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Export Demand for Tahitian Black Pearls

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Abstract

French Polynesia exports more than 90 per cent of its pearl production, making it the world's largest exporter of Tahitian black pearls. Tahitian black pearl exports are therefore crucial for the Tahitian economy as they accounted for an average of 50 per cent of total export earnings, for the latest data available, for the years 2004, 2005, and 2006. This means that export performance not only plays a major role in determining the profitability of the Tahitian pearl industry, but also in the growth and development process of the local economy. For this reason, knowing the determinants of the external demand for pearl exports remains crucial for all industry players and policymakers.

In terms of export performance, the aims of this paper are (i) to estimate the price and income elasticities for raw pearl exports, (ii) to estimate the substitution relationships between raw, semi-processed and processed pearl exports, and (iii) to identify what product differentiation needs to be considered.

Empirical findings suggest (i) a price inelastic (-0.42) and income elastic (3.53) export demand for raw Tahitian pearl exports, (ii) cross-price elasticity estimates that are inconclusive, and (iii) the need to support the development of product diversification into value-added processing in each product market.

However, the most significant and unexpected finding from this study is the poor quality of industry data available for analysis. A significantly improved data collection is a matter of extreme urgency.

Keywords: Elasticities, Exports, Market Opportunities, Product differentiation.

Introduction

In many developing countries that have relatively limited access to international financial markets, exports play an important role in the growth process by generating the scarce foreign exchange necessary to finance imports of energy and investment goods, both of which are crucial to capital formation (Senhadji and Montenegro, 1999). This applies also to French Polynesia, for several reasons. First, French Polynesia is a small (population of 269,043 as estimated in 2009) and geographically isolated territory with significant transportation costs for exporting and importing.

Second, French Polynesia's political status is characterized as a "rentier" economy or reliant on aid, and this means it has a relatively high gross domestic product per capita as compared to its Pacific neighbours (Bertram and Watters, 1985). Indeed its GDP per capita was estimated to equal $US 17,500 in 2003 for the latest data available, close to that of New Zealand (Poirine, 1999). French Polynesia, like other Pacific Island economies that have retained close links with Mainland France, is generally richer than those Pacific Islands that have acquired independent status (Bertram, 1999). However, in such economies, aid is sometimes thought to crowd-out export led growth even if there is little evidence in the relevant literature (Fraenkel, 2006).

In the case of French Polynesia, internally generated current account receipts increased from 21 per cent of total foreign exchange receipts in 1999 to 41 per cent in 2001 mainly from tourism and black pearl exports (Fraenkel, 2006; Tisdell and Poirine, 1998). Third, the current political environment which has caused considerable instability has resulted in a will for independence amongst some Tahitian people.

French Polynesia has a history of economic dependence on French public transfers. The dependence on military spending grew during the 1960s and 1970s due to France's atomic-testing activities in the Tuamotu Archipelago, which ended in 1995. Since then, the official strategy, stated in the Pacte de Progrès in 1993, has been to promote export and tourism revenues, as a substitute for French public transfers. The strategy has not, however, been successful because the policy measures necessary to reach this goal have not been implemented. High costs and high prices due to protectionist policies, the high cost of public administration and the Pacific franc's high real exchange rate continue to have negative effects on exports, including tourism (Poirine, 2010).

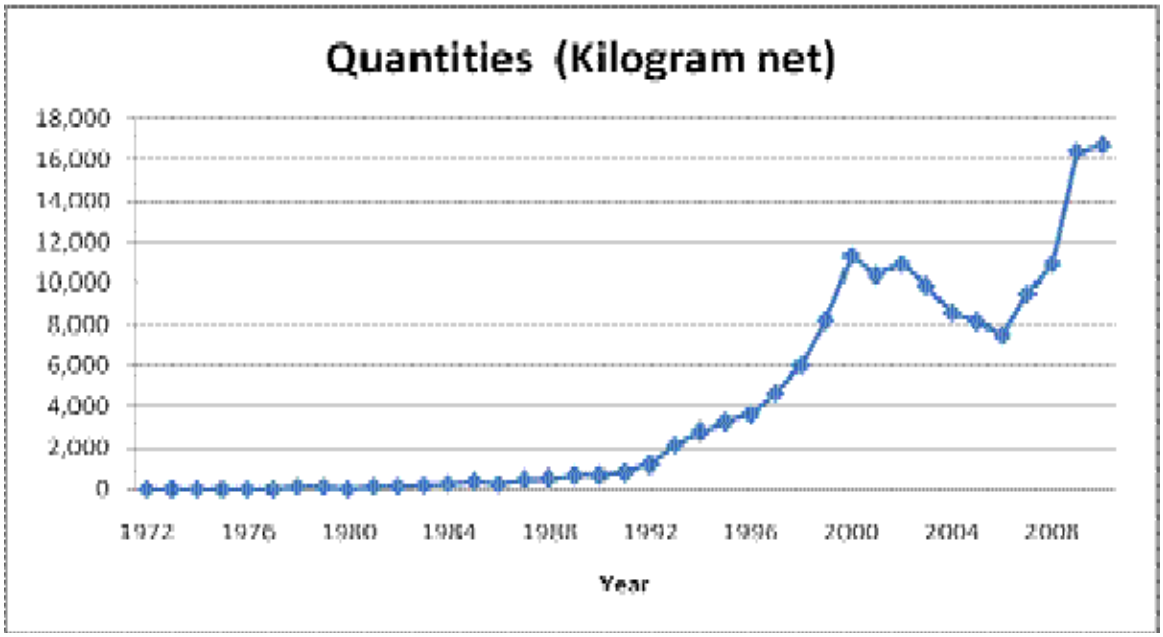
For all those reasons, developing exports represents a major challenge for the economic growth of French Polynesia. In this study we focus on pearl exports from French Polynesia as they represent the largest source of foreign receipts, accounting for more than 50 per cent of total exports (Chamber of Commerce Export Department, 2007; Entrepreneurship in French Polynesia, 2007). The Tahitian pearl industry is relatively young and French Polynesia has only become a recognized pearl producer and exporter in the past two decades.

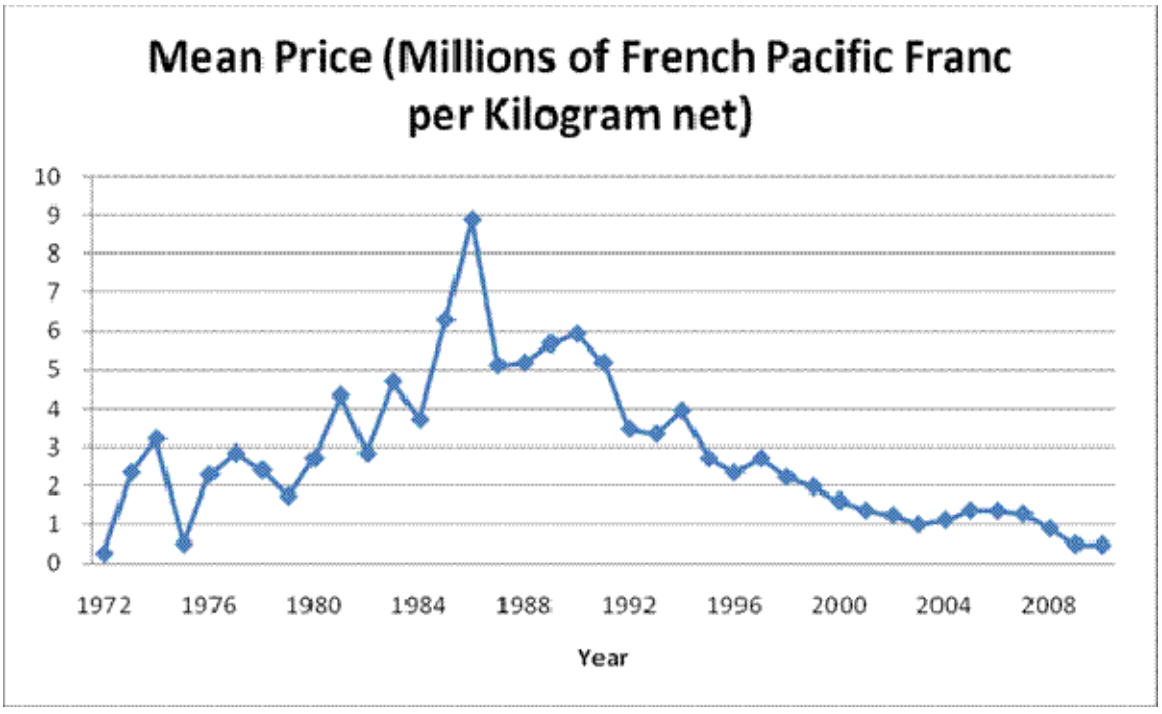
The pearl industry is important at three levels of geographical aggregation. First, at the widest level of all, of the South Pacific Islands, pearls could be a potential income-earning activity for outer islands and for rural areas. Pearls have been exported from French Polynesia since 1975, from the Cook Islands since the early 1990s and from the Marshall Islands since the late 1990s. Second, pearls are economically important for the whole of the French Polynesian territory. They produce more than US$ 40 million/year directly plus the gross economic value from support services of about US$ 200 million (as estimated in 1994 with the latest data available) (Aiavao, 1994). In production terms it produces at least 90 per cent of all of the stock on the market. Third, the pearl industry in French Polynesia at the end of 1980s was booming but the good times did not last, and since 1991 the market has been depressed and prices have fallen considerably and have remained low since 1995. This has brought about bankruptcies and re-structuring in the industry (See Poirine (2001) for details on major restructuring measures.)

The Tahitian pearl industry relies heavily on its exports to be profitable because of the very small domestic market and the changes in export quantities and prices over time (See Figure 1). Indeed,

French Polynesia supplies around 20 per cent of the world's supply of pearls, and almost 90 per cent of all black pearls on the international market.

Figure 1. Tahitian Pearls' Exports: Quantities (weight) and Mean Prices (1972-2010)





Sources: Data supplied by the Tahitian Bureau of Statistics

Raw Tahitian pearl exports are not a homogeneous product, rather a quality mix with differences in the five general criteria classified according to size, weight, shape, quality and colour (GIE Perles de Tahiti, 2005). Their shapes vary from round, semi-round, baroque, semi-baroque, button-shaped, pear-shaped to circled pearls. Their quality depends on the state of its surface and its lustre. Five quality categories exist. The first category being the perfect pearl without any imperfections and an excellent lustre, and the last category (or category D pearls) characterised by more than 60 per cent of light imperfections and minimum lustre. Their colour is not only black as many people still think; they can possess a wide range of colours (grey, white, yellowish, purple, and many others). This offers a very large array of possible differentiation strategies and market niche opportunities.

The export dependence of this industry means that its performance is greatly affected by the ups and downs of the related industries in its major export markets, as well as by what happens in the competitive countries' markets (See Table 1).

Table 1. World Production Value of Cultured Pearls in 2004 (US$)

Type of Pearl and Main Producer	Value (Million US$)	Percentage of Supply
White South Sea Pearls (Australia, Indonesia, Philippines, Myanmar)	220	35
Freshwater Pearls (China)	150	24
Akoya Pearls (Japan)	135	22
Tahitian Pearls (French Polynesia)	120	19
TOTAL	625	100

Source: Based on Anon (2006).

On a global scale we can expect an increase in pearl production as production techniques are mastered and spread to other former non-producing countries. Between the 1920s and 1970s, most cultured pearls found on the market were Japanese Akoya pearls. Thirty years later, the South Sea pearl industry (Australia, French Polynesia, Indonesia, Philippines and Myanmar) is responsible for producing around 50 per cent of the cultured pearls on the market. China's freshwater cultured pearl industry has also become a major competitor producing around 20 per cent of the world supply. Demand, however, though rising, is not keeping pace with skyrocketing production, leaving pearl farmers with unsold inventory driving prices down (Anon., 2006). Therefore, in order to avoid the saturation of the market there is a need for all pearl industry players to control the supply of pearls and to improve strategies to increase demand.

Studies of pearl industries are rare in the academic literature and French Polynesia has seldom been the subject of such studies. This can probably be explained by the difficulty in obtaining accurate statistics for pearl production and export sales. This study, one of the first to be done in this context, estimates the export demand for Tahitian black pearls.

In terms of export performance, the aims of this paper are (i) to estimate the price and income elasticities for raw pearl exports, (ii) to estimate the substitution relationships between raw, semi-processed and processed pearl exports, and (iii) to identify what product differentiation needs to be considered.

Estimating elasticities of demand for a good is commonplace amongst economists and policymakers as it is widely believed to be one of the most important parameters used in policy decisions (Devadoss and Meyers, 1990). Knowledge of price elasticity is also particularly valuable to business, marketing people and producers in general, because it tells them what happens to their total revenue when the product price changes (Swann and McEachern, 2001).

In terms of what product differentiation needs to be considered, the aim of this paper is to draw on our literature review and on our empirical evidence.

To the best of the authors' knowledge, there are very few studies on the responsiveness of the demand for pearls, their price and income. Poirine (2007) estimated an inelastic price elasticity of demand for Tahitian pearls (-0.36) for the period 1980–1999. However, in an update, Poirine suggested a much higher price elasticity (-3.1) for the following period 2002–2005. The policy implications based on the assumption of elastic foreign demand could differ dramatically from those based on the assumption of inelastic foreign demand; so further research is warranted in this area (Duffy *et al*., 1990).

Thus, this study is expected to contribute to the literature by providing new estimations for the price and income elasticities for the export demand of raw Tahitian pearls and useful information for policy makers in government and industry organisations assisting the Tahitian pearl industry to succeed in today's highly competitive market environment.

The rest of the paper is organised as follows. In the next section we present a brief review of the literature. Then, data and methodology are discussed, followed by a discussion of the empirical results and policy implications.

An Overview of the Literature

Estimating elasticities of export demand is an important research issue in both marketing and applied economics in the context of international trade. These estimates help researchers to better understand consumer behaviour and are frequently used to establish firm or industry level marketing strategies and appropriate government policies (Chung *et al*., 2005). Empirical studies on export demand have been studied on two levels: macroeconomic studies looking for the total export demand for a particular country in order to determine implications for exchange rates and currency fluctuations, and microeconomic studies using disaggregate data to look for the relative importance of other factors such as product quality, product composition and others (Barrell and Pomerantz, 2007).

The more recent studies have mainly focused on the newly industrialised economies (NIE) in South and East Asia, Africa, and South America (Riedel, 1988; Arize, 1990; Muscatelli *et al*., 1992; Senhadji and Montenegro, 1998, 1999). A major conclusion from this stream of research was that the state of the external demand explained the rapid growth in Asia's NIEs (Bond, 1987; Muscatelli *et al*., 1992). In particular, Arize (2001) concluded that the state of the external demand was the main ingredient in explaining Singapore's export growth. However, very little emphasis has been given to small Pacific islands; only Fiji in the Pacific has received such interest for its total export demand (Narayan and Narayan, 2004.)

In most conventional trade models and export demand studies, the aggregate export demand relates real exports to a measure of foreign real income and to relative prices as the key determinants of export demand (Houthakker and Magee, 1969; Khan, 1974; Bond, 1987; Senhadji and Montenegro, 1999; Arize, 2001).

The literature shows strong support for a significant relationship between exports and relative prices. For example, Reinhart (1995) found that relative prices significantly determine the demand for exports in developing countries (See also Senhadji and Montenegro, 1998, 1999).

A foreign activity variable is usually also used to obtain the income elasticity of demand. Since high foreign activity induces increased demand for exports, the income elasticity of demand is expected to be positive; and therefore exports can be seen as an engine of growth (Senhadji and Montenegro, 1999). More precisely, the higher the income elasticity of the export demand, the more powerful exports will be as an engine of growth and, the higher the price elasticity, the more competitive the international market will be for exports of the particular country (Senhadji and Montenegro, 1999; Goldstein and Khan, 1982).

In those studies of a particular commodity, researchers have often found a wide range of elasticity estimates for the same commodity studied (Gardiner and Dixit, 1987; Devadoss and Meyers, 1990). For example, past empirical estimates of U.S. export demand elasticities ranged from -0.23 to -6.72 for wheat, -0.86 to -10.18 for coarse grains, and -0.47 to -2.80 for soybeans (Gardiner and Dixit, 1987).

The reasons for this variety of elasticity estimates include differences in model specification, estimation techniques, period of estimation, and methods used in computing the export elasticity (Cameron, 1998; Gallet and List, 2003). In addition, export demand elasticities change over time because of continual variations in the several factors that influence their values (See Gardiner and Dixit (1987) for a complete list of these factors.)

A major conclusion from this brief literature overview is that studies on the export demand for a commodity from a particular country comprise a relatively common and well developed literature.

Data and Methodology

The traditional framework for analysing the export demand for a particular commodity or for a set of commodities was set out by Goldstein and Khan (1978). Even if export demand specifications do vary in empirical studies, the core of this (long-run) framework usually relates the quantity of exports demanded to the price of its exports, the export price of competing commodities and a weighted average of real incomes of the country's trading partners. This approach follows from the "imperfect substitute" model which assumes that exports are imperfect substitutes for domestic goods (Khan and Knight, 1988; Balassa *et al*., 1989; Senhadji and Montenegro, 1999; Moreno, 1997; Naranyan and Naranyan, 2004).

In this present study the export demand function was estimated by a single equation method. In order to avoid possible biased results, theory suggests that the system of export demand and supply equations should be solved simultaneously in order to emphasise the simultaneous relation between quantities and prices (Stern, Baum and Greene, 1979; Mervar, 1994). Nevertheless, export demand functions can still be estimated in isolation using the Ordinary Least Squares method under the assumption of an infinitely elastic export supply function or a stable demand function as it is done in most empirical export demand studies (Warr and Wollmer, 1997; Goldstein and Khan, 1982; Moreno 1997; Brakman and Sterken, 1998).

A) <u>The export demand model for raw Tahitian pearls</u>

This study assumes that raw pearl exports demanded from French Polynesia are determined by its export price, the general level of income in the main trading countries, and the prices of related pearl export products. The basic specification of this empirical study is the demand export equation which takes the following general logarithmic form:

$$\text{Ln}(Xt) = \alpha + \beta 1\ \text{Ln}(Pt) + \beta 2\ \text{Ln}(Yt) + \beta 3\ \text{Ln}(PSPt) + \beta 4\ \text{Ln}(PPt) + \varepsilon t$$

Where

Ln (Z) is the logarithmic value of variable Z.

Xt is the quantity (weight) of raw pearl exports demanded at time t; measured in grams.

Pt is the unit price of raw pearl exports at time t; measured as the average price per gram.

Yt is a trade-weighted index of real incomes of the country's trading partners.

PSPt is the unit price of semi-processed pearl exports demanded at time t; measured in average price per gram.

PPt is the unit price of processed pearl exports demanded at time t; measured in average price per gram.

In the above model, the β1, β2, β3 and β4 coefficients are elasticities to be estimated, representing the own-price, income, cross-price (semi-processed pearls), and cross-price (processed pearls) elasticities of raw Tahitian pearl exports, respectively. According to economic theory, higher economic activity in the trading partner countries is likely to cause an increase in the demand for Tahitian pearl exports; thus β2 is expected to have a positive sign ($\beta 2 > 0$). Regarding prices, an increase in export prices (own prices) leads to a fall in the demand for raw Tahitian pearl exports; hence β1 is expected to have a negative sign ($\beta 1 < 0$).

However, because the available data necessary to perform the multiple regressions were limited, two separate regressions were run. The first one estimates the long-run own-price and income elasticities for raw Tahitian pearl export demand for the period 1972–2003. The second one estimates the substitution relationships between raw pearl exports and related pearl-products (processed and semi-processed pearls) which began to be exported in the 1990s. The data set used corresponds to the period 1997–2005 as quantity and price data only began to be collected in 1996. Processed pearl exports correspond to jewellery made with pearls, and semi-processed pearl exports correspond to general semi-finished jewellery products.

Both regressions have been estimated using the Ordinary Least Squares method. The log-linear form has been specified as elasticities are directly obtained from the estimates in this form of the regression equation as it is done in several export demand studies (Lanphier and Stoeckl, 2006; Tach and Cuellar, 2007; Jha, 2002).

B) Data

The long-run price and income elasticities of raw pearl export demand were estimated from annual data corresponding to the period from 1972–2003 on values and quantities (weight) of raw Tahitian pearl exports. Unfortunately, data on export quantities and values were only available in grams and average prices per gram instead of by the five general criteria classified according to size, weight, shape, quality and colour (GIE Perles de Tahiti, 2005). These data were collected personally by the author from the Bureau of Statistics in French Polynesia. In order to represent the foreign income variable, we computed a weighted foreign income index. This index represented the income of the main importing countries, namely Japan, Hong Kong and the United States importing on average 45 per cent, 40 per cent and 10 per cent respectively of raw Tahitian pearls per year.

This index of foreign income was defined as the Gross National Income per capita of the countries to which Tahitian pearls were exported, the weights being country j's share in pearl exports, i.e. $Yw = \sum aijYj$, where aij is the share of market j in Tahitian exports as done in Balassa *et al*. (1989). Data on income for Japan, the United States and Hong Kong were collected from the World Bank Database through the DX database in November 2007. Data on countries' shares of Tahitian pearl exports were estimated from industry documents collected in person at the Service de la Perliculture, a government agency based in Tahiti.

To estimate the substitution relationships between raw, semi-processed, and processed pearl exports a different data set was used because information on semi-processed and processed pearl exports was very limited. Indeed, data began to be collected only in 1996 by the Polynesian Bureau of Statistics. Therefore, we used quarterly data prices on those pearl products to maintain consistent data (as compared to yearly data) to attempt the estimation of the substitution relationships between raw, semi-processed and processed pearl exports. All data were supplied by the French Polynesian Bureau of

Statistics for the period 1997–2005. To account for the seasonality in the quarterly data set (as the Tahitian pearl export quantity usually increases at the end of the year because of the harvesting season), a dummy variable was added into the demand equation.

In concluding this section it is worth noting the fact that data for this study are very limited and any policy advice based on the data will thus need to be provided with due caution. However, useful conclusions and policy implications can still be drawn. Therefore, the need for a significant improvement in data collection and more sophisticated demand analysis seems clear. If and when improved data become available it would be interesting to analyse the substitution relationships between the different quality-types of Tahitian pearls, and between the different cultured-pearl species (Australian South Sea pearls, Akoya pearls, and Chinese freshwater pearls). Indeed, such analysis has never been published before in the academic literature or in industry studies.

Empirical Results

The results from the regression to estimate the own-price elasticity and income elasticities for raw Tahitian pearl export demand for the period 1972–2003, are presented in Table 2 below. The estimated own-price elasticity for raw pearl exports is -0.42, suggesting that the demand for raw Tahitian pearl exports is own-price inelastic. This means that when export price increases by 1 per cent, *ceteris paribus,* the quantity of Tahitian pearls demanded will decrease by 0.42 per cent. An inelastic demand for Tahitian pearls means that export revenues can be increased with a price increase. This suggests that a strategy to improve price may be one effective way for improving the export performance of Tahitian pearls. A similar result was reported by Poirine (2007), where the corresponding elasticity was -0.36 for the period 1980–1999.

Table 2. Long-Run Results for Raw Tahitian Pearl Export Demand (1972-2003)

Dependent Variable: Real Exports

Variables	Coefficients	Standard Error	t-statistics	5% critical t-value
A	-22.721***	1.383	-16.428	
β1 (Praw)	-0.420***	0.134	-3.144	-1.6996
β2 (Income)	3.534***	0.128	27.559	+1.6996

Diagnostic tests:
$R^2 = 0.964$, adjusted $R^2 = 0.961$, $\sigma = 0.5523$
F (2, 29) = 384.719*** , $d = 1.657$

Notes:
1. *** indicate a significance at the 1 per cent level.
2. σ is the standard error of the regression. F value is for the F-test; d value is the Durbin-Watson test for autocorrelation.

Our results for the income elasticity indicate that Tahitian pearls are a normal good. The demand for Tahitian pearl exports is very income elastic (3.53). This means that when income in the major importing countries increases by 1 per cent, *ceteris paribus,* the quantity of Tahitian pearls demanded will increase by 3.53 per cent. Therefore, improving economies and increasing consumers' income can be a major source of growth in export demand for raw Tahitian pearls. This result cannot be compared to previous results as this elasticity has never been computed or estimated. However, when comparing the magnitude of this elasticity with other studies it appears to be reasonable. For example, compared to primary commodities' income elasticities like for rice, cotton, fish or tobacco (Asche *et al.,* 1998; Warr and Wollmer, 1997; Jha, 2002) that we would usually consider as necessities, we find that it is much higher. Compared to goods and services which we would usually consider as luxuries for example: 1.2 for healthcare (Ang, 2010) and 1.3 for sports (Loyland and Ringstad, 2009); it is still much higher. If and when improved data become available it would be interesting to re-analyse the income elasticity of Tahitian pearls.

The signs of the estimated coefficients are as per the economic logic. The export price and foreign income have respectively a negative and positive effect on the demand for exports of raw Tahitian pearls. Those two determinants together explain 96 per cent of the total variation in exports of raw Tahitian pearls from French Polynesia. The levels of significance of the estimates for these two variables were both high, indicating that export prices and foreign income are strong determinants for raw Tahitian pearl export demand.

The results for the regression to estimate the substitution relationships between raw pearl export and related pearl-products (processed and semi-processed pearls) which began to be exported since the 1990s are reported in Table 3 below.

Table 3. Results for Substitution Relationships

Dependent Variable: Raw Pearl Exports (1997Q1-2005Q4)

Variables	Coefficients	Standard Error	t-statistics	5% two tailed critical t-value
α'	28.025***	9.404	2.98	+2.0423
β1' (Praw)	-0.430**	0.187	-2.292	-2.0423
β2' (DummySe)	0.489***	0.125	3.928	+2.0423
β3' (Income)	-1.33	1.046	-1.271	-2.0423
β4' (Pprocess)	-0.006	0.095	-0.07	-2.0423
β5' (Psemi)	0.194	0.12	1.614	+2.0423

Diagnostic tests:
$R^2 = 0.531$, adjusted $R^2 = 0.452$, $\sigma = 0.326$
$F(3,32) = 6.786$***, $d = 1.603$

Notes:
1. ** and *** indicate a significance at the 5 per cent and 1 per cent level respectively
2. σ is the standard error of the regression. F value is for the F-test; d value is the Durbin-Watson test for autocorrelation.

The estimated own-price coefficient is negative (-0.43) and significant at the 5 per cent level ($p < 0.05$) for the period 1997(Q1)-2005(Q4). It has a similar magnitude to the previous estimated own-price elasticity (-0.42), confirming that the export demand for raw Tahitian pearls is price-inelastic. The income elasticity estimate is the most surprising. It is now negative (-1.33) although insignificant, implying that Tahitian pearls are an inferior product. We must suspect this reflects the effects of the economic crisis that took place in some Asian countries and especially Japan, who ran into an economic recession, in the mid-1990s. This obviously had an impact on Tahitian pearl export demand as Asia and especially Japan represent major markets for raw Tahitian pearl exports.

The cross-price elasticities examine how sensitive the demand for raw Tahitian pearl export is to changes in the price of processed and semi-processed pearl exports. The estimated coefficient is negative for processed pearl exports and positive for semi-processed pearl exports meaning that processed pearls and semi-processed pearl exports are complements and substitutes to raw pearl exports, respectively. If these two coefficients were significant they would be consistent with local knowledge, because processed pearl exports are defined as finished jewellery products and semi-processed pearl exports are defined as pearls that are put on a string for easy transportation and can therefore be processed again in foreign markets. The appropriate marketing strategy here would be to increase the complementarity between processed and raw pearl exports, and to reduce the substitution effect between semi-processed and raw pearl exports. Thus the results from this model are inconclusive. Indeed, the explanatory variables included in the second regression together explain only 45 per cent of the export demand for raw Tahitian pearls for the period 1997 (Q1)-2005(Q4). The low adjusted R^2 suggests that better data are required and other variables should be included in the model.

Autocorrelation was tested using the Durbin-Watson test, as it has been the most common tool for testing for autocorrelation in demand studies (Asche *et al.,* 1998). The computed *d* statistic indicates no serial autocorrelation, either positive or negative for the first regression. However, in the second regression, the Durbin-Watson test is inconclusive as the estimated *d* value lies in the indecisive range. Therefore, the LM test was undertaken by first obtaining the residuals from the OLS regression. The residuals which lagged one period were then added to the regressors in the equation and this new system was estimated. The result from the LM test shows no autocorrelation. In addition, the p-value of the Durbin-Watson test shows no positive (p-value = 0.054) or negative (p-value = 0.945) autocorrelation.

If similar results were obtained using improved data then two data issues that could be considered are as follows: First, the global market for all pearls witnessed a major decrease in total export earnings (-27.3 per cent) for all pearl exchanges in the world in 2001; since then it has slightly increased (GIE Perles de Tahiti, 2005). Second, the international pearl market has become increasingly competitive (as more pearls are available) and pearl farming technology has spread to new producing countries such as Indonesia and the Marshall Islands, among others (GIE Perles de Tahiti, 2005; Fong, Ellis and Haws, 2005). Therefore, other explanatory variables must be included such as data on close substitutes for raw Tahitian pearls (such as prices and quantities of Australian South Sea pearls, Chinese freshwater pearls and Akoya pearls).

Conclusion and Policy Implications

Pearl exports are important for the French Polynesian economy. Today, French Polynesia is the largest producer of Tahitian pearls in the world exporting mainly to Japan, Hong Kong and the United States. Thus, the export performance of pearls is of major importance for French Polynesia.

In terms of export performance, the aims of this paper are (i) to estimate the price and income elasticities for raw pearl exports, (ii) to estimate the substitution relationships between raw, semi-processed and processed pearl exports, and (iii) to identify what product differentiation needs to be considered.

In this last section, policy and marketing implications are derived for improving Tahitian pearl export performance.

The analysis was based on the Ordinary Least Squares method using data from 1972–2003. The estimated (long-run) own-price elasticity was found to be -0.42 suggesting an inelastic demand for raw Tahitian pearl exports. In terms of a price strategy, an increase in pearl export prices will likely induce a less than proportionate fall in demand for exports, and thus an increase in total export revenues. Therefore, in terms of supply management, it is important for French Polynesia to control the supply of Tahitian pearls to the international market if it wants to keep their premium prices. The concept of rarity is an important element in this industry like in many other luxury industries, such as the diamond industry. The estimated (long-run) income elasticity was found to be 3.53, suggesting that the income of trading partner countries has a positive impact on pearl export demand. Tahitian pearl exports can therefore be regarded as an engine of growth for French Polynesia. Tahitian pearl exports should then be targeted to high-income countries.

In terms of cross-price elasticities, however, the results were inconclusive. Therefore, deriving policy implications may be biased. Nevertheless, we do have considerable evidence from other industry studies showing what can be achieved with better data (Buccola and VanderZanden, 1997; Asche *et al*., 1998; Moreno, 1997; Chang and Nguyen, 2002; Marsh, 2005). Indeed, knowing the substitution relationships between all the product forms could help in increasing the export performance and economic sustainability of the Tahitian pearl industry.

There are two specific applications of a better understanding of these substitution relationships. First, they are important in the context of the debate in French Polynesia about setting up *La Maison de la Perle*, a producer organisation that would aim at stabilising prices by controlling export supply of raw pearls. The likelihood of success for a producer organisation is critically dependent on the assumption that there are no close substitutes for raw pearl exports, as the ability to control price by controlling supply is dependent on market power. The issue of marketing boards (or producers' boards) has been extensively brought up in the so-called “commodity problem” in terms of national coordination (and state support) and their records have been mixed in terms of efficiency (Green, 2005). However, today the challenge is to ensure that past mistakes do not repeat but rather equip producers in engaging with the market on the most beneficial terms (Green, 2005).

Second, the substitution relationships are central to obtaining information about the international market structure for Tahitian pearls in order to support the development of product diversification into value-added processing, and to develop price strategies and future market niche opportunities. Indeed, the versatile nature of Tahitian pearls allows considerable room for differentiation or segmentation. For instance, top quality pearls could be targeted only to the high-end jewellery market where they can most probably fetch their highest prices. The lowest quality pearls could be kept in the territory and used to develop a local-based crafting industry targeted to the tourism industry or for specific exports. This is likely also to benefit the Tahitian society in providing training and work opportunities. An important issue here is what to do with the middle-category pearls; this question deserves further study for an appropriate strategy.

From a policy perspective several implications can be derived from this study. The first and most important policy implication is the need for the French Polynesian government to significantly improve data collection and then to use this significantly improved data to support more sophisticated demand analysis. The improved data needs to reflect the fact that raw Tahitian pearl exports are not a homogeneous product, but rather a quality mix with differences in the five general criteria: size, weight, shape, quality and colour (GIE Perles de Tahiti, 2005). Second, better data collection and use need to include close substitutes like the different cultured-pearl species (Australian South Sea pearls, Akoya pearls, and Chinese freshwater pearls). Unless data collection takes into account these differences it is likely that any future demand analysis will be biased.

In the literature several researchers have already emphasised the importance of collecting information that provides insight on the magnitude of elasticities of demand and their role in formulating agricultural policy (Ahmadi-Esfahani, 1989; Marsh, 2005). Therefore, we suggest that significantly improved data must be collected if we want the derived information to be meaningful and pertinent.

The second policy implication is the need to control the supply of Tahitian pearls on the foreign market in order to avoid the export of low quality pearls. By doing this we expect the price of Tahitian pearls to increase.

The third policy implication is the need for greater attention to be put into understanding the state of external demand and designing policies for improving Tahitian pearl export non-price competitiveness, see for example Arize (2001). In this context, implementing policies that increase both the average quality of the raw exports and the number of varieties of pearl products could ultimately enable the country to increase its market shares in the world market and their aggregate returns (Nguyen, 1996; Ongsritrakul and Hubbard, 1996). The relevant literature proposes different approaches including improving technological capital and advertising efforts (Moreno, 1997), improving branding strategy (Asche *et al*., 1998), improving the relationship between the exporter and importer (Thach and Cuellar, 2007) and embarking on research and promotion to improve a segmentation strategy (Chang and Nguyen, 2002). Additional efforts should also be made in researching consumers' tastes and preferences for future expansion in the European market.

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