0.876 and 0.621, respectively for eight lags). These results provide evidence that the residuals of the simplified regression model do not have a unit root (i.e. are stationary) and thus the model is cointegrated.

Table 5.5. Autocorrelation coefficients for 8 lags, their standard errors, and the test statistics and p-values for the Box-Pierce and Ljung-Box tests of the null hypothesis that all ρ_k, from 1 to k, are equal to 0.

Lag (k)	Autocorrelation Coefficient (ρ)	Standard Error	Box-Pierce Statistic [p-value]	Ljung-Box Statistic [p-value]
1	-0.07663	0.236	0.106 [0.745]	0.124 [0.724]
2	-0.14971	0.237	0.509 [0.775]	0.629 [0.730]
3	-0.01714	0.242	0.514 [0.916]	0.636 [0.888]
4	-0.19129	0.242	1.173 [0.883]	1.577 [0.813]
5	0.12761	0.250	1.466 [0.917]	2.028 [0.845]
6	-0.06152	0.254	1.534 [0.957]	2.141 [0.906]
7	-0.34906	0.255	3.728 [0.811]	6.129 [0.525]
8	-0.05440	0.280	3.781 [0.876]	6.235 [0.621]

In summary, these analyses have demonstrated a strong relationship between disposable income in Mainland China and market demand for shark fin, as indicated by imports of unprocessed shark fin into Hong Kong. This result is highly significant ($p = 0.000$) with an income elasticity of 0.579, indicating that for every 1% increase in income the demand for shark fin will increase by 0.58%. The model also describes weaker, though still valid, relationships between demand for shark fins and consumer spending (private consumption) in Hong Kong. The point estimate of elasticity (0.702) is higher than for disposable income in the Mainland, but the two coefficients are not significantly different at α=0.05. Finally, the model identifies a seasonal effect matching a pattern of increasing imports in the second half of the year to prepare for a peak in consumption at the Chinese New Year holiday in January/February.

5.3 Survey of Hong Kong Traders' Business Practices and Attitudes

Although the shark fin market is undoubtedly driven by economic factors, the business practices and attitudes of traders also determine key market features. Therefore, in order to provide a more complete analysis of market pressures and responses, surveys of dried seafood traders in Hong Kong were conducted to determine at which points in the supply chain, and to what degree, dealers were aware of and sensitive to resource depletion or regulation. Survey results complement the quantitative findings of the econometric modelling by providing a qualitative means of characterizing both the responsiveness, and the likely form of response, to various market pressures. This section summarises a more detailed discussion of the findings contained in Clarke (2002).

During the period June-August 2001, a total of 69 dried seafood importers, wholesalers and retailers in the Sai Yin Pun district (see Figure 3.2) were observed during reconnaissance surveys to determine the diversity of products traded. A previous research project (Chan 1997) identified 50 shark fin businesses in Sai Yin Pun, and the tally of 52 establishments dealing in shark fin in this study suggests that the number of shark fin traders has not greatly increased in the past 5 years. Of the 69 businesses observed, 23 agreed to participate in structured interviews. The interviews, consisting of 27 questions (Appendix 4), were conducted verbally at seven shark fin, five abalone, five bêche-de-mer (sea cucumber), two fish maw (swim bladder), and four dried fish wholesale and retail establishments (see Clarke (2002) for product background). One of the shark fin respondents was among the 16 firms that auctioned shark fins (Chapter 2), but reluctance on the part of many of the larger shark fin dealers to cooperate with this study led to a broadening of the interview base to encompass all types of dried seafood merchants.

The most salient feature of the Hong Kong dried seafood trade emerging from the interview results is its pre-occupation with the sales side of the business and its limited knowledge of the resources from which the products derive. While many dealers were well-informed about product processing and resulting forms and grades, very few exhibited any knowledge of the biology of the organisms, the methods of capture, or whether populations were stable or declining. Although they are purveyors of luxury foodstuffs, the interview participants generally demonstrated little interest in the use of the products and did not articulate why certain products were desirable other than commenting on their sales performance.

In contrast, all firms were able to describe the factors they felt were contributing to the current (i.e. summer 2001) low levels of consumer demand for dried seafood. A majority of firms (n=21) cited either the downturn in the regional economy and/or seasonal cycles which follow the holiday calendar and traditional times for eating certain foods as the most important factors. Only four firms suggested that prices, or tariffs for those re-exporting goods to Mainland China, had a large influence on demand, and only one dealer mentioned product supply or quality. This fixation on demand, at the expense of supply issues, assists in explaining why only a few of the interviewed firms (n=2) involve themselves in the financing or operation of overseas harvests. In the cases where this does occur, traders suggested their motives were to prevent being outbid by competing traders for raw products, or to expand their operations and increase profits, rather than any perceived or anticipated decline in the buyer's market for raw product over time.

The structure and size of any given business was found to be determined by the proprietor's attitude toward business risk, the ability to establish and maintain trading relationships with overseas suppliers, and the ability to advance capital for product purchase. Of the 23 interviewed firms collectively dealing in shark fin, abalone, bêche-de-mer, fish maw and dried fish products, 7 specialized in one product, whereas 16 traded at least two. Certain products, particularly shark fins, were seen as high profit but high risk commodities due to the need to advance large amounts of cash to suppliers and the considerable potential for fraud under such circumstances. While some firms choose to specialise in these potentially high-margin goods, others prefer to spread their risk by offering a range of goods thereby providing a buffer against fluctuating prices and demand cycles.

The concentration of the dried seafood business in one district of Hong Kong may appear to be at odds with its highly independent nature. This physical proximity, however, provides a sense of security to traders in that they are able to visually track each other's shipments and customers, while still guarding proprietary secrets such as prices and supplier names and addresses (Lam 1990). Most dealers purchase goods with cash and often do not have the opportunity to inspect the goods before purchase. Therefore, relationships with distant suppliers are the foundation of their business and once trust is established, dealers endeavour to guard information about suppliers from competitors in Hong Kong.

The simple nature of dried seafood products appears to discourage innovation within the trade. Aside from use of the latest communication technologies to allow instantaneous contact with overseas suppliers when necessary, traders rarely use computers for business management or the internet for communication or advertising. The intensive focus on protecting suppliers and key purchasing clients, leads to a self-focused business outlook: very few traders (n=6) were able to estimate their share of the Hong Kong market or to contextualise the Hong Kong market within the world trade.

These characteristics also contribute to a largely passive attitude toward external factors influencing the trade. Participants were given a list of potential constraints and asked to identify those which apply to their business. Of the 23 firms surveyed, 20 identified 'lack of demand' as the key constraint to their business success. The second most commonly articulated factor (n=5) was Mainland China regulations and customs tariffs. Aside from the tariff issues, most interviewed traders claimed to be unconcerned by current or potential regulations or conservation campaigns. In response to a separate, specific query, only two respondents (both of them shark fin traders) indicated a knowledge of any current regulations applying to their trade, although five firms (all of them shark fin traders) acknowledged that future regulations could impact their businesses. When asked to comment on a hypothetical scenario of regulatory impacts on their business, almost all of the respondents (n=22) indicated they would do nothing, switch to a product that is not regulated (including switching to an unregulated source of the same product), or simply raise the price. Only one trader stated he would participate in lobbying against potential regulations.

Trader attitudes demonstrated a prioritisation of maintaining the business cash flow over any loyalty to the industry per se. Although nine of the 23 firms interviewed stated the business was family-owned, and many of these had been operating for 30-70 years, none of the respondents replied affirmatively to a question asking whether they expected their children to carry on in the business. In fact, several dried fish traders (n=4) stated they actively discouraged their children from entering the trade as they believed the outlook for the future was not positive. While this finding appears to contradict the general trend of shark fin trade expansion in recent years, the short-term focus of most traders, in combination with the poor economic climate at the time of the survey, may have contributed to this gloomy outlook. Some traders have also been known to express distaste for the smell and the long hours involved in the dried seafood business, and this may also contribute to a lack of interest in continuing the business indefinitely.

The trade profile that emerges from these interviews is one of highly independent, conservative, and self-focused merchants who are orientated toward short-term gains and largely unconcerned with supply issues including resource sustainability and potential regulation. These findings suggest that trade volumes would be most directly influenced by shifts in consumer demand, rather than by calls for voluntary self-regulation. Limits on supply, such as conservation-based harvest or trade restrictions, particularly if global in scope, might cause some traders to divert to more sustainable products. However, opportunities to circumvent such supply obstacles, especially in unregulated fisheries, would be likely to tempt recalcitrant traders to continue with their current business practices.

5.4 Discussion

Despite limited access to relevant data, and a highly simplified approach to a complex and somewhat arcane market, a relationship between imports of shark fin and disposable income and spending in China (the Mainland and Hong Kong) has been identified. The usefulness of the model in predicting future demand for shark fin depends on the ability to predict future values of income and spending in China. Once additional data become available, this relationship can be further explored and a more definitive link between income and imports can emerge through, for example, predictive failure testing of the model using a longer time series. Based on the limited time series available in this analysis, price of shark fin was not found to be a significant factor in market demand. This may, however, be due to the quality of existing price data, and should be re-examined if better price data become accessible. The model's ability to account for singular events affecting the shark fin trade may benefit from the inclusion or substitution of new variables. For example, the utility of restaurant spending as an explanatory variable could be re-examined, or the use of an additional dummy variable considered, in view of the major impacts on the catering industry, and presumably the shark fin trade, of the recent Severe Acute Respiratory Syndrome (SARS) outbreak.

The influence of Mainland disposable income on demand for shark fin is more significant in the model than is the influence of consumer spending in Hong Kong. This result may be due to the considerably larger size of the economy in the Mainland and the proportionally stronger influence it exerts to the shark fin market. As the Mainland economy continues to expand and to become more integrated into international markets, and with increasing urbanization in the Mainland providing greater access to shark fin products, existing differences between Hong Kong and Mainland markets are likely to diminish. This expectation, in combination with the observed similarity of the income and spending elasticities for shark fin demand in this model, suggest that the Chinese market for shark fin can be considered as a single entity. In this sense, income and spending patterns in the Mainland, home to nearly 1.3 billion Chinese, will be the most important influences on this integrated market.

Several studies of consumer behaviour and spending patterns support the linkage identified in this analysis between disposable income and spending on goods such as shark fin. Estimates released in the early and mid 1990s predicted that as incomes increased, per capita rice and grain consumption in Mainland China would decrease and be replaced in the diet by meat and seafood (Peterson et al. 1991, Beijing Review 1996). Disregarding price effects, seafood consumption per se was predicted to grow by 31% between 2000 and 2010 to 38.9 kg per capita per annum (Beijing Review 1996), 1.8 times higher than per capita values in the United Kingdom and the United States in 2000 (FAO

2002). Survey research in the mid 1990s also observed that rising incomes paralleled a rapid growth in sales of medicinal products, with Chinese medicines and health tonics comprising 30% of the growth (Li 1998). Since many Chinese believe that shark fin provides health benefits (Phipps 1996), increased demand for both seafood and traditional tonics may be fuelling growth in shark fin imports.

With China's current Five Year Plan calling for quadrupling gross domestic product between 2000 and 2020 (Lawrence 2002), strong trends in consumer spending on a per capita basis, in combination with an inevitable increase in population, are likely to draw an ever-increasing proportion of marine products into the Chinese market. The implications of China's economic growth and consumer spending patterns for the utilisation of high-end fisheries resources such as shark fins will depend on several factors including the constancy of consumers' spending priorities, the ability of supplies to keep pace with demand, and potential changes in consumers' awareness of conservation issues.

One theory of consumer behaviour in China suggests that as the Mainland economy develops, consumers will be become more rational or conservative, in their spending habits. It is believed that this factor, in combination with the withdrawal of State-sponsored housing benefits, will result in reduced expenditures on luxury goods and more channelling of income into housing, insurance, pension plans and savings (Li 1998). In support of this scenario, some analysts have questioned whether high measures of consumer confidence in China are masking mounting concerns regarding increasing unemployment and the escalating costs of medical care and education (CEQ 2002).

If shark fins become scarce due to supply constraints and price increases occur, consumers may be prompted to shift to alternative products. This could lead more consumers to purchase, knowingly or otherwise, artificial shark fin despite the fact that under current conditions this product is not considered an acceptable substitute (Phipps 1996). The influence of habit on diet composition has been investigated for the Japanese consumer and found to induce strong preferences, even in the face of rising prices, for some food items (Price and Gislason 2001). The extent to which Chinese consumers maintain habit-based preferences has yet to be explored but recent broad-scale changes in product availability may create a greater flexibility in Chinese markets (Beijing Review 1999). Based on the findings of the trader survey in Hong Kong, some traders also appear ready to diversify or change product stocks in response to supply constraints.

Many wildlife protection campaigns, including those for sharks, have cited education as a key element of increasing conservation awareness (Martin 1993, Watts 2001). A recent study of the exotic species trade in Hong Kong found that younger and better educated survey respondents were more likely to support wildlife conservation and it recommended that future education efforts be targeted toward Mainland Chinese immigrants (Lee 1998). Raising consumer awareness of the conservation issues associated with the shark fin trade could act in tandem with other factors to slow the rate of increase in demand.

The dried seafood trader survey portion of this study concluded that while a small minority of dealers is involved in sourcing products overseas, and several are aware of calls for conservation action, all were primarily pre-occupied with short-term impacts to sales and none considered harvest sustainability to be their concern. These results extend little hope for motivating traders to advocate or practice resource conservation as a means of maintaining their trade in the long-term. These same results, however, indicate the trade’s vulnerability to faltering consumer demand. The survey responses revealed that most traders would react to a diminishing market in a passive manner, or would switch to other products, suggesting that consumer behaviour will play a large role in future market dynamics.

5.5 Conclusions

Increased understanding of shark fin trade dynamics and their consequences is an important component in both the appropriate management of shark fisheries and in maintaining a sustainable supply of this traditional product. This theoretical and empirical study of the market demand for shark fin has explored the relationship between the economies of Mainland China and Hong Kong, and the growing trade in shark fins. The results point to an increase in market demand proportional to the increase in disposable income in Mainland China such that if disposable income continues to grow at the current rate (9.8% per annum from 1996-2001), and prices are held constant, the trade will grow by 5.7% per annum. Projection of trends based on Mainland China disposable income is, however, inadvisable given the potential for the rate of growth in disposable income to shift in response to unforeseen economic influences. It is also likely that patterns of consumer spending of disposable income may change with economic development and alter the demand function for shark fin. Traders are expected to react to, rather than initiate market shifts: implementation of regulations in some shark fisheries or markets will prompt some traders to explore new sources of shark fins, while triggering others to shift to existing markets for less problematic products. Finally, according to economic theory, if the supply is fixed, the market would be expected to raise prices in response to an increase in demand and thereby exert a dampening effect on the market. Although further work would be required to draw definitive conclusions about the possible role of other factors influencing market dynamics, these findings have highlighted the importance of the Chinese consumer in shaping the future status of shark resources. This, in turn, suggests that raising consumer awareness of shark resource issues in China is a worthwhile precautionary action.

Forecasting the future impacts of the shark fin trade on shark populations is even more difficult than predicting trends in the shark fin market itself. There is current concern that shark populations cannot sustain existing fishing pressures, and that resource sustainability would be even further compromised by any additional trade growth (Fowler, Reed and Dipper 2002). This issue has been explored in detail in Chapter 4 by estimating the number and biomass of sharks utilised each year in the shark fin trade, and by assessing the sustainability of the current utilisation of blue sharks. Even so, there is still no baseline for quantifying the present impacts of the trade on most shark species. Therefore, any increases in market demand, in China or elsewhere, will only serve to exacerbate existing concerns for vulnerable species and underscore the need for appropriate shark fisheries management.